THE EFFECTS OF STATE MINIMUM STAFFING STANDARDS ON STAFFING, QUALITY OF CARE, AND FINANCIAL PERFORMANCE IN NURSING HOMES

Jeongyoung Park

A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Health Policy and Administration, School of Public Health.

Chapel Hill
2007

Approved by:

Sally C. Stearns (Advisor)

Kathleen Dalton

Barbara A. Mark

Edward C. Norton

Frank A. Sloan

ABSTRACT

JEONGYOUNG PARK: The Effects of State Minimum Staffing Standards on Staffing, Quality of Care, and Financial Performance in Nursing Homes
(Under the direction of Sally C. Stearns)

This dissertation attempts to provide a comprehensive understanding about the impacts of state minimum staffing standards and to determine unbiased estimates of the effect of staffing on quality of nursing home care. Specifically, by exploiting differences in the timing of staffing standard changes for the 50 states and the District of Columbia from 1998 to 2001, this study conducts three empirical analyses to examine (1) the total effects of staffing standards on staffing choices and on quality of care, (2) the total effect of staffing standards on financial performance, and (3) the underlying (causal) relationship between staffing and quality of care.

The major findings are as follows: (1) Increases in staffing standards matter particularly for the subset of nursing homes with staffing level previously below or close to new standards, whereas the results show consistent beneficial effects for the rate of restraint use and the number of total deficiencies at all types of facilities. (2) Increases in staffing standards have significant negative impacts on total margin at nonprofit facilities with relatively low staffing. (3) When endogeneity of staffing is taken into account, the results support the persistent beneficial effects of increasing total staff hours on the onset of pressure sores, contractures, and catheter use.

The analyses performed in this dissertation are particularly relevant to the era of growth in the aged population and provides important policy implications. Structural differences in nursing home behavior in response to increased staffing standards suggest that future policy should be developed by emphasizing on stragetic planning and operative management of scarce labor resources to achieve both better quality and greater efficiency. In order to achieve the benefits of mandatory staffing standards, the federal and state governments should determine the additional costs and develop a plan to adequately fund the required increases in staffing levels. The monitoring and enforcement of federal and state laws and regulations are necessary. Lastly, the findings suggest that differences in financial performance may result in differences in quality produced and vice versa. An integrative perspective which explores the relationship between quality and financial performance may be insightful in the future research.

ACKNOWLEDGEMENTS

First, I would like to express my deepest thanks to my advisor, Dr. Sally C. Stearns, for her mentorship and continuous support throughout my doctoral training at the University of North Carolina at Chapel Hill. Without her encouragement and guidance, I could not have finished this dissertation. She was always there to meet and talk with me, but more importantly she always had confidence in me even when I doubted myself. I am also greatly indebted to my committee members, Drs. Frank A. Sloan, Edward C. Norton, Kathleen Dalton, and Barbara A. Mark. The comments and guidance they provided during the process of dissertation were extremely helpful in completing this study. I am especially grateful to Drs. Charlene Harrington, R. Tamara Konetzka, and David Grabowski, who generously share data with me and provide helpful comments on this work.

This study was supported by a research grant from the Department of Health Policy and Administration at the University of North Carolina at Chapel Hill, as well as the Summer Fellowship from the Mathematica Policy Research, Inc.

Also thanks to my friends, Rafael Ruiz, Bhavna T. Pahel, France Weaver, and Hua Wang, for sharing their experience, and for listening to my complaints and frustrations at any time. Last, but not least, I thank my family for unconditional support and encouragement to pursue my goal.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ADL	Activities of Daily Living
ARF	Area Resource File
BBA	Balanced Budget Act
BBRA	Balanced Budget Refinement Act
BIPA	Benefits Improvement and Protection Act
CMS	Centers for Medicare and Medicaid Services
CMS OACT	Centers for Medicare and Medicaid Services Office of the Actuary
CON	Certificate of Need
CPI	Consumer Price Index
CY	Calendar Year
DD	Difference-in-Differences
DDD	Difference-in-Differences-in-Differences
DON	Director of Nursing
FD	First Difference
FE	Fixed Effects
FTE	Full-Time Equivalent
FY	Fiscal Year
GAO	General Accounting Office
HHI	Herfindahl-Hirschman Index
HPRD	Hours Per Resident Day
IC	Isocost

ICF/MR	Intermediate Care Facilities for the Mentally Retarded
IOM	Institute of Medicine
IRR	Incidence rate ratios
IV-FE	Fixed Effects with Instrumental Variables
LATE	Local Average Treatment Effect
LM	Lagrange Multiplier
LN	Licensed Nurse
LPN	Licensed Practical Nurse
MCR	Medicare Cost Reports
MDS	Minimum Data Set
MedPAC	Medicare Payment Advisory Commission
MRTS	Marginal Rate of Technical Substitution
MSS	Minimum Staffing Standards
NA	Nurse Aide
NB	Negative Binomial
NHC	Nursing Home Compare
NHRA	Nursing Home Reform Act
OBRA	Omnibus Budget Reconciliation Act
OLS	Ordinary Least Squares
OSCAR	Online Survey Certification and Reporting System
PPS	Prospective Payment System
RN	Registered Nurse
RUGs	Resource Utilization Groups

SCR	State Cost Reports
SNFs	Skilled Nursing Facilities
2SLS	Two-Stage Least Squares Regressions
2SRI	Two-Stage Residual Inclusion

CHAPTER I

INTRODUCTION

Quality of nursing home care is an important public policy issue, especially given the aging of the population. Inadequate nurse staffing could reduce the use of timely health interventions, which may result in deterioration of resident health outcomes because of delayed care (IOM, 1993). Public concerns about the quality of care led researchers and policymakers to develop and implement staffing standards to ensure higher quality of nursing home care. Over the past 10 years, a number of states have implemented or expanded minimum staffing standards that exceed current federal guidelines. While some states have considered or implemented a broader array of reforms to help providers recruit and retain a stable, well-trained workforce, the minimum staffing standards in nursing homes have become a major subject for debate at the state and national level because of the importance of nurse staffing levels to the processes and outcomes of care (Harrington, 2005a, 2005b; PHI and NCDHHS, 2004).

Considerable research has been devoted to the issues of the number and composition of nursing staff required to meet the needs of nursing home residents (Abt, 2001; Carter and Porell, 2003; Castle, 2000; Cohen and Spector, 1996; GAO, 2002a; Harrington et al., 2000b; Kayser-Jones et al., 2003; Weech-Maldonade et al., 2004). Not surprisingly, most findings have suggested that a higher nursing staff level (i.e., more care hours per resident day) and more highly skilled nursing staff mix (i.e., a greater proportion of professional nursing staff

such as registered nurses) are associated with higher quality of care in nursing homes measured by various process and outcome indicators.

Despite the public policy importance, little analysis has been done to link the staffing standards to outcomes, either with regard to the level of staffing, quality of care, or financial performance in nursing homes. The role of minimum staffing standards was not directly considered in the earlier empirical work, and little is known about whether the staffing requirements lead to higher levels of staffing and quality of care, or whether or to what extent staffing requirements influence financial performance in nursing homes. This dissertation attempts to provide a broad understanding of impacts of state staffing standards. Three investigations are provided.

The first component uses a national sample of freestanding nursing homes to investigate whether the increased state minimum staffing standards have changed nursing home staffing levels and quality of care. Between 1998 and 2001, 16 states implemented or expanded minimum staffing standards in excess of federal requirements with a goal of improving quality of care. Information on the experience or outcomes associated with recent changes in state staffing standards was scanty, and researchers and policymakers had contradictory comments about the use of staffing standards. Some critics contend that the federal and state governments have implemented regulations based on anecdotal information, with no research-based evidence (Kovner and Heinrich, 2000). This study is the first to attempt to assess the impact of state minimum staffing standards on the level of staffing and quality of care by exploiting differences in the timing of standard changes for the 50 states and the District of Columbia from 1998 to 2001.

The second component examines the impacts of state minimum staffing standards on financial performance for a national sample of freestanding Medicare-certified skilled nursing facilities. The cost of increasing the staffing levels under the current nursing workforce shortage can be substantial for both the government and nursing facilities. The government paid 61% of the total costs and the Medicaid program alone paid 48% of the total $92 billion in nursing homes expenses in 2000 (Levit et al., 2002; Zhang and Grabowski, 2004). The call for greater staffing suggests that additional government funds could be required. Moreover, staffing is the main input in the production of care accounting for nearly two-thirds of all nursing home costs, implementation or expansion of staffing standards may generate an industry-wide cost increase and place substantial financial pressures on nursing homes. Further assessment of the financial impacts[1] of minimum staffing standards for nursing homes is useful to understand the benefits and pitfalls of implementing or increasing mandated staffing standards.

The third component of this dissertation uses the same national sample used in the first component to explore causal pathways of the relationship between staffing and quality of care by controlling for underlying staffing choices made by the facilities. Existing estimates of the effect of staffing on quality may be biased because the prior estimates of the relationship between staffing and quality of care have been identified by cross-sectional variation, and the potential endogeneity of staffing has not been fully controlled for. In the absence of some corrective statistical procedure, endogeneity of staffing may result in a spurious correlation between staffing and quality of care. The purpose of the third analysis is to assess longitudinally whether in fact changes in total staffing hours lead to changes in

[1] Assessing fiscal impacts on the federal or state's budget is beyond the scope of this dissertation. In this dissertation, the impact of minimum staffing standards limits to the finances of individual home.

quality of care while controlling for the potential endogeneity of staffing. This approach helps to resolve the gaps in the previous literature on the relationship between staffing and quality of care.

The remaining chapters of this dissertation are organized as follows: Chapter II provides background on minimum staffing standards and reviews the relevant literature. Chapter III provides a theoretical framework for the three research questions. The main data and construction of key variables in the empirical analyses are described in Chapter IV and V, respectively. The empirical models, specific analytic issues related to each research question, and results are presented in Chapter VI, VII, and VIII, respectively. Finally, Chapter IX discusses overall results and their implications with regard to current nursing home staffing policy and future policy development.

CHAPTER II

BACKGROUND

This chapter provides updated background information about minimum staffing standards and their implementation. Section 2.1 outlines main features of federal and state minimum staffing standards. In addition, it discusses why federal and state government set and/or changed the minimum staffing standards, and how compliance has been monitored and enforced. Section 2.2 discusses the minimum staffing standards in the context of major policy changes in Medicaid and Medicare during the study period, with a brief review of the major impacts of these changes on nursing home staffing. Finally, Section 2.3 reviews the previous work on the effects of minimum staffing standards and the relationship between nursing home staffing and quality of care.

2.1. Overview of Minimum Staffing Standards (MSS)

2.1.1. Factors leading to MSS

Poor quality of care in nursing homes has been a national concern to policymakers and the public since the U.S. Senate Special Committee on Aging first began hearings in 1963 (Harrington et al., 2004). Reports about poor quality as well as the active efforts of many consumer advocacy and professional organizations called for stronger federal regulations (IOM, 1986).

In an attempt to improve the quality of care in nursing homes, the federal government strengthened national staffing standards through the Nursing Home Reform Act (NHRA) which was enacted as part of the Omnibus Budget Reconciliation Act of 1987 (OBRA). OBRA 87 requires nursing facilities that wish to be certified for participation in Medicare or Medicaid to have: licensed nurses (LNs) on duty 24 hours a day; a registered nurse (RN) on duty at least 8 hours a day, 7 days a week; and a registered nurse director of nursing (DON). Facilities should also have sufficient nursing staff to maintain the physical, mental and psychosocial well-being of residents (Zhang and Grabowski, 2004).

Although it was expected that the OBRA 87 would improve quality, the existing federal staffing standards have come under scrutiny because a number of studies identified that many nursing homes still had quality of care problems (GAO, 1998, 1999, 2000). In response to continuing concerns about the quality of care in nursing homes, President Clinton and Senators Grassley, Breaux, and Reed called for increased nurse staffing in nursing homes in 2000 (Harrington, 2005b). Congressman Waxman and other in the U.S. House of Representatives introduced legislation in 2001 and 2002 calling for minimum federal staffing levels for nursing homes, improved staff reporting requirements, and improved regulation of staffing (Harrington, 2005b). Several different federal minimum staffing levels have been examined by the Centers for Medicare and Medicaid Services (CMS), the Institute of Medicine (IOM), and other experts since OBRA 87.

The CMS reported the findings of research conducted by Abt Associates in their Phase I and II studies (Abt, 2000, 2001). These reports found a relationship between staffing levels and quality of care. In particular, the reports found evidence of critical thresholds for nursing staff, below which nursing home residents were at risk for serious quality of care

problems, and above which no measurable increases in quality of care were observed with additional nursing staff. The Phase I report (2000) indicated that staffing levels below a specific threshold (3.9 hours per resident day) could result in serious resident impairment. A more recent study (2001) reported a minimum of 4.1 hours per resident day (HPRD) was needed to prevent harm to residents with long stays (90 days or more) in nursing homes. Of this total, 0.75 RN HPRD, 0.55 licensed practical nurse (LPN) HPRD, and 2.8 nurse aide (NA) HPRD were needed to protect residents. Although CMS did not make a recommendation for a federal minimum standard for nursing homes, the reports were clear about the potential jeopardy to residents in nursing homes without adequate nurse staffing levels.

A recent IOM study (2003) recommended at least one registered nurse on duty at all times and staffing levels that increase as the number of patients increases. Higher minimum staffing standards have also been strongly recommended by an expert panel on nursing homes sponsored by the Hartford Institute for Geriatric Nursing (Harrington et al., 2000a). In addition to the RN DON, the panel recommended a full-time assistant DON for nursing homes with more than 100 beds, at least one RN nursing supervisor on duty at all times, and one full-time RN director of in-service education in nursing homes with more than 100 beds. The experts recommended a ratio of 1 direct caregiver to 5 residents on the day shift (1.6 HPRD), 1 to 10 for evening (0.8 HPRD), and 1 to 15 for nights (0.53 HPRD). Finally the panel recommended nurse staffing levels be adjusted upward for residents with higher nursing care needs. Overall, the experts recommended a minimum 4.44 HPRD of total nursing time (Harrington et al., 2000a).

While debate over the federal standards has intensified, some states have established or increased their staffing standards. Findings from case studies of eight states (e.g., Arkansas, California, Delaware, Minnesota, Missouri, Ohio, Vermont, and Wisconsin) with recent changes in their staffing standards indicated that activities to increase state staffing requirements typically came about as a reaction to publicity about quality problems and with the goal of improving the quality of resident care in nursing homes (DHHS, 2003). Advocacy groups were frequently involved in promoting state action in response to the publicity. Arkansas experienced high-profile lawsuits concerning nursing home quality, and California has been the subject of some highly negative reviews by the federal General Accounting Office (GAO). In Ohio and Wisconsin, state officials responded to a stream of consumer complaints about inadequate staffing, and in Vermont, union-sponsored organizing activity was instrumental in generating support for that state's new standards. Such activities resulted in important improvement in nurse staffing standards through changes in state legislation and regulation (DHHS, 2003).

More generally, a number of political scientists have sought to understand why states choose particular public policies. Most assessments have focused on historical and cultural attitudes as well as political and socioeconomic variables in explaining state variation in policies (Miller, 2005). The willingness of the federal government and states to increase nursing staffing standards may also depend on the general economy within states, tax revenues available within states, the action of advocacy organizations or interest groups, the political orientation of state legislators and elected officials, and many other considerations (Harrington, 2005b).

2.1.2. Variation in MSS across states

2.1.2.1. Variation in standards implemented

By the year 2003 a total of 36 states supplemented the nominal federal guidelines with more stringent staffing standards which require either a certain number of nursing care hours per resident day or a specified staff-to-resident or staff-to-bed ratio. As Table 2.1 shows, the other 14 states and the District of Columbia did not have minimum staffing standards beyond the federal requirements for Medicare and Medicaid participating facilities.

Table 2.1 State Minimum Staffing Standards Type for Nursing Homes by 2003

State		Standards Type
AL	Alabama	Federal
AK	Alaska	Staff-to-occupied bed ratio
AZ	Arizona	Federal
AR	Arkansas	Staff-to-resident ratio
CA	California	HPRD
CO	Colorado	HPRD
CT	Connecticut	HPRD
DE	Delaware	HPRD + staff-to-resident ratio
DC	District of Columbia	Federal
FL	Florida	HPRD + staff-to-resident ratio
GA	Georgia	HPRD
HI	Hawaii	Federal
ID	Idaho	HPRD
IL	Illinois	HPRD
IN	Indiana	HPRD
IA	Iowa	HPRD
KS	Kansas	HPRD + staff-to-resident ratio
KY	Kentucky	Federal
LA	Louisiana	HPRD
ME	Maine	Staff-to-resident ratio
MD	Maryland	HPRD + staff-to-resident ratio
MA	Massachusetts	HPRD
MI	Michigan	HPRD + staff-to-resident ratio
MN	Minnesota	HPRD
MS	Mississippi	HPRD
MO	Missouri	Federal
MT	Montana	Staff-to-bed ratio
NE	Nebraska	Federal

NV	Nevada	Federal
NH	New Hampshire	Federal
NJ	New Jersey	HPRD
NM	New Mexico	HPRD
NY	New York	Federal
NC	North Carolina	HPRD
ND	North Dakota	Federal
OH	Ohio	HPRD + staff-to-resident ratio
OK	Oklahoma	HPRD + staff-to-resident ratio
OR	Oregon	Staff-to-resident ratio
PA	Pennsylvania	HPRD + staff-to-resident ratio
RI	Rhode Island	Federal
SC	South Carolina	Staff-to-resident ratio
SD	South Dakota	Federal
TN	Tennessee	HPRD
TX	Texas	HPRD + staff-to-resident ratio
UT	Utah	HPRD
VT	Vermont	HPRD
VA	Virginia	Federal
WA	Washington	Federal
WV	West Virginia	HPRD
WI	Wisconsin	HPRD
WY	Wyoming	HPRD

Note: HPRD=hours per resident day
Sources: (1) Harrington, C. (2002). Nursing Home Staffing Standards. *The Kaiser Commission on Medicaid and the Uninsured.* (2) U.S. Department of Health and Human Services Assistant Secretary for Planning and Evaluation Office of Disability (2003). *State Experiences With Minimum Nursing Staff Ratio For Nursing Facilities: Finding From Case Studies of Eight States.*

State staffing standards differ across states and vary in terms of which types of staff are regulated and how standards are defined (DHHS, 2003). Of the 36 states with staffing standards, 29 states set standards for total nursing staff, and 27 states establish direct care staff (including RN, LPN, and NA) standards. Thirty two states have licensed nurse requirements, and 9 states set specific registered nurse requirements. For example, California requires 3.2 hours of direct care per resident day while Maine maintains a direct care staff-to-resident ratio of 1 to 5 during the day, 1 to 10 in the evening, and 1 to 15 at night in 2003. Twenty one states have staffing mandates defined as staff hours per resident day, 6

states set mandates in ratios, and 9 states establish standards in terms of both staff hours per resident day and ratio.

Some states (e.g., Alaska, Arkansas, Connecticut, Delaware, Montana, Pennsylvania) have more complex standards in terms of facility size, shift, staff type, and licensure type. Arkansas, for example, has standards that facilities containing 70 beds or more must employ an RN supervisor during the day and evening shifts; facilities containing 100 beds or more must employ an RN supervisor during night shift, a full-time assistant director of nursing, and a full-time RN director in service education in addition to previous requirements (DHHS, 2003). New Jersey requires 2.5 hours of direct care per resident day and additional hours of direct care for residents receiving special care such as wound care, tube feeding, and oxygen therapy. Given these variations, direct comparisons across states should be made with caution.

2.1.2.2. Variation in timing of implementation

While the details differ by state, a total of 16 states made major changes to their staffing standards from 1998 to 2001 with the goal of improving quality of care in nursing homes (Table 2.2). Fourteen states (Arkansas, California, Delaware, Florida, Georgia, Iowa, Maine, Minnesota, Mississippi, Ohio, Oklahoma, Pennsylvania, South Carolina, and Wisconsin) increased existing state staffing standards. California increased direct care staff standards from 3 HPRD to 3.2 HPRD in 2000, and Maine increased direct care ratios from 2.07 HPRD to 2.93 HPRD in 2001. Three states (Arkansas, Delaware, and Oklahoma) made more comprehensive changes to staffing requirements, using a phase-in period to implement standards by shift and staff type. In 2000, Delaware passed Eagle's law which established

minimum staffing standards in nursing homes. This law phases in three standards of care over time. Facilities must provide at least 3 direct care HPRD in phase I (2001), 3.28 HPRD in phase II (2002), and 3.67 HPRD in phase III (2003). Wisconsin increased direct care staff HPRD and had case-mix adjusted staffing standards for intensive skilled nursing care, skilled nursing care, and intermediate care based on resident need. Minnesota rescinded a case-mix adjusted ratio in 2001 and is developing standards with conversion to a Medicaid payment methodology based on the Minimum Data Set (MDS) and Resource Utilization Groups (RUGs) (34 case-mix levels). Two states (New Mexico and Vermont) implemented new staffing standards in 2000 and 2001, respectively. Starting in 2001, Vermont required nursing homes to provide an average of 2 HPRD of nurse aide care as part of an average 3 HPRD of overall nursing care.

Table 2.2 Summary of Changes in State Minimum Staffing Standards, 1998-2001

Status	State (year of legislative change)	
Modification	AR (1998, 2001, (2003))*	MN (2001)
	CA (2000)	MS (2000)
	DE (2001, (2002, 2003))*	OH (2001)
	FL (2001)	OK (2000, 2001, (2002, 2003))*
	GA (1998)	PA (1999)
	IA (2000)	SC (1999)
	ME (2001)	WI (1999)
Establishment	NM (2000)	
	VT (2001)	
No change	AL, AK, AZ, CO, CT, DC, HI, ID, IL, IN, KS, KY, LA, MD, MA, MI, MO, MT, NE, NV, NH, NJ, NY, NC, ND, OR, RI, SD, TN, TX, UT, VA, WA, WV, WY	

Sources: (1) Harrington, C. (2002). Nursing Home Staffing Standards. *The Kaiser Commission on Medicaid and the Uninsured.* (2) U.S. Department of Health and Human Services Assistant Secretary for Planning and Evaluation Office of Disability (2003). *State Experiences With Minimum Nursing Staff Ratio For Nursing Facilities: Finding From Case Studies of Eight States.*
* Multiple changes/Phase-in

2.1.3. Compliance with MSS

2.1.3.1. Monitoring process

The government is the dominant purchaser of nursing home care by means of the Medicare and Medicaid programs, with state Medicaid programs covering approximately 50% of all nursing homes expenditures and 70% of all bed days (Zhang and Grabowski, 2004). Since 1965, when the Medicare and Medicaid programs were established, nursing home regulation has been a joint federal and state responsibility (GAO, 1999, 2000; Harrington et al., 2004). State agencies are responsible for certifying facilities that meet the conditions for participation in the Medicare and Medicaid programs, and for licensing nursing facilities if they meet state legal requirements. Oversight includes routine and follow-up surveys to assess compliance with federal standards and enforcement activities to ensure that identified deficiencies are corrected. States also enforce their own licensing requirements in all state-licensed nursing homes, and check for compliance with these licensure requirements during standard surveys.

At the time of the annual facility survey by state agencies, CMS requires nursing homes to submit a uniform staffing report on nurses by type of staff (for a two-week period prior to the survey). These data are reported on the federal Online Survey Certification and Reporting (OSCAR) system. Most states' surveyors take a sample of staff schedules, time sheets, or payroll records to determine facility compliance. In addition to the survey process, Arkansas and Vermont periodically review monthly staffing data submitted by facilities, which helps state officials monitor staffing levels. Most states also monitor staffing when investigating any complaints about poor quality of care that may be related to insufficient staffing.

2.1.3.2. Enforcement process

Nursing homes that are not compliant with a staffing standard receive a deficiency citation labeled "A" through "L" depending on the scope (the number of patients adversely affected) and severity (the extent of patient harm) (GAO, 1999). Table 2.3 provides the scope and severity grid for the Medicare and Medicaid compliance deficiencies.

Table 2.3 Scope and Severity Grid for Deficiencies

Severity Category	Scope		
	Isolated	Pattern	Widespread
Immediate jeopardy (i.e., actual or potential for death/serious injury)	J	K	L
Actual harm	G	H	I
Potential for more than minimal harm	D	E	F
Potential for minimal harm (i.e., substantial compliance)	A	B	C

Source: GAO. (1999). *Nursing Homes: Additional Steps Needed to Strengthen Enforcement of Federal Quality Standards*. Washington DC.

Facilities with deficiencies at the C level or below are considered to be in "substantial compliance" with the regulations and are not subject to sanctions. Facilities with deficiencies that have a potential for more than minimal harm (D or E level) are required to submit a plan of correction. If the harm is serious or the problem persistent, more severe remedies are available, including directed plans of correction, civil monetary penalties, and denial of payment for new or current admissions. Facilities with deficiencies rated as F through I are required to receive a denial of payment for new or current admissions or civil monetary penalties of $50 to $3,000 per day. Deficiencies that cause actual or potential for death or serious injury (J through L) are categorized as causing immediate jeopardy and are subject to such sanctions as temporary management, termination, and civil monetary penalties of $3,000 to $10,000 per day of noncompliance.

Under the shared responsibility for Medicare-certified nursing homes, state agencies identify and categorize deficiencies and make referrals with proposed sanctions to CMS. CMS is responsible for imposing sanctions and collecting monetary penalties (GAO, 1999). However, the federal government does not require states to report state penalties and fines or other state enforcement actions to the federal government (Tsoukalas et al., 2006).

Furthermore, although the regulatory system is shared between CMS and states, the implementation of the regulations has been largely devolved to the states (Harrington et al., 2004). CMS has detailed requirements for states regarding nursing home surveys, but the state survey process and enforcement activities vary widely across states in the number and type of deficiencies issued, collection and use of penalties and fines, and intermediate sanctions (DHHS, 2003; GAO, 1999, 2000; Harrington et al., 2004).

Harrington et al. (2004) conducted a study of state nursing home enforcement systems and ranked all states across the five enforcement indicators in 1999: (1) average number of deficiencies per facility, (2) percent of facilities with deficiencies, (3) percent of facilities cited for harm or jeopardy, (4) percent of cited for substandard care, and (5) average civil monetary penalties issued per facility. Washington, Arkansas, California, Oregon, and Idaho were ranked as the top five states with the most stringent enforcement activities, while the lowest were Colorado, the District of Columbia, Rhode Island, Virginia, and Vermont.

In addition to variation in state enforcement stringency, poor enforcement systems and the ineffective use of both intermediate and permanent sanctions have been documented. Only a few facilities were terminated from the Medicare or Medicaid programs, and most of these were later reinstated and continued to have deficiencies (Harrington et al., 2004). States issued many deficiencies, but few deficiencies resulted in penalties and fines in

general (Harrington et al., 2004; Tsoukalas et al., 2006). According to a recent Commonwealth Fund-supported study on the collection and use of funds from civil money penalties and fines from nursing homes, out of a total of $61 million in collected penalties over the 1999-2005 period, 32 states spent $28 million on projects to relocate residents, train employees, and explore opportunities to promote resident-centered care (Tsoukalas et al., 2006). Most of the funding, however, was used for short-term or one-time projects. State officials reported that few projects reported outcomes and most did not have any formal evaluations.

Various factors predict the variation in enforcement activities across states: political variables, facility characteristics, competition measure, state generosity measure, and quality of care indicator (Harrington et al., 2004). Staff turnover, recruitment problems and fiscal problems at the state agency level may hamper survey and enforcement efforts (GAO, 2000). More standardization of survey and enforcement process across states may be necessary for minimum staffing standards to be effective in order to protect and promote the quality of care in nursing homes.

2.1.3.3. Exemptions process

An important issue in considering the appropriateness of minimum staffing standards is whether the nursing workforce will be adequate to meet higher workforce requirement that would result from adoption of a staffing requirement (Abt, 2001). A large number of studies have referred to the existence of a current nursing shortage and recruitment problems (Abt, 2001; Buerhaus et al., 2000; Grabowski et al., 2004b). In particular, the RN shortage continues to be somewhat problematic (Buerhaus et al., 2000). Buerhaus et al. (2000)

projected that the size of the RN workforce will be nearly 20 percent below projected requirements by 2020. With the decline over the past twenty years in the number of younger women entering the nursing profession, the nation's nursing workforce is aging and fewer RNs are choosing to work in long-term care facilities (Grabowski et al., 2004b). Certain rural and urban areas may experience difficulty in recruiting required additional nursing staff.

In practice, therefore, some states do allow waivers of licensed nursing staff (i.e., federal staffing requirements) under limited conditions such as the inability to recruit the required personnel despite efforts or location in a rural area with an insufficient labor supply (DHHS, 2003). For example, nursing homes in Delaware that cannot meet the required staffing standards may apply for a waiver through the Division of Long Term Care Residents Protection, waivers are subject to approval by the Delaware Nursing Home Residents Quality Assurance Commission (DHHS, 2003). However, comprehensive data on state-specific exemptions processes are not available in the data sources used for this study.

2.2. MSS in the Context of Other Nursing Home Policy Changes

Some studies have indicated that minimum staffing standards might not have much effect on staffing, because they are too low to affect average staffing in any appreciable way (DHHS, 2003; GAO, 2002c). Staffing regulations mainly target a subset of facilities with relatively low staffing; therefore, staffing standards will not necessarily affect those facilities already at or above the standards.

However, the amount of money that nursing homes have available to spend on increased staffing is heavily dependent on public (Medicaid or Medicare) payment systems. State initiatives on long-term care direct care workforce such as a wage pass-through and

major payment changes in Medicaid and Medicare occurred during the study period from 1998 through 2001. Those other policy changes for nursing homes most likely have a direct impact on staffing levels. Therefore, teasing out the effects of MSS when implementation was accompanied by other regulatory changes can be very challenging. This subsection provides a brief review of these changes and their impacts on nursing home staffing.

2.2.1. Wage pass-through

Recruitment and retention of adequate numbers of qualified direct care workers are major concerns for many long-term care providers. A wage pass-through is the most commonly proposed strategy to achieve wage increases by funding benefit enhancements including health insurance, or implementing activities aimed at recruitment and retention of direct care staff (DHHS, 2003).

From the 2003 survey by the Paraprofessional Healthcare Institute and North Carolina Department of Health and Human Services' Office of Long Term Care, the majority (26 states, 59.1%) have funded a wage or benefit pass-through (PHI and NCDHHS, 2004). Typically, a wage pass-through has been implemented by a designating specified dollar amount ranging from $0.5 per hour to $2.14 per hour and $4.93 per resident day. These states included Arkansas, Colorado, Massachusetts, Missouri, Oregon, Rhode Island, South Carolina, Texas, Virginia, and Washington. Some states (e.g., California, Illinois, Maine, Michigan, Minnesota, Montana) established a certain percentage of the increased reimbursement rates. For example, 80% of Minnesota's recent 40% rate increase was earmarked for wages and benefits, while Illinois had a law requiring 73% of all rate increases be used for wages and benefits.

In spite of state initiatives on the long-term care direct care workforce, the effects of such initiatives have not been assessed across states. Several case studies from California and Vermont reported that a wage pass-through had no observed effect on staffing levels (DHHS, 2003).

2.2.2. Medicaid reimbursement rates

Prior to 1998, state Medicaid officials opposed the Boren amendment[2] because it was believed to cause states to spend too much on nursing home care relative to other services (Grabowski et al., 2004b). The repeal of the Boren amendment in 1997 gave states considerable discretion in setting Medicaid payment methods and rates. Given state budget shortfalls, several studies expressed concerns that states might reduce the rate of growth in Medicaid spending by cutting Medicaid payment rates for nursing homes (Kaiser Family Foundation, 2003; GAO, 2003; Grabowski et al., 2004a).

However, in spite of concerns about widespread adoption of cost-saving state policies, the average Medicaid payment rates for nursing home care experienced a sizable increase since 1998 (GAO, 2003; Grabowski et al., 2004b). Grabowski et al. (2004b) surveyed the average daily Medicaid nursing home payment rate during 1999-2002 and found that the inflation-adjusted average per diem rate was $105.8 in 1999, $108.14 in 2000, $112.21 in 2001, and $117.73 in 2002, with an average annual increase of 3.8 percent.

Increased Medicaid nursing home reimbursement generally accompanied increased state minimum staffing standards in many states, through a variety of mechanisms. Some

[2] The Boren amendment required that Medicaid nursing home rates be reasonable and adequate to meet the costs which must be incurred by efficiently and economically operated facilities in order to provide care and services in conformity with applicable state and federal laws, regulations, and quality and safety standards (Section 1902(a)(13)(A) of the Social Security Act).

states either used some form of bed tax or quality improvement fee to generate increased Medicaid revenues which were then passed back to facilities to help pay their labor costs. Other states implemented wage pass-through legislation designed to require facilities to spend the increased funding on staffing (DHHS, 2003). For example, California increased Medicaid rates by approximately $2.96 per resident day to pass through wages and benefits to support higher standards in 2000 (Horowitz et al., 2003). Delaware increased average daily rates from $105.22 a day in 1998 to $171.62 in 2002 and estimated that it has spent about $14.2 million in additional nursing home reimbursement expenditures since implementing the new MSS in 2001 (DHHS, 2003).

Even though the previous work on the relationship between Medicaid payment levels and quality of or access to care has been inconclusive, more recent work has found that higher Medicaid payment rates were positively associated with staffing, nursing home care, and access to care for Medicaid recipients (Cohen and Spector, 1996; Grabowski, 2001a, 2001b, 2002; Grabowski et al., 2004a).

2.2.3. Medicare prospective payment system (PPS) and post-PPS implications for nursing homes

Medicare payment rates have been considered to be less important to nursing home finances than Medicaid because only about 9% of patients on any one day nationwide have care paid for by Medicare, compared to about 69% for whom Medicaid is the primary payer (Abt, 2000). However, until July 1998 Medicare reimbursed skilled nursing care on a retrospective cost-based system. Medicare payments under cost-based reimbursement encouraged a rapid increase in the use and cost of skilled nursing care, and historically

helped subsidize Medicaid reimbursements that were felt to be less than adequate. The Congress responded to the growth in Medicare skilled nursing facilities (SNFs) expenditure by adopting a prospective payment system for Medicare skilled nursing care as part of the Balanced Budget Act of 1997 (BBA). Under the new PPS system, Medicare nursing facility rates are calculated prospectively based on the resident needs (acuity) for nursing care and therapy services.

SNF PPS resulted in increased payments for some institutions and decreased payments for others. Payment reductions were particularly severe for hospital-based SNFs, which historically have had shorter stays and much higher costs per day than freestanding facilities. Many hospitals responded to the transition to SNF PPS by getting out of this line of business (Dalton et al., 2005).

Because payments are fixed per resident day, the PPS system has strong incentives for providers to reduce spending, including that on nursing staff. Even though new policy initiatives for higher standards are being considered in some states, the average hours of RN care in nursing homes declined dramatically since the PPS was implemented (Harrington and O'Meara, 2006; Konetzka et al., 2004b).

The Congress responded to these concerns with temporary increases in the nursing component of the Medicare payment in order to encourage SNFs to increase their nursing staff. The Balanced Budget Refinement Act of 1999 (BBRA) raised the daily payment rates by 20 percent for 15 high-cost RUGs beginning in April 2000. BBRA also increased the daily rate for all RUGs by 4 percent for fiscal years 2001 and 2002. The Benefits Improvement and Protection Act of 2000 (BIPA) increased the nursing component of the SNF PPS rates by 16.66 percent effective in April 2001.

A report from the U.S. General Accounting Office (GAO, 2002c) found that SNF staffing changed little after April 2001 when the increase in the nursing component of the PPS payment took effect. This report, however, found that SNFs with relatively low staffing level in 2000 increased their staffing hours in 2001, and SNFs provided slightly less RN time and slightly more LPN and NA time in 2001.

2.3. Prior Studies

2.3.1. Effects of MSS on staffing and quality of care

Several studies have examined state minimum staffing standards (Harrington, 2002; DHHS, 2003) and analyzed the relationship between state minimum staffing standards and actual staffing levels in nursing homes (Harrington, 2005a, 2005b; Mueller et al., 2006). Harrington (2005a, 2005b) reviewed the nurse staffing standards in nursing homes in all states and the District of Columbia in 2000 to 2001 through the Internet survey of state statutes and regulations. Harrington found that the actual median nurse staffing level in nursing homes was substantially higher than each state's staffing standards. These studies, however, were based on simple comparisons between staffing standards and actual staffing levels without controlling for any facility and/or state characteristics. While controlling for facility and state covariates, Mueller et al. (2006) investigated how state staffing standards were related to staff hours per resident day with data in 2004. Using hierarchical linear models, their study found that facilities in states with high staffing standards had somewhat higher staffing on average than states with no standards or low standards, whereas facility staffing in states with low standards was not significantly different from that in states with no standards.

Several early studies examined the impacts of federal staffing standards on nursing home quality of care. Janelli et al. (1994) found that the implementation of federal standards was associated with a decrease in restraint use, but this decrease in restraint use was accomplished largely without an increase in staffing among nursing homes in New York State. Moseley (1996) examined the 1990 implementation of NHRA legislation on catheter use among Virginia nursing home residents, and found that post-NHRA catheterization rates were lower than the pre-NHRA rates. These studies, however, were based on simple pre and post comparisons in one or several states.

With national data and further methodological improvement, a recent paper by Zhang and Grabowski (2004) directly attempted to link the staffing requirements under NHRA with quality measures to determine whether the increased staffing requirements have translated into higher quality. However, the results from their study were unable to link higher staffing under the NHRA to better quality except in certain cases where facilities had substandard staffing in the pre-NHRA period.

Although previous studies have found some evidence that the federal staffing standards via NHRA have had a positive impact on nursing home quality of care, the federal staffing standards have not been changed since 1987, and the current federal requirements are far below the actual levels used by many facilities (Harrington, 2005a, 2005b; Zhang and Grabowski, 2004). As described earlier, the state standards are much more stringent than federal mandated levels, so a number of nursing homes may have to respond to the state standards. Variation also exists across states in terms of types of standards and the timing of legislation, as a total of 16 states made major changes to their staffing standards from 1998 to 2001 period. Furthermore, the federal BBA of 1997 repealed the Boren Amendment, giving

states additional flexibility in determining nursing home payment rates as well as other state Medicaid policies (Weiner and Stevenson, 1998). As states gain freedom to set the Medicaid policies, it becomes important to understand whether and how these recent changes in the states might affect staffing decisions and quality of care in nursing homes.

2.3.2. Effects of MSS on financial performance

With respect to the financial outcomes, considerable research has focused on the impacts of Medicare or Medicaid reimbursement changes on financial performance (Cohen and Dubay, 1990; Davis et al., 1998; GAO, 2002b; Nyman and Connor, 1994) and efficiency in nursing homes (Nyman and Bricker, 1989; Sexton et al., 1989).

In understanding the potential cost implication of minimum staffing standards, it is important to estimate the cost increase to the federal or state government of paying facilities associated with the higher staffing requirements. Since the Medicare and Medicaid programs together are responsible for more than half of the nursing home resident revenues, increasing minimum staffing standards will have a significant impact on the federal and state's budget. Several studies estimated the potential costs to increase staff to meet various levels of new (or proposed) staffing standards to the Medicare or Medicaid programs (Abt, 2000; CADHSLCP, 2001; Decker and Dollard, 2001). According to the American Health Care Association, the added costs to increase staff to meet the various ratios proposed by CMS sponsored study can range from approximately $3 billion to over $15 billion in 2001 alone (Decker and Dollard, 2001). The exact cost implication for public payers may depend on how many facilities need to increase staff up to a new standard, or how adequate the current

Medicare and Medicaid payment rates are to allow facilities to staff at or above the new standards.

However, the cost to the government might not be the same as the cost of compliance to facilities. Although little analysis of estimating fiscal impacts on facilities has been done, a report to the California Legislature noted that the industry as a whole was already suffering financial stress facing increased staffing standards[3] in 2000 (CADHSLCP, 2001). For example, as of December 2000, six of the nation's largest nursing home chains in California had fallen into Chapter XI bankruptcy, with approximately 11 percent of nursing homes filing for bankruptcy as of August 2000. The financial stability of nursing homes is an important consideration. Resident care can be disrupted as a result of financial problems; facility closure requires that the residents be moved to another facility, which causes a great deal of stress for the residents and their families (CADHSLCP, 2001). In addition, any significant reduction of available beds in a community may reduce access to needed nursing care for frail and chronically ill patients (CADHSLCP, 2001).

No prior work has directly examined whether or to what extent recent state minimum staffing standard changes might affect financial performance in nursing homes. Further understanding of the effects of minimum staffing standards is obtained by assessing whether these pressures alter financial status in nursing homes.

2.3.3. Effects of staffing on quality: concerns about endogeneity of staffing

Staffing may be the most critical element in ensuring high quality of care in nursing homes. Using OSCAR data from 1992 to 1997, Castle (2000) examined the effect of staffing patterns on the use of physical restraints. The full-time equivalent (FTE) hours of registered

[3] California increased direct care staff standards from 3.0 HPRD to 3.2 HPRD in 2000.

nurses, licensed practical nurses, and nurse assistants per 100 beds were included as nurse staffing variables. The results showed that facilities with more FTE RNs per 100 beds were less likely to increase restraint use, and those with more NAs per 100 beds were more likely to increase restraint use. Harrington et al. (2000b) examined the relationship between different types of nursing home staffing hours per resident day and facility deficiencies identified by state surveyors under the federal nursing home certification regulations. Consistent with previous research, fewer RN staff hours were associated with more quality of care deficiencies and fewer NA hours had a consistent, significant negative relationship with total, quality of care, and quality of life deficiencies. Using qualitative methods to analyze physical environment and organizational factors influencing end-of-life care in nursing homes, Kayser-Jones et al. (2003) argued that inadequate staffing and lack of supervision contributed to poor quality of care, with 54% of the residents having pressure ulcers and 82% of these residents subsequently dying. Schnelle et al. (2004) compared California nursing homes on 27 quality of care processes, showing that the highest-staffed homes performed significantly better on 13 of 16 care processes implemented by NAs compared to lower-staffed homes.

Having certain types of staff may be more important than the total number of nursing staff hours per resident (IOM, 1986). In a study using a nationally representative sample of nursing homes and residents, Cohen and Spector (1996) measured staffing intensity as the number of FTE staff by type of staff (RNs, LPNs, and NAs) per 100 residents adjusted for case mix. They found that a higher RN intensity was associated with a lower rate of mortality, and a higher intensity of LPN staffing improved functional status measured by Activities of Daily Living (ADLs). However, having more NAs had no impact on resident

outcomes. These findings suggest that the professional mix of staff may be more important than the overall number, and that efforts to improve quality should focus on increasing the intensity of the professional staff. Carter and Porell (2003) examined the relationship between nursing personnel expenses and hospitalization rates among residents of 527 nursing homes in Massachusetts using three years (1991-1994) of state quarterly Medicaid case mix reimbursement data linked with Medicare hospital claims. Residents of nursing homes where nursing personnel expenses were more heavily allocated to LPNs versus RNs were at greater risk of hospitalization relative to similar residents of nursing facilities with relatively greater RN expenses. Using a sample of 1,287 nursing homes in five states (New York, Maine, Vermont, Kansas, and South Dakota), Weech-Maldonado et al. (2004) found that greater use of RNs, both in total and relative to total nursing staff, was associated with a reduced likelihood of pressure ulcers or restraint use, and with better cognitive functioning and processes of delivering care such as lower use of restraints.

Porell et al. (1998) investigated resident and facility attributes associated with health outcomes for long-stay residents using quarterly survey data for Medicaid case mix reimbursement of nursing homes in Massachusetts from 1991 to 1994. Regression models were estimated for survival, ADL functional status, incontinence status, and mental status outcomes. Better survival chances were found in facilities devoting large fractions of their nursing expenses to LPNs, and better mental status was found in facilities with greater nurse FTE staffing levels per resident day. The authors speculated that the lack of effect for RN staffing in their study may be due to their focus on long-stay rather than short-stay residents. More recently, Decker (2006) used National Nursing Home Survey Data from 1999 to show that RN staffing levels were associated with better outcomes measured by faster discharge to

the community for short-stay residents requiring primarily post-acute or rehabilitation care but not for long-stay residents. The cross-sectional nature of the study, however, may have limited the ability to detect an effect for long-stay residents.

Although most studies have found that higher nursing home staffing are associated with higher quality of care, the implication of previous findings may not reflect the true relationship between staffing and quality of care. Many of these studies were based on the cross-sectional variation in staffing and quality of care, and did not control for the unobserved facility-specific characteristics that influence both the level of staffing and the quality of care. For example, while increasing staffing may improve quality of care in a given facility, facilities with better managerial efficiency and leadership may also have been more likely to adopt a higher level of staffing and higher quality. The omission of a measure of managerial efficiency and leadership will cause upward bias on the estimated effect of staffing on quality of care, with an overestimate of the effect of staffing on quality of care. Alternatively, if an unobserved measure of nursing practice skill is positively associated with quality of care but negatively related to the staffing, then the estimated effect of staffing on quality of care will be understated due to downward bias.

Indeed, staffing may also be adjusted and chosen by facilities in response to the changes in residents' health needs as well facilities' internal resource allocation criteria. In particular, staffing may be jointly determined with the level of quality of care. It is possible that facilities that attract sicker residents, those more prone to adverse outcomes, tend to hire more staffing. In that case, failure to account for this endogeneity or reverse causality would result in underestimates of the effect of staffing on outcomes. Conversely, a facility with higher quality also may have more incentive to adopt a higher level of staffing. As high

quality may drive a facility to adopt high staffing, quality and staffing may be simultaneously determined. In this case, the omitted variable bias would likely result in an overestimation of the effect of staffing on outcomes in nursing homes.

Analyses that do not control for unobserved facility heterogeneity and simultaneity (or reverse causality) will produce misleading results and policy implications. Concerns about possible endogeneity of staffing due to facility heterogeneity and simultaneity have been raised by recent studies (Castle, 2005; Harrington and Swan, 2003; Zhang and Grabowski, 2004), and examined by several hospital staffing studies (McCue et al., 2003; Mark et al., 2004; Mark et al., 2005). The use of a longitudinal model in a recent study of the effect of hospital staffing on mortality was shown to result in substantially smaller estimates than estimates from cross-sectional research (Mark et al., 2004), with a larger RN effect when endogeneity was addressed.

Within the nursing home literature, a recent paper by Zhang and Grabowski (2004) is the only published study that directly controls for the unobserved time-invariant factors across homes using a first difference (FD) approach to fixed effects (FE) regression analyses. Using data from 5,092 nursing homes from 22 states linked across the pre-NHRA (1987) and post-NHRA (1993) period, they examined whether changes in staffing have been related to changes in quality before and after the federal staffing regulation. However, as mentioned before, the results from this model were unable to link higher staffing under the NHRA to better quality except in certain cases where facilities had substandard staffing in the pre-NHRA period.

Although their study tried to control for unobserved and potentially confounded factors which are common across homes over the study period, FE estimators do not fully

correct for potential simultaneity, and are still biased if there are omitted variables correlated with staffing choice which are not common across homes over time. Furthermore, their study analyzed a period prior to important legislation affecting the nursing home industry.

CHAPTER III

THEORETICAL FRAMEWORK

In order to assess the effects of state minimum staffing standards on nursing home performance and to estimate the unbiased effect of staffing on quality of nursing home care, it is important to explore how nursing homes make input and output decisions in response to the various internal and external environments they face. Section 3.1 provides an overview of economic models of nursing home behavior previously published in the nursing home literature. Section 3.2 discusses the implications for nursing home input and output decisions in face of increased minimum staffing standards. Section 3.3 summarizes several other factors affecting nursing home decisions. Finally, three research questions with testable hypotheses and the significance of this study are described in Sections 3.4 and 3.5.

3.1. Economic Models of Nursing Home Behavior

Over several decades, economists have developed theories to explain the behavior of health care organizations. This subsection reviews the standard economic theories of nursing home behavior, and further explores the empirical models to explain nursing home decision-making process.

3.1.1. Nursing home objective function and the choice of quantity and quality

The standard economic model generally hypothesizes that health care organizations maximize the quantity and quality of services they provide (Newhouse, 1970; Phelps, 1997; Sloan, 2000). An individual firm has a utility function (i.e., objective function) of the form $U = U(Quantity, Quality)$, and gains utility from both quantity and quality of services. After taking the full derivative of the utility function and then holding the change in utility equal to zero, the resulting expression $dQuantity / dQuality = -U_{quality} / U_{quantity}$ gives the usual economic notion of quantity and quality trade-off in producing utility. Regarding the best choice of quantity and quality, this result implies that firms will choose the point on the quantity and quality trade-off curve (i.e., the loci of equilibrium quantity-quality combinations) which yields the highest utility (i.e., tangent to the highest attainable indifference curve) (Phelps, 1997).

Facilities may weigh quantity and quality considerations differently depending on various internal and external factors. Evidence from empirical studies indicates that nonprofit firms will emphasize quality (Chou, 2002; O'Neill et al., 2003). The decisions are also influenced by unobserved facility characteristics (e.g., norms, tastes of the facility administrator, etc.).

This general idea of the utility-maximizing model has often been cited to explain behavior by nonprofit-dominated firms such as acute hospitals. While a hospital can be better off with an increase in services provided, at the same time the hospital decision makers may desire to show professional excellence or technical virtuosity by stressing quality of care (Newhouse, 1970).

Although the utility-maximizing behavior would be similar for nursing homes, the nursing home market differs from the acute hospital market in several fundamental ways.

For example, the nursing home industry is dominated by for-profit facilities sometimes facing excess demand (Norton, 2000). Despite extensive theoretical examination of the utility-maximizing framework, in the real world, empirical models for the for-profit dominated nursing home industry often consider alternatives such as profit-maximization or cost-minimization models. The following subsection (3.1.2) briefly introduces a formal model of profit-maximizing nursing home behavior frequently used in the nursing home literature.

3.1.2. Profit-maximizing level of quality

Unlike acute hospitals, nearly two-thirds of nursing homes are for-profit facilities (Grabowski and Norton, 2005). Thus, the majority of nursing homes have strong incentives to choose the profit-maximizing level of quality of care under a given level of quantity. Most economic studies of quality of care in nursing homes during the 1980s and 1990s were based on Scanlon's (1980) and Nyman's (1985) models of a profit-maximizing monopolistically competitive market under a binding bed constraint. Nonprofit facilities may have different goals from for-profit facilities but still must operate efficiently to stay in business under the current competitive circumstances; therefore, the essence of the same profit-maximization problem would be imbedded in the decisions of any nonprofit facilities (Konetzka et al., 2004a). In the absence of an alternative well-accepted model of nursing home behavior, therefore, a profit-maximization framework would appear to be a good starting point for analysis.

Norton (2000), who synthesized the previous theoretical and empirical work, described the following model of nursing home quality of care. Nursing homes care for two

types of patients: those who finance their care privately and those whose care is paid for through the Medicaid program.[4] The sum of private and Medicaid residents cannot exceed the total capacity regulated by the Certificate of Need (CON) and construction moratoria legislation which restrict the supply of nursing home beds. Nursing homes are assumed to provide the same level of quality to both private and Medicaid residents (i.e., quality as a public good), but only private residents can choose nursing homes based on quality.

Private demand is a function of price and quality $X(p,q)$, where X is the number of private residents, p is the private price, and q is the quality provided. The number of private residents is assumed to be decreasing in price and increasing in quality. The nursing home takes both the Medicaid payment rate r and its own bed supply Y as given. The nursing home cost function depends on quality and is assumed to be increasing in quality. Under these assumptions, the nursing home chooses the optimal private price p and quality of care q so as to maximize profit Π subject to the binding bed constraint Y:

$$\max_{p,q} \Pi = pX(p,q) + r[Y - X(p,q)] - C(q \mid Y) \tag{3.1}$$

The first-order conditions, $\Pi_p = 0$ and $\Pi_q = 0$, imply that the nursing home sets the marginal revenue from a change in either private price or quality of care to be equal to the marginal cost.

$$(p - r)X_p + X = 0 \tag{3.2}$$

[4] Although nursing homes also serve Medicare residents, the proportion has historically been small and, prior to prospective payment, had reimbursement rates that were as desirable as private rates.

$$(p - r)X_q - C_q = 0 \tag{3.3}$$

This type of model has been applied to study nursing home decisions about the private price and quality of care in face of various Medicaid cost containment policies, including changes in payment method, payment level, and CON legislation (Cohen and Spector, 1996; Gertler, 1989; Gertler and Waldman, 1992; Nyman, 1985; Scanlon, 1980). For example, the effects of a change in the Medicaid payment rates on the private price and quality of care can be found by (1) totally differentiating the first-order conditions with respect to private price, quality of care, and the Medicaid rate, and then (2) applying Cramer's rule to get the equations of $\partial p / \partial r$ and $\partial q / \partial r$. The comparative statics results lead to intuition pertaining to the effects of Medicaid payment rates (r) on the private price (p) and quality of care (q). Under a binding bed constraint, nursing homes do not view a Medicaid payment as a reward for quality, and thus have an incentive to first accept higher-paying private pay residents and then fill the remaining beds with Medicaid residents (Grabowski, 2001b). Raising Medicaid rates in a market with excess demand is, therefore, hypothesized to reduce an incentive to use quality of care to compete for the private residents. Several earlier studies confirmed this inverse relationship between Medicaid payment rates and quality of care (Gertler, 1989; Gertler and Waldman, 1992; Nyman, 1985).

However, several conditions have changed since most of these studies were conducted. In particular, the model above may not account for the more recent competitive state of the nursing home industry. Competition from other long-term care alternatives (e.g., assisted living facilities, home health care etc.) has reduced demand for nursing home services (Grabowski, 1999, 2001b; Grabowski and Norton, 2005). The steady declines in

nursing home occupancy rates over the last two decades and recent repeal of CON or moratoria laws in many states confirmed that current market conditions may no longer support the existence of excess demand in the nursing home industry (Grabowski, 1999, 2001b). Without a binding bed constraint, nursing homes use quality of care to compete for both private and Medicaid residents. Unlike the earlier research, recent studies have generally found a modest positive relationship between Medicaid payment rates and nursing home quality of care (Grabowski, 1999, 2001b; Grabowski and Castle, 2004).

In addition, the model may not account for an important third group of nursing home Medicare residents. Given the fact that the implementation of prospective payment system for Medicare skilled nursing services in 1998 ended the generous cost-based reimbursement that Medicare previously offered, recent Medicare payment changes may directly alter nursing home behavior and affect quality of care provided. In order to account for recent changes in nursing home market, several recent studies modified the model above by weakening the binding bed constraint (Grabowski, 1999, 2001b; Grabowski and Castle, 2004) and adding Medicare residents explicitly (Konetzka et al., 2004a, 2004b).

Despite some of the recent changes in the current nursing home market, the conceptual framework in this study uses the profit-maximization model in order to be consistent with the assumptions from the previous literature, and for simplicity as well. The next subsection (3.1.3) will introduce another important concept of factor substitution to explain how profit-maximizing nursing homes choose the optimal combination of input uses to produce nursing home care. The profit-maximizing model described above and the theory of factor substitution together will provide useful intuition as to the nursing home decision-

making process in response to increased minimum staffing standards while holding quantity constant.

3.1.3. Factor substitution in the production of nursing home care

Nursing homes choose levels of inputs such as labor, materials, and capital to maximize profit which is equal to the sum of revenues from selling their output minus the costs. In the short run, however, the capital is fixed ($\overline{K}$) and a nursing home must choose the cost-minimizing combinations of labor (L) and materials (M) to produce a given level of output.

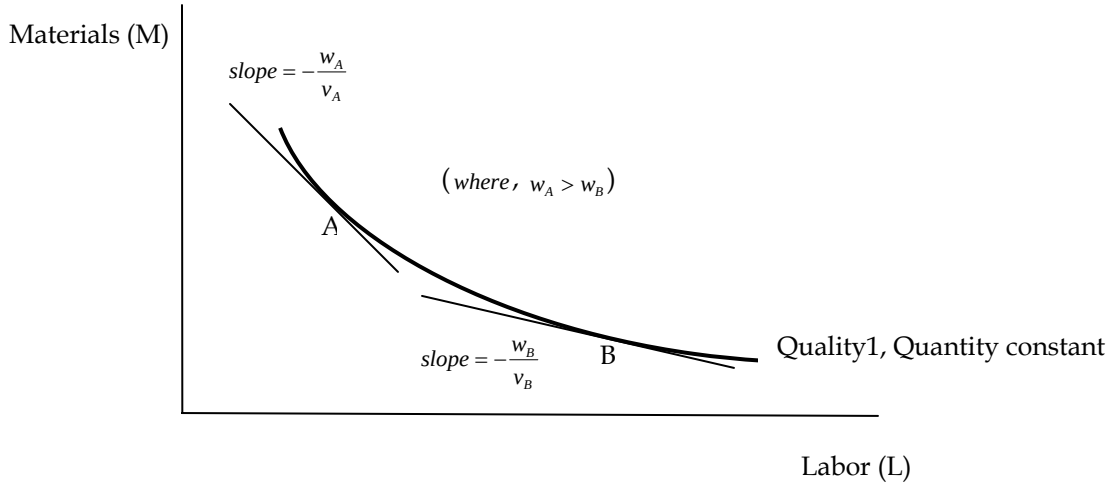
The marginal rate of technical substitution ($MRTS$), the rate at which one input can be substituted for another without changing the amount of output produced, is defined as the ratio of marginal products of two inputs (Folland et al., 2001; Jehle and Reny, 2000). Suppose w and v are the prices of labor and materials, respectively. Firms will maximize their output subject to a budget constraint by setting the MRTS equal to the ratio of input price: $MRTS_{LM} = \frac{\partial q / \partial L}{\partial q / \partial M} = \frac{MP_L}{MP_M} = -\frac{w}{v}$.

In Figure 3.1, the isoquant curve shows the combinations of labor and materials producing equal quality level 1, holding quantity constant. The negative slope to an isoquant indicates the possibility of factor substitution. The optimal choice of inputs should depend on the relative price of labor (w) and materials (v) holding capital fixed. For example, ignoring the income effect,[5] a lower price of labor (w_B) will lead to a relatively large

[5] In general, when the price of any one input increases, the total effect of a price change can be decomposed into the substitution and income effects. The substitution effect occurs because the firm shifts away from the now more expensive input into less expensive input. The income effect occurs because the firm demands less of

substitution of labor for materials (point B) for a given output quality1. When labor becomes relatively more expensive (w_A), nursing homes might choose less labor-intensive care (e.g., feeding by hand, scheduled toileting) and more material-intensive care patterns (e.g., use of feeding tubes, urethral catheterization) to minimize costs. This effect is shown as the movement along the isoquant Quality1 from point B toward A (i.e., substitution effect).

Figure 3.1 Factor Substitution in the Production of Nursing Home Care



3.2. Input and Output Decisions in Response to MSS

Nursing home input and output decisions in response to the increased minimum staffing standards are a major focus of this study. The framework described in Section 3.1.3 allows for consideration of the impact of MSS on staffing, quality of care, and financial performance while holding quantity constant.

3.2.1. Implications of MSS for the staffing decision

---

both labor and materials because of the increase in costs. In this discussion, the income effect is ignored initially for simplicity under the assumption that the substitution effect will dominate the income effect.

The theory of factor substitution suggests that the optimal choice of inputs should depend on the relative price of labor and materials. However, nursing homes do not have complete freedom in choosing the amount of labor used in production. Federal and state minimum staffing standards impose constraints on nursing homes' choice of staffing level (Cawley et al., 2004). Nursing homes can only choose their staffing at or above the minimum regulation level of MSS represented by the vertical portion of the isoquant in Figures 3.2 and 3.3. The compliance is monitored through an annual survey and certification process. Unless they apply for and receive an exemption, facilities that are not compliant with staffing standards can receive a deficiency and are subject to such sanctions as civil monetary penalties, denial of payment, or termination depending on the scope and severity.

Suppose that the minimum staffing standards increase from MSS to MSS' in Figures 3.2 and 3.3. Since mandated staffing standards are mostly directed at marginal performers at the low-end of the staffing spectrum, the new staffing standards will not necessarily affect facilities already at or above the standards (i.e., above MSS'). For this reason, two separate responses may occur, depending on the level of staffing prior to the regulation change.

If staffing were below the new standards (MSS'), those facilities at point A in Figure 3.2 must increase their staffing level to become compliant with new standards in the next period. While low-end facilities may be able to increase staffing level above new standards, the new MSS constraint likely leads those nursing homes to choose the corner (binding) solution of staffing at the new minimum regulation level of MSS' (point A'). Assuming both quantity and quality are held constant with no change in input prices (of either labor or materials), the relevant isocost (IC) line shifts from IC_1 to IC_2 and the firm operates at point A' with more labor and less materials being used in the production of QualityA1 (Figure 3.2).

IC_2 represents a greater level of total costs of production than IC_1, so financial performance may decline because of the need to cover the extra costs (as discussed in more detail in Section 3.2.3). Furthermore, those low-staff facilities may compete with other facilities in the market in order to employ or maintain adequate numbers of qualified workers, and thereby may need to increase wages or benefits paid to the nurse staff in order to meet new standards. A rise in wages makes the isocost line steeper at point A'(from IC_2 to IC_3 in Figure 3.2). According to the traditional theory of factor substitution, as wages rise, facilities will have an incentive to substitute materials for labor to minimize costs of production. However, because they need to keep minimum level of staffing for certification, the firm will continue to operate at point A' (the corner solution) facing even higher labor and therefore higher total costs.

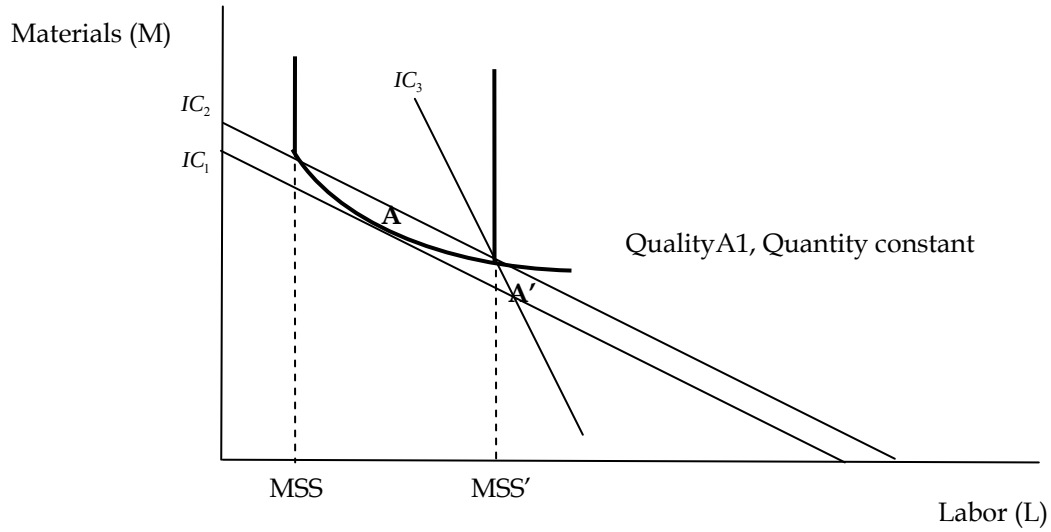
Facilities with relatively high staffing may respond to new standards differently. First, since mandated staffing standards are mostly directed at marginal performers at the low-end of the staffing spectrum, the new staffing standards will not necessarily affect facilities already at or above the standards (i.e., above MSS'). Facilities with already higher staffing level than new standards may not change their staffing level and may keep their current level of staffing for certification (i.e., stay at point B in Figure 3.3).

As facilities with previously lower staffing hire more staff, nursing homes with sufficiently high staffing that were not originally affected by the new standards may have to pay higher wages given the limited supply of nursing workers in the market. According to the traditional theory of factor substitution, as wages rise, facilities will have an incentive to substitute materials for labor to minimize costs of production. The new MSS constraint then leads those nursing homes to reduce their staffing level. As an extreme solution, the firms

might even have to choose the same corner (binding) solution of staffing at new minimum regulation level of MSS' as low-staff facilities do (though they might not decrease their staffing this much, it all depends on how much nursing wages increase). In this case, a rise in wages results in less labor and more materials being used in the production of QualityB1 in order to minimize costs. This effect is illustrated as the movement along the isoquant QualityB1 from point B toward B' in Figure 3.3.

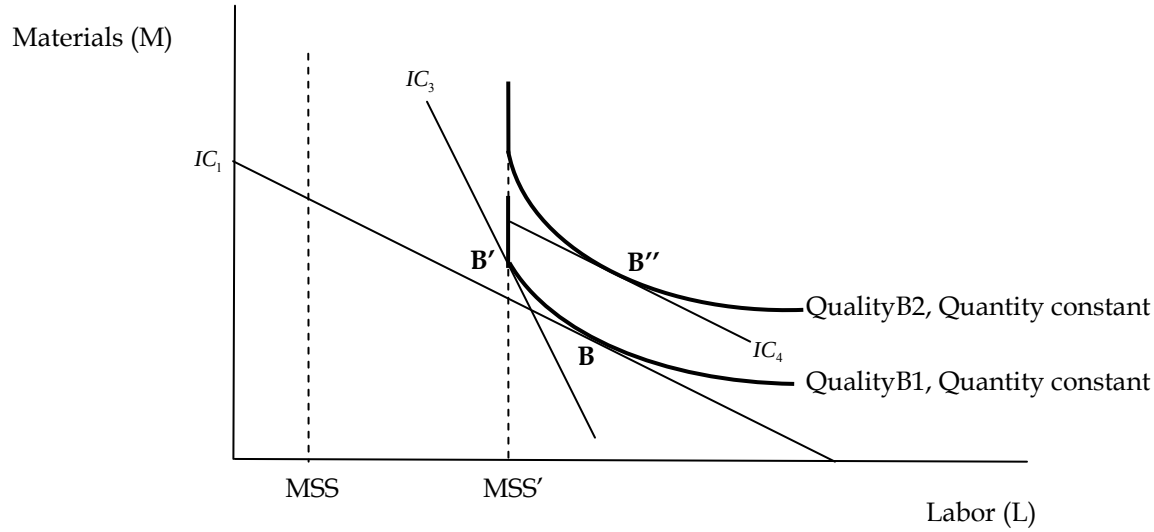
Other changes that are not as easily derived within this framework may also occur. For example, more and more facilities have shifted their focus to using quality of care as a means of competing for patients to improve their financial performance in the recent more competitive market. Thus, another plausible response is that those facilities may view the new staffing regulation as either increased scrutiny on their quality of care or as heralding new competition on quality from previously lower quality facilities with lower staffing. A differentiation strategy based on quality may make them look for other ways to improve quality by facilities to increase their use of both labor and materials. The isocost line then shifts from IC_1 to IC_4 (assuming both prices constant), and the firm operates at point B'' with more labor and more materials to produce the higher level of QualityB2. In this case, as a result, the staffing or quality spectrum between low-end and high-end facilities could become wider than it once was.

Figure 3.2 Factor Substitution in the Production of Nursing Home Care: Low-Staff (Below New MSS)



Notes: slope (IC_1)=slope (IC_2)$=-\frac{w}{v}$, slope (IC_3)$=-\frac{w'}{v'}$, $w < w'$, $IC_1 < IC_2$

Figure 3.3 Factor Substitution in the Production of Nursing Home Care: High-Staff (At or Above New MSS)



Notes: slope (IC_1)=slope (IC_4)$=-\frac{w}{v}$, slope (IC_3)$=-\frac{w'}{v'}$, $w < w'$, $IC_1 < IC_4$

3.2.2. Implications of MSS for the nursing home quality

While MSS is a strong predictor of staffing choices, the effects of MSS on quality of care might not be straightforward because MSS affects the non-staffing input decisions as well. Even though the theory of factor substitution assumes no change in quality of care along the given quality isoquant, empirically, increased staffing is generally hypothesized to result in higher quality since better staffing is likely to be associated with more individual attention to residents and an improved quality of life (Cohen and Spector, 1996). Conversely, the provision of nursing home care in material-intensive ways has been of particular concern because such care patterns are associated with greater risks of morbidity and mortality (Cawley et al., 2004; Zinn 1993). Under the production function of quality of care, the optimal combination of staffing and non-staffing inputs is transformed into a certain level of quality. An additional hour of nursing time will produce different amounts of quality depending on the levels of other inputs (i.e., materials).

Furthermore, the increased demand for staffing due to new MSS and its consequent effects on nursing home quality will depend at least in part on unobserved characteristics such as organizational efficiency and productivity of nursing home workers (i.e., unobserved heterogeneity in factor quality). Nursing homes are forced to operate at a high level of efficiency, particularly under the nursing shortage and documented staff recruitment and retention difficulties. Nursing homes that employ or retain more productive workers under the new MSS likely pay higher wages. Increases in labor costs, however, may be mitigated by improvements in production processes such as increases in overall organizational efficiency. By improving efficiency, nursing homes can produce more output with the same inputs, thereby generating higher revenues or reducing costs. This improvement in

organizational process may cause a facility with staffing originally higher than MSS' to achieve higher level of quality of care even without changing staffing hours, holding materials use constant. Nursing homes may also be able to improve the productivity level of nursing workers by increasing job satisfaction or decreasing turnover rates. In this case, nursing homes may end up producing higher quality of care without changing staffing hours.

Even though the points along the isoquant assume a single type of labor or, at least, a constant staff mix, facilities are also able to change their mix of staffing in that they can substitute cheaper forms of labor (e.g., LPNs or NAs) for some expensive forms (e.g., RNs) that may have higher productivity. It is also important to note, therefore, that increases in staffing hours may not necessarily result in increases in quality if other dimensions of staffing are changing.

3.2.3. Implications of MSS for the nursing home financial status

While MSS is hypothesized to unambiguously increase staffing at facilities whose staffing is below the new standards, the impacts on financial performance are less clear. Increases in staffing will increase costs (and may also increase quality unless the facility simply substitutes staff for non-staff inputs). The implications for financial performance, however, depend heavily on the response by consumers. The response will also depend on the payer status of consumers.

If private pay residents value quality, then they may be willing to pay more for better quality of care. Facilities that increase their staffing might then not only be able to cover increases in costs but might even show improved financial performance if there is an increase in demand for their services. If private pay residents do not realize the value of increased

quality, then they may not be willing to cover the costs of the additional staffing, and facility financial performance would decline because of the inability to get residents to cover the higher staffing costs. Since Medicaid rates are set by each state, a facility's financial return on Medicaid clients will only increase if the state raises the rate (e.g., in conjunction with the MSS). Even if Medicaid residents value quality, however, they may not be able to increase their use of nursing homes and could find themselves displaced by private pay residents seeking higher quality of care (unless the market has excess capacity or unless the state intervenes by increasing the rate).

Some of these changes, especially the input and to some extent the output responses, can be delineated using the graphical approach employed in the previous section. For facilities with low staffing levels before the new regulation, an increase in staffing input use (from point A to A' in Figure 3.2) increases nursing home costs. IC_2 represents a greater level of total costs of production than IC_1 so that profits should decrease to operate at point A' unless the facility looks for other ways to improve financial performance. If increasing either staffing or quality raises costs more quickly than revenues, profit must fall (at least in the short run) as quality improves (O'Neill et al., 2003). Furthermore, as discussed earlier, the increased demand for staffing due to new standards and competition with previously higher quality facilities with high staffing may lead those low-staff facilities to face higher wages even after they meet new standards. A rise in wages makes the isocost line steeper at point A' (from IC_2 to IC_3 in Figure 3.2), as a result, profit may be even lower under IC_3 due to additional labor costs.

However, this conventional trade-off between quality and profit would not pertain to all nursing homes. Facilities, especially those with high staffing, can vary in their ability to

efficiently produce quality, for example, as a result of differences in their scale of operations (O'Neill et al., 2003). Nursing homes with higher quality may also experience better financial performance through their ability to generate higher revenues to offset increased costs.

More importantly, financial status will depend at least in part on consumers' responses to changes in price and quality level. Facilities could differ in terms of their ability to charge higher prices due to differences in demand elasticity in the markets they serve (O'Neill et al., 2003). Nursing homes blend multiple revenue streams to cover fixed and operating costs for all residents (Konetzka et al., 2006). Nursing homes may generate higher revenues especially from more profitable private pay residents, to compensate for the additional costs associated with new staffing standards. As the model of profit-maximizing nursing home behavior suggests, the decisions about the private price ($\partial p / \partial MSS$) and quality of care ($\partial q / \partial MSS$) will also change as nursing homes maximize profits under the new staffing standards. Since the number of private residents is assumed to be decreasing in the private price and increasing in quality, facilities can compete for private pay residents by increasing quality or (less likely) by decreasing price. In particular, more and more facilities focus on enhancing their quality of care as a means of improving their financial performances (Weech-Maldonado et al., 2004).

The private resident price that evolves in the market is a function of the elasticity of private demand with respect to price and the elasticity of private demand with respect to quality of care. Measuring elasticities is complicated but provides useful intuition on changes in profit level. If the private demand with respect to quality of care becomes more elastic (i.e., private residents become more sensitive to quality), an increase in quality of care

will attract more private residents and increase private demand. This increase in quality can pay for itself if the increase in private demand is large enough. Thus, the marginal benefit of raising quality of care is higher than before, and nursing homes can raise quality to attract private demand.

Even though the general assumption is that private demand is decreasing in price, homes may charge higher private prices to match the additional costs associated with enhancing quality as long as the market bears these increases. In particular, firms that previously had staffing below new standards may have to increase private rates to cover their now higher staffing costs; at the same time, firms that originally had staffing above new standards may also increase their private prices without losing market share and may use those higher revenues to improve quality (through staffing or non-staffing measures). These changes may be explained by the fact that private residents satisfied with the quality of care are more willing to pay for the benefits they receive and are more likely to tolerate price increases (Weech-Maldonado et al., 2004).

One important way a nursing home can increase revenues to offset increased costs is, therefore, to attract more profitable private pay residents. The increased revenues from the private residents are used to maintain overall revenues that support the costs of care for all types of patients (Konetzka et al., 2006).

3.3. Factors Affecting Nursing Home Choices

General agreement exists in research on the factors which affect both input and output decisions in the production of nursing home care. For example, the acuity level of residents is expected to be the most important factor in determining both facility staffing decisions and

observed health outcomes. Facility characteristics such as ownership and market and state-specific environments affect both staffing decisions and quality of care. The decisions are also influenced by unobserved facility characteristics (e.g., norms, tastes of the facility administrator, etc.).

3.3.1. Initial staffing status

In order to increase quality in a policy domain, many current state minimum staffing standards serve as the "floor (or minimum)" rather than the "ceiling (or optimum)" regarding quantity and quality of staffing (Marek et al., 1996). Mandated staffing standards are directed at marginal performers at the low-end of the quality spectrum, in particular, with respect to the staffing level. Therefore, new staffing standards will not necessarily affect those facilities already at or above the standards. Those facilities at the high-end may decide to maintain current level of staffing for certification. Only facilities with relatively low staffing will have to increase staffing level to become compliant with new standards. Most importantly, therefore, nursing homes will likely respond differently to the standards based on their staffing status along with their organizational goals, market socioeconomic conditions, or state political environment.

3.3.2. Ownership type

In contrast to the hospital industry, nearly two-thirds of all nursing homes are for-profit. The mix of for-profit and nonprofit firms has led to studies of how ownership affects costs, quality, and access to care (Grabowski and Norton, 2005). For example, nonprofit facilities may weigh quality and profit considerations differently, and they may end up with

zero profit. Many studies found that for-profit homes have significantly lower quality than nonprofit homes (Chou, 2002; O'Neill et al., 2003). It is commonly assumed by property rights theory that the profit motive is attenuated in nonprofit firms (Rosko et al., 1995). As competition increases, however, differences in behavior among different ownership types would be narrow and the decision-making process will be similar (Sloan, 2000; Grabowski and Hirth, 2003).

3.3.3. Market competition

Facilities in different market environments may have different incentives to make decisions. If nursing homes compete on the basis of quality, facilities in more competitive areas may maintain staffing or quality above the minimum requirements. Many recent studies argue that the nursing home market has become more competitive than it once was, especially with the implementation of Medicare PPS (Konetzka et al., 2006). Over the last two decades many states have repealed CON legislation, and declining occupancy rates suggest that the excess demand is not the case in recent nursing home market (Grabowski, 1999, 2001b; Grabowski and Norton, 2005). Competition from assisted living facilities and other alternative care sites (e.g., home health care, adult day care, and hospice care) has reduced demand for nursing home services. Therefore, nursing homes in more competitive markets could find it more difficult to retain clients while delivering poorer quality, or find that quality is a way of distinguishing oneself in a competitive market (O'Neill et al., 2003).

3.3.4. Informed consumers: publicizing quality information

Nursing homes have additional incentives to improve quality by other forms of regulation such as provision of quality information to consumers. Quality of health care was considered to be difficult for consumers to monitor, but much progress has been made in this field in recent years. CMS has published nationwide reports with quality measures at the individual nursing home through the Nursing Home Compare (NHC) website.

The collection and reporting of quality information may assist consumers in choosing nursing homes and may improve providers' performance by stressing quality of care. For example, some nursing homes may believe that higher nursing staffing levels are directly related to higher quality of care and to consumers' perceptions of quality (Harrington and Swan, 2003). These facilities may be aggressive in increasing staffing levels regardless of costs. Other facilities which are more profit-oriented may be less aggressive in implementing costly care services and, as a result, keep staffing levels at the minimum standard levels. Publicly available quality information may also remove the worst performers out of business and help to improve quality in nursing home market.

3.3.5. Medicaid reimbursement rates and other policies

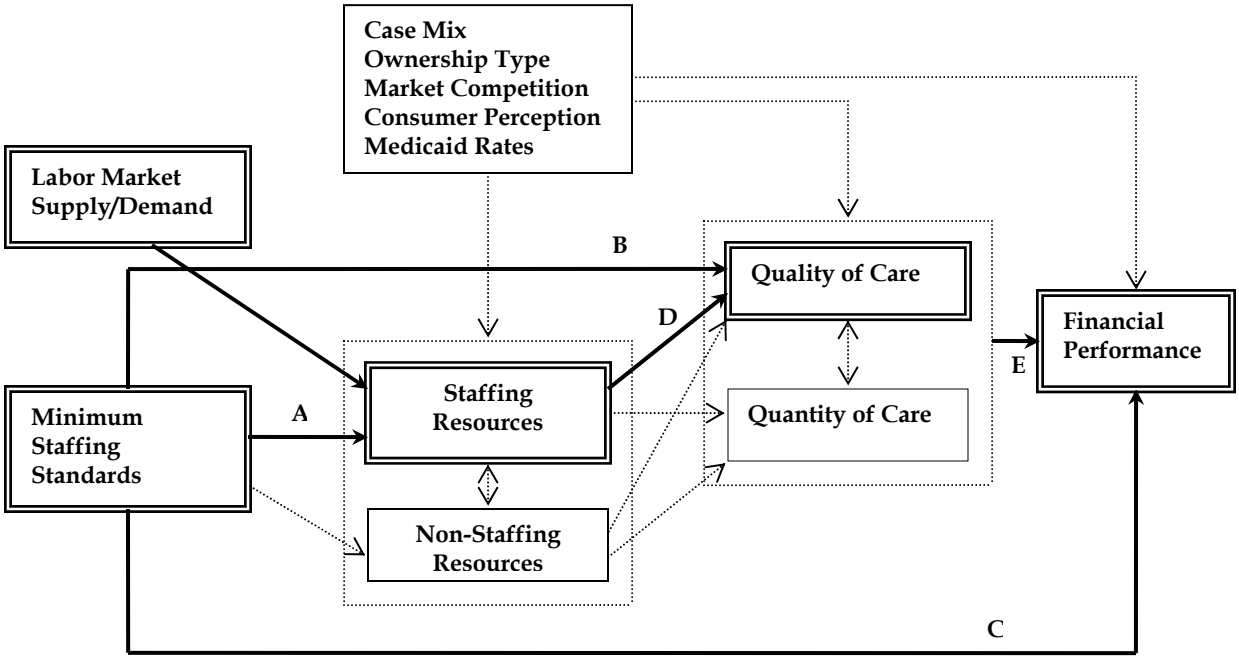
Facilities in different state environments may have different incentives to make decisions. States with more generous Medicaid programs as reflected by higher reimbursement rates will enable facilities to maintain higher staffing and quality than will facilities in states with less generous Medicaid rates. As described in Section 2.2, in particular, many states implemented several quality initiatives at the same time as they increased MSS. For example, many states increased Medicaid rates accompanied by MSS and those states commonly used a wage pass-through for recruitment and retention of

adequate numbers of qualified direct care workers (DHHS, 2003). Increased public funding allows facilities to increase both staffing and non-staffing input to produce more output (i.e., income effect). Other policy changes for nursing homes have a direct impact on nursing home decision-making process. Therefore, such policy changes should be controlled for in the empirical models of assessing the effects of MSS.

3.4. Research Questions and Hypotheses

The theoretical models described above enable important policy assessments by exploring facilities' strategic decisions on staffing input use, quality of care, and financial performance. The empirical analyses use different strategies to estimate total effects of MSS, and to estimate the relationship between staff and quality of care to determine if in fact more nurse staffing hours result in better quality of care. Figure 3.4 shows the pathways between state minimum staffing standards, nursing home staffing, quality of care, and financial performance. This dissertation was conducted in three parts to answer the three research questions described below.

Figure 3.4 Pathways between Minimum Staffing Standards, Staffing, Quality of Care, and Financial Performance in Nursing Homes



Note: Bold lines represent the pathways estimated in this dissertation.

Research Question 1: Do state minimum staffing standards improve the level of staffing and quality of care in nursing homes?

The first analysis assesses the total effects of state minimum staffing standards on staffing choices and on quality of care in nursing homes using a reduced-form facility-level fixed effects (difference-in-differences) approach. The effect of staffing standards on actual level of staffing is represented by pathway "A" in Figure 3.4, and the effect of staffing standards on quality of care is represented by pathway "B or (A+D)" in Figure 3.4.

While the hypothesized effect of MSS on staffing is direct, quality of care may be influenced by other aspects determined by MSS such as physical environment, differing

methods of treatment, the facility's efficient use of staff and non-staff inputs, or staff quality and productivity level. The reduced-form quality analyses do not directly answer the question whether more staffing results in better quality of care, but instead address the question of the total effects of MSS on quality.

Although not depicted in the diagram, the model specifies two different levels of policy effects (transition effects and steady state effects) by using a one year lagged time variable in order to account for a transition year as well as the fact that the effect of policy changes may occur after some lead time. Since a number of facilities operate at levels far above the mandated levels, nursing homes with staffing level previously below or close to new standards are more likely to have responded to the increased state standards. To the extent that the effect of minimum staffing standards is heterogeneous, the magnitude and direction of effects will be different. The analysis exploits this variation by including two policy variables reflecting time since implementation and their interactions with the indicator of low-staff facility. Furthermore, the study allows for differential effects of policy changes by ownership type. Structural differences for different types of facilities may suggest different policy implications in implementing or expanding staffing requirements, and may help to make well-informed policy decisions.

Based on the discussion above, the first analysis tests the following hypotheses. Hypothesis 1a provides an overall assessment, while hypotheses 1b and 1c focus on comparisons by staffing status or ownership type.

- Hypothesis 1a: Increases in state minimum staffing standards will increase the staffing and quality of care in nursing homes.

- Hypothesis 1b: Low-staff facilities (facilities with previous staffing levels below newly mandated standards) are more likely to be influenced by increases in staffing standards.
- Hypothesis 1c: For-profit facilities are less likely to be influenced by increases in staffing standards.

Research Question 2: What are the impacts of state minimum staffing standards on financial performance in nursing homes?

While higher nursing home staffing is hypothesized to lead to higher quality of care, the higher quality comes at a cost. In particular, increased mandated staffing standards may cause (at least some) facilities to face severe financial constraints. The second analysis investigates how recent changes in state staffing standards affect the financial performance in skilled nursing facilities by comparing financial measures before and after the changes in state staffing standards.

The total effects of staffing standards on financial performance, represented by pathway "C or (A+D+E)" in Figure 3.4, is assessed using the same reduced-form facility-level fixed effects (difference-in-differences) approach used in the staffing and quality analyses. The purposes of the second analysis are to: (1) assess the effects of state minimum staffing standards on the financial performance as reflected by profit, revenue, and cost during the period 1998 to 2001, and (2) determine whether nursing homes differ in financial performance in response to policy changes by staffing status or ownership type. Hypotheses tested are as follows:

- Hypothesis 2a: Increases in state minimum staffing standards will diminish financial status in nursing homes.
- Hypothesis 2b: In response to increases in state staffing standards, low-staff facilities are more likely to experience greater declines in financial performance than facilities with relatively high staffing.
- Hypothesis 2c: In response to increases in state staffing standards, for-profit facilities are more likely to experience less severe declines in financial performance than nonprofit facilities.

Research Question 3: What is the causal relationship between nursing home staffing and quality of care?

Besides identifying the effects of MSS on nursing home performance, an understanding and awareness of how current staffing differences across facilities affect the quality of care is also a major purpose of this study. A separate analysis is performed to confirm the relationship between staffing and quality of care. In contrast to the first analysis on the effect of MSS on quality of care, the third analysis directly measures the effect of a one unit increase in total staff hours on quality of care by including a staffing variable on the right hand side. However, the possibility that there may be unobserved heterogeneity in facility characteristics in choosing staffing could be a function of quality of care (i.e., reverse causality) makes it important to seek exogenous variation in staffing when attempting to estimate the unbiased effect of staffing on quality of care.

In the absence of some corrective statistical procedure, endogeneity of staffing may result in a spurious correlation between staffing and quality of care. In contrast to earlier

studies, the empirical models in the third analysis are designed to reduce or eliminate possible endogeneity bias while at the same time taking into account the panel nature of data. The third analysis assesses the causal effect of staffing on quality of care, represented by "D" in Figure 3.4, using state policy, market (county) level nurse supply and demand shifters as instruments to predict the staffing changes over time. Instrumental variables are incorporated in the empirical models in order to (1) identify how nursing homes respond to the changes in the exogenous state policy shock (i.e., state minimum staffing standards), the relative competitiveness of the market and local resource constraints, and (2) investigate how these changes interact with staffing to yield changes in quality of care. The following hypothesis is tested.

- Hypothesis 3a: After accounting for endogeneity, more total staff hours will improve quality of nursing home care.
- Hypothesis 3b: The direction or magnitude of the effects will be significantly different from the estimated effects in a model without adjustment for endogeneity.

3.5. Significance of This Study

This dissertation attempts to provide a detailed understanding of the main impacts of state minimum staffing standards. Specifically, the proposed study contributes to a more comprehensive understanding of the relationship between staffing standards, the level of staffing, quality of care, and financial performance in nursing homes in several ways.

- By comparing state minimum standards with actual nurse staffing levels in nursing homes in each state, this study assesses the behavior of nursing homes in

response to the changes in staffing standards, which may differ significantly when nursing homes face various environments. In addition, this study helps to inform a debate on the need for government regulations of nursing home staffing levels.

- By evaluating whether mandated staffing levels ensure high-quality nursing care, this study provides the insights into the policy debate about whether staffing standards are indeed an important policy instrument towards addressing the quality of nursing home care.
- By evaluating the impacts on financial performance in nursing homes, the potential association between quality and financial performance gives a new insight into policy implications relevant to facility management strategies to achieve both better quality and greater efficiency (i.e., increased productivity or more effective use of staffing).
- By investigating the underlying (causal) relationship between staffing and quality of care, this study provides further information about the appropriate staffing levels to ensure quality of care.

CHAPTER IV

DATA SOURCES

This study used secondary datasets from several distinct sources. Information on state minimum staffing standards was obtained from various published sources.[6] The facility-level staffing, quality, and financial information were drawn from two sources: Online Survey Certification and Reporting System and Medicare Cost Reports (MCR). Two other data sources were utilized to supplement OSCAR and MCR data. Market-level socioeconomic variables were obtained from the Area Resource File (ARF), and data on the population for each county came from the U.S. Census Bureau. The four distinct datasets that were combined with MSS data to form the analytic file are described separately below.

4.1. Online Survey Certification and Reporting System

The data on facility characteristics, staffing, and quality measures came from the OSCAR from 1998 through 2001. The OSCAR data are from state surveys of all federally certified Medicare skilled nursing facilities and Medicaid nursing facilities in the U.S. The OSCAR system includes about 96% of nation's nursing homes, and information from the

---

[6] (1) Harrington, C. (2002). Nursing Home Staffing Standards. *The Kaiser Commission on Medicaid and the Uninsured.* (2) U.S. Department of Health and Human Services Assistant Secretary for Planning and Evaluation Office of Disability (2003). *State Experiences With Minimum Nursing Staff Ratio For Nursing Facilities: Finding From Case Studies of Eight States.*

system is used to determine whether nursing homes are complying with federal regulations (Grabowski, 1999).

On average, nursing homes are surveyed every 12 to 15 months by state agencies under contract to CMS. In an initial survey, the standard forms are filled out by each facility at the beginning of the survey, and a team of state surveyors review the data and check its accuracy by comparing the facility report with individual resident medical reports, staffing records, and observations of data. In certain cases, follow-up surveys are conducted to assure that a facility correctly reported at the initial survey. Additionally, facilities must be re-surveyed when there are substantial changes in organization and management or to follow-up any complaints that allege substandard care. When there were multiple surveys of the same facility within a given calendar year, the most recent survey was used for the analysis in this dissertation.

Although OSCAR is the only uniform and easily available source for the data required for this analysis, it has several limitations. First, the certification procedures are generally not audited, which raises concerns regarding the validity and reliability of the data. Furthermore, staffing is reported for a two-week period at the time of survey, so it may not accurately depict the facility's staffing over a longer period. In particular, it may overstate the actual staffing level if the facility increases the staffing level during the period around the survey (Harrington et al., 2000b; Zhang and Grabowski, 2004). Staffing information is also found in annual Medicaid cost reports that nursing homes are required to file with the state health department. These reports provide staffing data for an entire year and they are reviewed by inside or outside auditors. However, these reports do not contain nationally uniform staffing data because the categories and definitions differ from state to state (GAO,

2003). A study by Harrington et al. (2000b) found that the staffing measures from OSCAR and California cost reports were quite similar; average staffing hours reported on OSCAR for California facilities were found to be only 0.1 hour higher than corresponding cost report data. Furthermore, OSCAR is the only national data available on staffing information and has been widely used for nursing home studies.

Second, the quality and resident characteristics available from OSCAR are also aggregated at the facility level. These data may, therefore, not reflect the true average resident-level case mix and severity, quality of care, or variation in these measures. More precise outcome measures (e.g., urinary tract infections, fractures, pain, weight loss etc.) would require resident-level data available in the MDS. However, the MDS is not readily available and some quality indicators from this data source may have reliability issues (Castle and Engberg, 2005). The MDS data acquisition process is very long and complex due to confidentiality concerns. Outcome measures are also available from the Nursing Home Compare (NHC) website. Since November of 2002, the CMS has reported information on quality indicators based on patient outcomes from the MDS (Mukamel and Spector, 2003). However, NHC measures are not yet stable and their risk adjustment methods change over time (Castle and Engberg, 2005). Therefore, the OSCAR data are the only national data source publicly available on the CMS website for this study.

Third, most data elements pertaining to resident characteristics and care practices from OSCAR are obtained partially by direct observation of surveyors based on the information provided by a facility. These measures include the use of restraints, activities of daily living, incontinence, and medications. However, the assessment of a selected sample is usually conducted in daytime, thus the observed care practices may not be accurate if other

shifts do not follow the same practices (i.e., restraint use may be higher at night when staffing levels are lower) (Grabowski and Castle, 2004).

One further limitation of the OSCAR data pertains to documented inter-survey reliability (both across and within states) in assessing the quality of facilities (IOM, 1986). Even though CMS has made efforts to standardize the reporting systems by state surveyors and provided extensive new federal training for state surveyors, some regional variations may exist. Different states may vary their survey procedures, training efforts, and enforcement stringency.

4.2. Medicare Cost Reports

All Medicare-certified SNFs are required to file cost reports annually in order to receive payments for treating Medicare residents. The MCR contains provider information such as facility characteristics, utilization data, cost and charges by cost center (in total and Medicare), Medicare settlement data, and financial statement data (http://www.cms.hhs.gov). Specifically, the data on financial performance analysis came from 1998 through 2001 freestanding SNF MCR that were in the CMS files released in June 2004. Since hospital-based nursing facilities are very different in terms of resident severity, care practice, and cost accounting systems (i.e., allocation of hospital overhead costs to the SNF units), this study only analyzes cost report data from freestanding skilled nursing facilities.

The historical purpose of MCR has been to determine Medicare's share of allowable costs and to provide a basis for calculating Medicare payments to providers. The cost reports for nursing homes do not undergo rigorous independent auditing. Consequently, the cost reports contain a wealth of cost accounting data, but a number of financial accounting

elements have historically been unreliable, poorly defined, and lacking in critical details. Documented problems include major differences in: reported profits; variations in the reporting of both revenues and expenses; an absence of relevant details, such as charity care, bad debt, operating versus non-operating income, and affiliate transactions; an inconsistent classification of changes in net assets; and a failure to provide cash flow statements (Kane and Magnus, 2001).

Although data quality concerns were identified, because of the limited disclosure of accurate, timely, and comprehensive financial statements, the MCR has been a primary national database of financial information of Medicare-certified providers including hospitals, SNFs, and home health agencies. The financial performance indicators in this study were obtained from the operating statistics on the SNF MCR (from worksheets G and S, as described in more detail in Section 5.1.3). These data were then converted to the calendar year data using the facilities' accounting period-end dates in order to merge with other calendar year data.

4.3. Area Resource File

The ARF is a collection of data from more than 50 sources, including the American Medical Association, American Hospital Association, U.S. Census Bureau, Centers for Medicare and Medicaid Services, Bureau of Labor Statistics, and National Center for Health Statistics. The data include county codes and classifications, health care professions, health care facilities, population and economic data, health care professions training, hospital utilization, hospital expenditure, and environment data. The county is used as the basic

geographical unit of aggregation since it is the smallest unit for which many health care measures are available.

The file is a publicly available dataset containing more than 7,000 economic and demographic variables for each of the nation's counties. The ARF is widely used by policymakers and researchers interested in the nation's health care delivery system and factors that may impact health status and health care in the U.S. Thus, market-level variables such as per capita income and unemployment rate were obtained from the ARF.

4.4. U.S. Census Bureau

The U.S. Census Bureau publishes annual population estimates for states, counties, and all other units of general purpose government each year. Specific information on the population estimates by age and sex for each county came from the U.S. Census Bureau. The reference date for these estimates is July 1st of each year.

CHAPTER V

CONSTRUCTION OF KEY VARIABLES

5.1. Variable Definition and Sources

Table 5.1 summarizes the definitions and data sources for the constructed variables in the models. Construction of variables within the major categories is described in separate sections below.

Table 5.1 Description of Variables and Data Sources

Variables	Definition	Sources
Staffing:		
RN HPRD	(RN FTEs reported for a 2-week period × 70(hr)) / (Total residents × 14(days))	OSCAR
LPN HPRD	(LPN FTEs reported for a 2-week period × 70(hr)) / (Total residents × 14(days))	OSCAR
NA HPRD	(NA FTEs reported for a 2-week period × 70(hr)) / (Total residents × 14(days))	OSCAR
Total HPRD	(Total FTEs reported for a 2-week period × 70(hr)) / (Total residents × 14(days))	OSCAR
Quality of Care:		
% Pressure sores	(Residents with pressure sores / Total residents) × 100	OSCAR
% Contractures	(Residents with contractures / Total residents) × 100	OSCAR
% Incontinence	(Residents with bladder incontinence / Total residents) × 100	OSCAR
% Catheter use	(Residents with catheter use / Total residents) × 100	OSCAR
% Restraint use	(Residents with restraint use / Total residents) × 100	OSCAR
Total deficiencies	Total number of deficiencies cited	OSCAR
Incidence rate of pressure sores	[(Residents with pressure sores on survey – Residents with pressure sores on admission) / Total residents] × 100	OSCAR
Incidence rate of contractures	[(Residents with contractures on survey – Residents with contractures on admission) /	OSCAR

	Total residents] × 100	
Incidence rate of catheter use	[(Residents with catheter use on survey – Residents with catheter use on admission) / Total residents] × 100	OSCAR
Incidence rate of restraint use	[(Residents with restraint use on survey – Residents with restraint use on admission) / Total residents] × 100	OSCAR
Financial Performance:		
Total margin	[(Net patient revenues + Other operating and non-operating revenues – Total operating expenses – Other expenses) / (Net patient revenues + Other operating and non-operating revenues)] × 100	MCR
Revenue per diem	Net patient revenues / Total resident days Adjusted by the Consumer Price Index (CPI)	MCR
Expense per diem	Total operating expenses / Total resident days Adjusted by the Consumer Price Index (CPI)	MCR
Policy: Staffing Standards		
Transition effect	=1, if one year after a state established or increased minimum staffing standards	Harrington (2002) DHHS (2003)
Steady state effect	=1, if two years afterward	Harrington (2002) DHHS (2003)
Facility:		
Ownership		OSCAR
For-profit	1=For-profit	
Nonprofit	1=Nonprofit	OSCAR
Government	1=Government	OSCAR
Chain	1=Chain, 0=No Chain	OSCAR
Payer mix		
% residents paid by Medicare	(Residents on Medicare / Total residents) × 100	OSCAR
% residents paid by Medicaid	(Residents on Medicaid / Total residents) × 100	OSCAR
% residents paid by others	(Residents on private pay / Total residents) × 100	OSCAR
Total beds	Total number of beds	OSCAR
Occupancy rate	(Total residents / Total beds) × 100	OSCAR
Case mix		
Acuity index	=ADLINDEX + STINDEX • ADL index (ADLINDEX): An average of the percent of residents who are bedfast or chairbound or need assistance with eating, toileting, and transferring, weighted by the amount of assistance needed • Skilled service index (STINDEX): A sum of the percentage of residents utilizing intravenous therapy, suctioning, respiratory therapy, tracheostomy care, and parenteral	OSCAR

	feeding	
% Pressure sores on admission	Rate of pressure sores on admission	OSCAR
% Contractures on admission	Rate of contractures on admission	OSCAR
% Catheter use on admission	Rate of catheter use on admission	OSCAR
% Restraint use on admission	Rate of restraint use on admission	OSCAR
Output:		
Ln (Total resident days)	The natural log of total resident days	MCR
Input Price:		
Ln (CMS SNF wage index)	The natural log of CMS SNF wage index	CMS
Market:		
Herfindahl-Hirschman index	The sum of each facility's squared percentage share of beds for all facilities in the county	Computed from OSCAR
Empty beds per 1,000 elderly (65+)	Number of empty beds per 1,000 community-dwelling elderly (65+) in the county	Computed from OSCAR
Per capita income (in $1,000s)	Per capita income in the county / 1,000	ARF
Unemployment rate (16+)	Unemployment rate (%) in the county	ARF
Population 85+ (in 1,000s)	Population aged 85 and over in the county / 1000	US Census Bureau
Female population 15-44 (in 1,000s)	Female population aged 15 to 44 in the county / 1,000	US Census Bureau
State:		
Medicaid rate	State Medicaid rate adjusted by the Consumer Price Index (CPI)	Grabowski et al. (2004) Harrington et al. (1999)

Notes: HPRD=hours per resident day, FTE=full-time equivalent, ADL=Activities of Daily Living, OSCAR=Online Survey Certification and Reporting System, MCR=Medicare Cost Reports, CMS=Centers for Medicare and Medicaid Services, ARF=Area Resource File
Sources: (1) Harrington, C. (2002). Nursing Home Staffing Standards. *The Kaiser Commission on Medicaid and the Uninsured.* (2) U.S. Department of Health and Human Services Assistant Secretary for Planning and Evaluation Office of Disability (2003). *State Experiences With Minimum Nursing Staff Ratio For Nursing Facilities: Finding From Case Studies of Eight States.* (3) Grabowski, D. C., Feng, Z, Intrator, O., & Mor, V. (2004). Recent Trends In State Nursing Home Payment Policies. *Health Affairs* Web Exclusive, June 16, 2004. (4) Harrington, C., Swan, J. H., Wellin, V., Clemena, W., & Carrillo, H. M. (1999). *1998 State Data Book on Long Term Care Program and Market Characteristics.* San Francisco: University of California, San Francisco.

5.1.1. Staffing

As described in Chapter IV, staffing information available from OSCAR is at the facility-year level, and measures of staffing available for the individual residents at different points in time are not available. Each facility reports the number of full-time equivalent

positions in the facility (employees or contract workers) over the previous 14 days. For this analysis, the staffing level variables are constructed by hours per resident day by licensure type (i.e., RNs, LPNs, and NAs) and total nursing staff. To convert the measures to hours per resident day, the total number of staffing payroll hours reported in a two-week period are multiplied by 70 hours and then divided by the total number of residents and by the 14 days in the reporting period. This approach is currently used by CMS and other nursing home studies (Harrington, 2002; Zhang and Grabowski, 2004).

5.1.2. Quality of care

A variety of quality measures have been recommended by the IOM as a component of a nursing home quality assurance system (IOM, 1986) and by several empirical studies (Abt, 2003; Grabowski et al., 2004a; Rantz et al., 2004; Zimmerman et al., 1995; Zinn et al., 1999). The quality measures in this study were chosen based on the standard measures used in nursing home research following these recommendations (Castle and Engberg, 2005; Grabowski, 1999; Harrington et al., 2000b) and on availability in the OSCAR data.

The six quality measures in the first analysis (i.e., effects of MSS on staffing and quality of care) were selected in order to capture multidimensional aspects of quality: resident outcomes, process of care, and overall facility quality. In many aspects, resident outcome measures are the single most important measure of quality of care in that such measures are resident-oriented, representing the actual impact of the nursing home staffing on the residents' physical, mental, and emotional wellbeing. Resident outcomes are therefore measured by the rates of pressure sores, contractures, and bladder incontinence.

Pressure sores are a particularly good outcome measure of quality because they are preventable and treatable conditions. Furthermore, they are thought of as an adverse outcome, regardless of the underlying health of the resident (Grabowski, 1999). Contractures are a special condition related to having a restriction of full passive range of motion of any joint due to deformity, disuse, pain, etc., including fingers, wrists, elbows, shoulders, hips, knees, and ankles (Cowles, 2002). Lack of movement can cause contractures, so the rate of contractures may be a valid indicator of staff availability to improve quality of care as well.

Process of care refers to the actual care the nursing home resident receives and pertains to the appropriate and correct performance of specific technical procedures and services. Processes of care measures include the rates of catheter use and restraint use. Urethral catheterization places the resident at greater risk for urinary track infection; other long-term complications include bladder and renal stones, abscesses, and renal failure (Cawley et al, 2004). Physical restraints may increase the risk of pressure sores, depression, mental and physical deterioration, and mortality (Zinn, 1993). Materials-intensive methods of care have been known to be associated with greater risks of morbidity and mortality among nursing home residents (Cawley et al., 2004; Zinn, 1993). Finally, overall facility quality is measured by total number of facility survey deficiencies.

For the third analysis assessing the relationship between staffing and quality of care, onset or prevention of certain conditions is of primary interest. Therefore, only four quality measures were used for the third analysis. Resident outcomes are measured by the incidence rates of pressure sores and contractures, while processes of care measures include the incidence rates of catheter use and restraint use. The current condition of residents at the time of survey might simply reflect the resident case mix and severity rather than onset of or

prevention of these conditions due to quality of care. To avoid this problem, the rates of onset of the four adverse outcomes since admission are constructed by subtracting the percentage of residents with either of four conditions on admission from the current rates. OSCAR requires the facility to provide both the number of residents with pressure sores, contractures, catheters, or restraints at the time of survey, and the number of residents with the conditions on admission among those who have either of four conditions. To prevent skewed results, erroneous negative values are recoded to zero, and unrealistically high incidence rates are recoded to the 99^{th} percentile values of the data. Each quality measure is treated as a continuous variable.

5.1.3. Financial performance

All the financial accounting elements were extracted from the MCR's worksheets G and S. Worksheet G contains a balance sheet, a statement of changes in net assets, and a statement of patient revenues and operating expenses, while worksheet S provides operational data. Financial performance indicators are subdivided into three categories: profit, revenue, and cost. Table 5.2 shows the definitions and MCR sources for the constructed financial performance indicators.

Profit level is measured by total margin. This indicator has been frequently used as a measure of financial performance in health services research (GAO, 2003; McCue et al., 2003; Wang et al., 2001; Weech-Maldonado et al., 2004). This indicator is calculated by dividing net income from both operations and non-operations (e.g., donations and gains or losses on investments in securities, real estate, or operating subsidiaries) by total health care

revenues. The ratio is expressed as a percentage and reflects profits from both operations and non-operations.

Net revenue per resident day is used to measure revenue performance. Net revenue is the total net patient revenue after the deduction from the gross routine and ancillary services revenue of contractual adjustments, allowance for bad debts, and charity care. Cost performance is measured by net expense per resident day. The annual Consumer Price Index (CPI) from the U.S. Bureau of Labor Statistics is used to convert all dollar amounts to constant 2001 dollars.

Table 5.2 Financial Performance: Definitions and Medicare Cost Report Sources

Financial Performance	Definition	Medicare Cost Report Sources
Profit		
Total margin	[(Net patient revenues + Other operating and non-operating revenues – Total operating expenses – Other expenses) / (Net patient revenues + Other operating and non-operating revenues)] × 100	[(Worksheet G-3, Line 3 + Worksheet G-3, Line 26 - Worksheet G-2, Part II, Line 15 - Worksheet G-3, Line 31) / (Worksheet G-3, Line 3 + Worksheet G-3, Line 26)] × 100
Revenue		
Revenue per diem	Net patient revenues / Total resident days	Worksheet G-3, Line 3 / (Worksheet S-3, Part I, Line 1, Column 7 + Worksheet S-3, Part I, Line 3, Column 7)
Cost		
Expense per diem	Total operating expenses / Total resident days	Worksheet G-2, Part II, Line 15 / (Worksheet S-3, Part I, Line 1, Column 7 + Worksheet S-3, Part I, Line 3, Column 7)

Note: FTE=full-time equivalent
Source: SNF Medicare Cost Report elements from CMS form 2540-96

5.1.4. Transition and steady state effects

The explanatory variables of key interest are the policy variables indicating staffing standard changes. State minimum staffing standards variables are constructed from various published sources. Dummy variables are used to indicate whether the state established or

increased minimum staffing standards for nursing staff for a given year by exploiting differences in the timing of standard changes for the 50 states and the District of Columbia from 1998 to 2001. Two dummy variables are constructed to specify two different levels of treatment effects: 'transition effects' and 'steady state effects'. The persistent (steady state) effect of policy changes is expected to be apparent after a while, thus the persistent effects of state policy changes are estimated with a one year lag specification. In particular, OSCAR measurement of staffing may occur before or after the actual start of the new standards in a calendar year. Therefore, estimating transition year effects separately should help to reduce possible measurement error.

Each facility-year observation could be a control or treatment group for estimating two different policy effects. For example, the information for year 2000 for facility "A" in a state that changed its policy in 1998 could be used as a control group for the transition effects and a treatment group for steady state effects.

5.1.5. Other explanatory variables

Several facility, market, and state level time-varying variables are used to control for changes in facility, market, and state characteristics over time. Time-varying facility characteristics available from OSCAR include ownership (i.e., for-profit, nonprofit, government), whether the facility is part of a chain, percent of residents on Medicare, bed size, occupancy rate, and information on resident case mix. The unit of analysis is the facility, and the resident characteristics are measured each year at the facility level. Resident case mix is represented by the sum of average ADL index and skilled service index (Cowles, 2002). The ADL index is the average of the percent of residents who are bedfast or

chairbound or need assistance with eating, toileting, and transferring, weighted by the amount of assistance needed. The skilled service index is a sum of the percentage of residents utilizing intravenous therapy, suctioning, respiratory therapy, tracheostomy care, and parenteral feeding. In addition, the rates of pressure sores, contractures, catheter use and restraint use on admission are included in each quality regression (in the first analysis) to capture baseline case mix differences between the facilities.

Market-level variables are used to provide additional controls over time. The Herfindahl-Hirschman index (HHI) is a proxy for a market competition with other nursing homes in the market. HHI is constructed by combining the squared market shares of all facilities in the county and determining each facility's percentage share of beds in the county (Castle, 2002). The index varies from 0 to 1, with 0 indicating perfect competition and 1 indicating monopoly (only one facility in the market). The identification of excess demand conditions has been a critical issue in the nursing home literature (Cohen and Spector, 1996; Grabowski, 2001b; Mukamel et al., 2005; Nyman, 1985). Using the presence of CON or construction moratoria regulation, however, does not capture the historical influence of policies to limit bed supply (Castle, 2002). Decreases in demand and increases in bed supply have eliminated the excess demand and forced nursing home markets to be more competitive (Mukamel et al., 2005). However, within-state variation in these policies is limited (Grabowski, 2004). As in several previous studies (Cohen and Spector, 1996; Grabowski, 2001a; Mukamel et al., 2005), excess demand was defined as the average number of empty beds in the county in which the facility was located. For this study, the average number of empty beds per 1,000 community-dwelling elderly (65+) in the county serves as a proxy for market demand, and indirectly captures the effects of facility occupancy and other long-term

care providers in the market. The annual average per capita income and the unemployment rate are included to control for county economic conditions. Total population aged 85 and over and female population aged 15-44 for each county are used to control for county demographic conditions.

Many of the study states implemented other quality initiatives at the same time they changed their minimum staffing requirements. State quality improvement such as Medicaid per-diem rates is included in the analysis. State Medicaid average per-diem rates over 1998-2001 are adjusted by the annual CPI and used as a continuous measure in 2002 dollars.

Consistent with empirical specification of prior cost and profits studies, the natural log of total resident days is included in the financial analysis as an output production, and the natural log of CMS SNFs wage index is used as an input price to measure variation in SNFs wage in a given year.

5.2. Descriptive Statistics for Identification of Low-Staff Facilities

As of 2001, a total of 30 states required total staffing standards, while 32 states required state-specific LN standards. Current federal standards require only minimum standards for LN. The federal LN requirements were applied for 19 states which did not have state-specific requirements. Seven states had established minimum state requirements for RN, whereas 10 states for NA.

5.2.1. Calculated MSS for a 100-bed nursing facility

State minimum staffing standards vary considerably in how they are described and are sometimes difficult to interpret. In order to assess the compliance rates with specific state

MSS and compare with actual staffing hours in nursing homes in each state, continuous measures of nurse staffing standards are constructed. Since each state has different types of regulations by size of facility or work shift, staffing standards need to be standardized to get a uniform measure. In this study, state minimum staffing standards are converted to staff hours per resident day for a 100-bed (approximately the average size of a facility) nursing facility with at least two units using Harrington's rule (Harrington, 2002). For simplicity, each full-time staff member is considered to work 8 hours per day, and one full-time DON is assumed to work 40 hours per week. If the state has staffing ratio regulations such as 1:10 full-time staff by shift (8hours/day), then it is converted to 0.8 HPRD (8 hours divided by the number of residents). All three shifts during a day are added (e.g., to equal 0.24 HPRD).

To meet the federal requirements, for example, a 100-bed nursing facility would need to have one RN and one LN on the day shift and one LN on the evening shift and one LN the night shift. This would be a total of 24 LN hours per day (equivalent to 0.24 HPRD for 100 residents) and 0.06 RN DON HPRD (40 hours divided by 7 days divided by 100 residents). Current federal LN requirements, therefore, would be approximately 0.30 HPRD, but federal standards do not require minimum standards for total nursing staff, direct care staff, or certified nurse assistants.

5.2.2. To identify facilities most likely to be affected by MSS: low-staff facilities

Nursing homes with staffing levels below or close to new standards in the period preceding the new standards are more likely to have responded to the increased state standards than facilities with prior staffing considerably higher than the new standards. To the extent that the effect of minimum staffing standards is heterogeneous, the magnitude and

direction of effects may be different. To create the indicator of low-staff facility, both licensed and unlicensed staffing in each year were compared to the required staffing in the next (subsequent) year to see if current staffing was lower than what was required in the next year. A facility was defined as low-staff if current (t) staffing was less than next year (t+1) required staffing in any one year.

It is important to remember that the low-staff variable in this study does not represent facilities that were below current standards, but instead identifies facilities that had to increase staffing to become compliant with new standards in the next period based on the standards as calculated for a 100-bed facility. Table 5.3 shows the percent of low-staff facilities by state in this study over the study period. Forty-nine percent of the facilities (N=7,460) were low-staff, while 51 percent of the facilities (N=7,765) were consistently above subsequent year standards over the study period.

Table 5.3 Low-Staff Facilities by State, 1998-2001

State	Number of Facilities (4-Year Average)	% of Low-Staff Facilities
AK	5	0.00
AL	199	0.11
AR	254	0.96
AZ	126	0.34
CA	1,053	0.86
CO	187	0.14
CT	257	0.29
DC	17	0.00
DE	35	0.48
FL	662	0.85
GA	308	0.94
HI	29	0.15
IA	458	0.63
ID	60	0.30
IL	777	0.75
IN	538	0.73
KS	350	0.48
KY	252	0.41
LA	360	0.75

MA	517	0.30
MD	228	0.15
ME	120	0.17
MI	416	0.18
MN	373	0.16
MO	507	0.74
MS	162	0.68
MT	62	0.15
NC	353	0.07
ND	69	0.26
NE	206	0.63
NH	78	0.29
NJ	326	0.26
NM	70	0.57
NV	37	0.79
NY	593	0.32
OH	966	0.26
OK	427	0.85
OR	148	0.16
PA	641	0.39
RI	95	0.47
SC	147	0.23
SD	96	0.56
TN	297	0.21
TX	1,183	0.68
UT	79	0.33
VA	265	0.39
VT	42	0.42
WA	256	0.15
WI	395	0.29
WV	117	0.09
WY	27	0.46
Total	15,225	0.49

5.2.3. Assessment of facilities compliant with MSS after implementation of new standards

While the process described in the previous section is used to identify the facilities most likely to be affected by MSS for the analyses, it is also of interest to assess the degree of compliance after implementation of MSS using the same approach. Therefore, total nurse hours were compared with constructed state staffing standards after implementation of MSS

(Table 5.4). Because many states account for the size of facility in setting staffing standards, the standards were calculated for a facility with 100 beds. To avoid errors in this comparison due to facility size relative to the actual standards, the comparison is limited to facilities with 80-120 beds.

States vary widely in their nursing homes' willingness and/or ability to meet the staffing standards. Most homes in most states met and exceeded the minimum staffing standards. In some states however (e.g., Arkansas, California, Illinois, Louisiana, Nevada), actual total staffing levels were substantially below the minimum staffing standards. A study by Harrington and O'Meara (2006) using California data also reported that a number of facilities operated at staffing levels below the mandated levels: 64% of nursing homes did not meet the mandatory standards in 2000, and 27% of facilities failed to comply by 2003, although the actual median nurse staffing level in nursing homes was substantially higher than each state's staffing standards.

Table 5.4 Compliance Rates to MSS for Total Staff: Facilities with 80-120 Beds

State		Year			
		1998 (26 States)	1999 (27 States)	2000 (29 States)	2001 (30 States)
AR	Calculated MSS	3.17	3.17	3.17	3.9
	Mean of total HPRD	2.65	2.65	2.82	2.73
	% Facilities met MSS	0.1	0.17	0.18	0.04
CA	Calculated MSS	3.06	3.06	3.26	3.26
	Mean of total HPRD	2.93	2.9	2.91	2.97
	% Facilities met MSS	0.33	0.3	0.21	0.24
CO	Calculated MSS	2.06	2.06	2.06	2.06
	Mean of total HPRD	2.87	2.87	2.78	2.83
	% Facilities met MSS	0.93	0.91	0.93	0.91
CT	Calculated MSS	1.96	1.96	1.96	1.96
	Mean of total HPRD	3.29	3.18	3.19	3.19
	% Facilities met MSS	0.88	0.89	0.89	0.89

DE	Calculated MSS	2.56	2.56	2.56	3.06
	Mean of total HPRD	3.91	4.19	3.9	3.51
	% Facilities met MSS	0.87	0.88	0.94	0.63
FL	Calculated MSS	2.3	2.3	2.3	3.6
	Mean of total HPRD	3.4	3.25	3.08	3.08
	% Facilities met MSS	0.95	0.96	0.96	0.13
GA	Calculated MSS	2.56	2.56	2.56	2.56
	Mean of total HPRD	2.83	2.78	2.87	2.88
	% Facilities met MSS	0.73	0.64	0.70	0.70
IA	Calculated MSS			2	2
	Mean of total HPRD			2.5	2.52
	% Facilities met MSS			0.82	0.82
ID	Calculated MSS	2.46	2.46	2.46	2.46
	Mean of total HPRD	3.32	3.07	3.35	3.35
	% Facilities met MSS	1.00	0.85	0.93	0.88
IL	Calculated MSS	2.56	2.56	2.56	2.56
	Mean of total HPRD	2.53	2.59	2.68	2.65
	% Facilities met MSS	0.39	0.41	0.42	0.44
KS	Calculated MSS	2.06	2.06	2.06	2.06
	Mean of total HPRD	2.29	2.33	2.41	2.47
	% Facilities met MSS	0.68	0.63	0.81	0.81
LA	Calculated MSS	2.66	2.66	2.66	2.66
	Mean of total HPRD	2.63	2.59	2.57	2.55
	% Facilities met MSS	0.38	0.38	0.36	0.35
MA	Calculated MSS	2.66	2.66	2.66	2.66
	Mean of total HPRD	3.19	3.43	3.16	3.2
	% Facilities met MSS	0.88	0.86	0.82	0.82
MD	Calculated MSS	2.06	2.06	2.06	2.06
	Mean of total HPRD	2.94	2.89	2.8	2.88
	% Facilities met MSS	0.97	0.94	0.88	0.92
MI	Calculated MSS	2.31	2.31	2.31	2.31
	Mean of total HPRD	3.07	3.05	2.98	3.06
	% Facilities met MSS	0.95	0.93	0.88	0.91

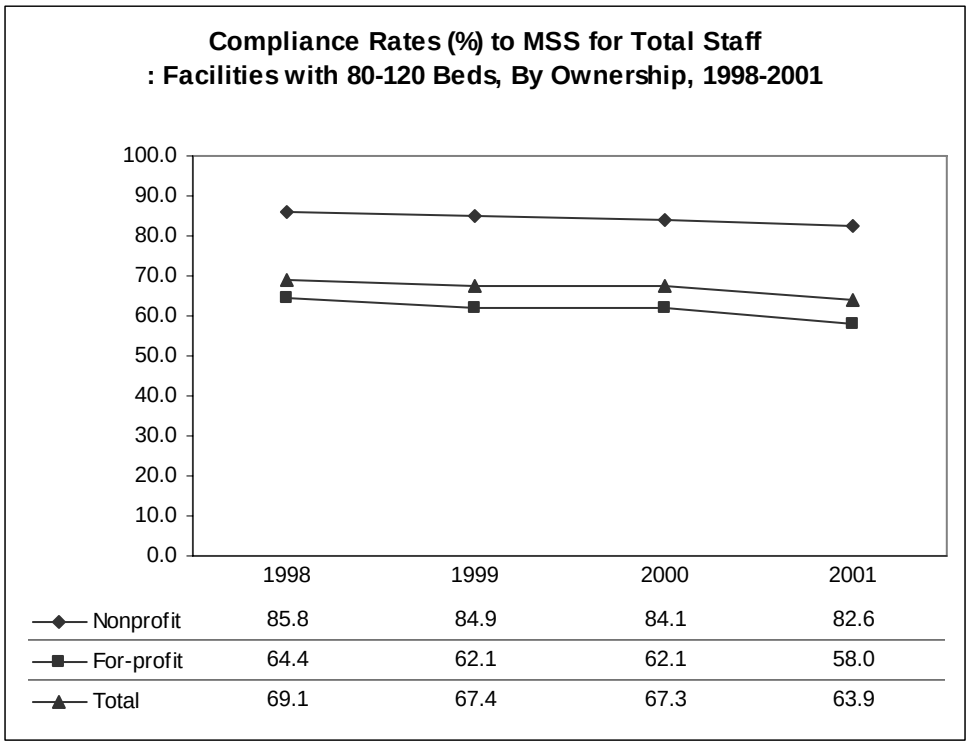
MN	Calculated MSS	2.06	2.06	2.06	2.06
	Mean of total HPRD	2.75	2.82	2.74	2.75
	% Facilities met MSS	0.93	0.92	0.92	0.92
MS	Calculated MSS	2.26	2.26	2.86	2.86
	Mean of total HPRD	2.71	2.71	2.9	2.91
	% Facilities met MSS	0.80	0.86	0.41	0.50
MT	Calculated MSS	1.2	1.2	1.2	1.2
	Mean of total HPRD	3.09	3.12	3.09	3.11
	% Facilities met MSS	1.00	1.00	1.00	1.00
NC	Calculated MSS	2.16	2.16	2.16	2.16
	Mean of total HPRD	3.32	3.23	3.19	3.27
	% Facilities met MSS	0.97	0.94	0.96	0.98
NJ	Calculated MSS	2.56	2.56	2.56	2.56
	Mean of total HPRD	3.19	3.14	3.12	3.09
	% Facilities met MSS	0.89	0.91	0.91	0.87
NM	Calculated MSS			2.56	2.56
	Mean of total HPRD			2.93	2.95
	% Facilities met MSS			0.82	0.81
NV	Calculated MSS	3.06	3.06	3.06	3.06
	Mean of total HPRD	2.82	3.04	2.76	2.81
	% Facilities met MSS	0.30	0.22	0.40	0.40
OR	Calculated MSS	1.95	1.95	1.95	1.95
	Mean of total HPRD	2.87	2.87	2.85	2.82
	% Facilities met MSS	0.93	0.91	0.91	0.91
PA	Calculated MSS		2.76	2.76	2.76
	Mean of total HPRD		3.12	3.1	3.08
	% Facilities met MSS		0.75	0.79	0.75
SC	Calculated MSS	2.16	2.41	2.41	2.41
	Mean of total HPRD	3.17	3.04	3.19	3.21
	% Facilities met MSS	0.98	0.88	0.96	0.98
TN	Calculated MSS	2	2	2	2
	Mean of total HPRD	2.76	2.57	2.58	2.69
	% Facilities met MSS	0.93	0.92	0.88	0.89
UT	Calculated MSS	2.06	2.06	2.06	2.06

	Mean of total HPRD	2.57	2.81	2.64	2.78
	% Facilities met MSS	0.73	0.9	0.88	0.88
VT	Calculated MSS				3.06
	Mean of total HPRD				3.54
	% Facilities met MSS				1.00
WI	Calculated MSS	2.31	2.56	2.56	2.56
	Mean of total HPRD	2.97	3.07	3.06	3.07
	% Facilities met MSS	0.96	0.85	0.86	0.86
WV	Calculated MSS	2.06	2.06	2.06	2.06
	Mean of total HPRD	3.06	3.13	3.28	3.4
	% Facilities met MSS	0.94	0.94	0.94	0.94

Notes: MSS=Minimum Staffing Standards, HPRD=hours per resident day

Figure 5.1 depicts compliance rates to MSS for total staff by ownership type among facilities with 80-120 beds. Most nonprofit nursing homes (about 84.4%) met the minimum staffing standards, while only 61.7% of for-profit homes complied with standards. The compliance rates have decreased slightly over the four-year study period. The post-MSS-implementation compliance results suggest that the licensing and certification programs responsible for regulating nursing homes have not effectively enforced the standards in some states although this analysis did not have data on exemptions processes that may have been used.

Figure 5.1 Compliance Rates to MSS for Total Staff: Facilities with 80-120 Beds, By Ownership, 1998-2001



CHAPTER VI

THE EFFECTS OF STATE MINIMUM STAFFING STANDARDS ON NURSING HOME STAFFING AND QUALITY OF CARE

6.1. Introduction

Quality of nursing home care is an important public policy issue, especially given the aging of the population. Public concerns about the quality of care led researchers and policymakers to develop and implement staffing standards to ensure higher quality of nursing home care.

Considerable research has been devoted to the issues of the number and composition of nursing staff required to meet the needs of nursing home residents (Abt, 2001; Carter and Porell, 2003; Castle, 2000; Cohen and Spector, 1996; GAO, 2002a; Harrington et al., 2000b; Kayser-Jones et al., 2003; Weech-Maldonade et al., 2004). Not surprisingly, most findings have suggested that a higher nursing staff level (i.e., more care hours per resident day) and more highly skilled nursing staff mix (i.e., a greater proportion of professional nursing staff such as registered nurses) are associated with higher quality of care in nursing homes measured by various process and outcome indicators.

Despite the public policy importance, there has been little research on the effect of state minimum staffing standards to date. The role of state staffing standards was not directly considered in the earlier staffing-quality studies, and little is known about whether the increased state staffing requirements lead to higher staffing and better outcomes. This

chapter presents an empirical analysis of whether state minimum staffing standards improved the level of staffing and quality of nursing home care during the period 1998 to 2001.

6.2. Data and Study Sample

6.2.1. Data sources

As described in more detail in Chapter IV, the data on facility characteristics, staffing, and quality measures came from the OSCAR system from 1998 through 2001. The OSCAR data are from state surveys of all federally certified Medicare skilled nursing facilities and Medicaid nursing facilities in the U.S. The OSCAR system includes about 96% of nation's nursing homes, and information from the system is used to determine whether nursing homes are complying with federal regulations (Grabowski, 1999). Although most OSCAR data elements are self-reported, OSCAR is the most comprehensive national source of facility-level information on the operations, resident characteristics, and regulatory compliance of nursing homes in the U.S. (Cawley et al., 2004; Zinn 1993).

The OSCAR data were linked to the data on specific state staffing standards, state Medicaid per-diem rates, and market conditions. State minimum staffing standards and Medicaid policy variable were constructed from various published sources. State minimum staffing standards came from two published reports which have collected state nurse staffing standards for nursing homes from state statutes, regulations, and administrative policies via the Internet and telephone survey.[7] State Medicaid per-diem rates were obtained from the Brown University Survey of State policies (1999-2002) and Harrington's 1998 State Data

[7] (1) Harrington, C. (2002). Nursing Home Staffing Standards. *The Kaiser Commission on Medicaid and the Uninsured.* (2) U.S. Department of Health and Human Services Assistant Secretary for Planning and Evaluation Office of Disability (2003). *State Experiences With Minimum Nursing Staff Ratio For Nursing Facilities: Finding From Case Studies of Eight States.*

Book on Long-Term Care Program and Market Characteristics: State Medicaid Policy. Market-level variables were obtained from the ARF, which is a publicly available dataset containing more than 7,000 economic and demographic variables for each of the nation's counties. Data on the population for each county came from the U.S. Census Bureau.

6.2.2. Study sample

The quality of measures in the OSCAR has been issued in previous studies (Abt, 2000, 2001; Zhang and Grabowski, 2004). In particular, staffing data have skewed distributions. To eliminate possibly erroneous outliers for the analytic data, the exclusion criteria developed by CMS (Abt, 2000) for its study of minimum nurse staffing ratios were adopted in this study.

All facilities that reported more residents than beds were excluded. Current federal regulations require that all certified nursing homes with 60 or more beds have a registered nurse on duty for 8 hours a day seven days a week and a licensed nurse on duty evenings and nights. Facilities with fewer than 60 beds can obtain a waiver that exempts them from this requirement. Thus, all facilities that reported no registered nurse hours and had 60 or more beds were also excluded. The facilities that reported more than 12 hours per resident day and less than 0.5 total hours per resident day were eliminated to avoid the unrealistically high or low staffing hours. Facilities that reported zero residents were excluded, and facilities with incomplete information were also removed from the analysis. The original database included 18,275 facilities; on the basis of the criteria above, 436 facilities (2.39 %) were excluded.

Since hospital-based nursing facilities are very different in terms of resident severity and care practice, an additional 2,271 hospital-based facilities were also eliminated.

Although Medicare-only-certified facilities are affected by state regulations, those facilities are primarily for short-stay residents after hospitalization. Thus, an additional 343 Medicare-only facilities were eliminated, so that only nursing homes with Medicaid-only or dually certified facilities were analyzed. Eight more facilities were excluded due to missing values. As a result of cleaning process, a total of 55,248 facility-year observations from 15,217 facilities were analyzed.

6.2.3. Descriptive statistics

The first three columns in Table 6.1 show summary statistics for all facilities. The values for the quality, staffing and other covariates are similar to values reported by other studies using these variables (Castle and Engberg, 2005; Cowles, 2002; Grabowski, 2004; Harrington et al., 2000b). It is important to remember that the low-staff variable in this study does not represent facilities that were below current standards, but instead identifies facilities that had to increase staffing to become compliant with new standards in the next period. By this definition, 49 percent of the facilities (N=7,248) were low-staff, while 51 percent of the facilities (N=7,969) were consistently above subsequent year standards over the study period. The rightmost three columns in Table 6.1 compare the mean values of all variables for facilities with relatively low staffing and those with relatively high staffing. The low-staff facilities were more likely for-profit and chain-affiliated, and had slightly fewer residents on Medicare and fewer beds than their counterparts. The low-staff facilities were more likely to be in counties with relatively greater elderly and female population, while the states where low-staff facilities were located were more likely to increase staffing standards and have less generous Medicaid reimbursement rates.

Table 6.1 Summary Statistics by Staffing Status, 1998-2001

	Full Sample			Low-Staff		
				No(=0)	Yes(=1)	
Variables	Mean	Range	SD	Mean	Mean	t-test
Staffing:						
RN HPRD	0.34	(0, 10.23)	0.32	0.42	0.26	***
LPN HPRD	0.65	(0, 9.64)	0.38	0.71	0.60	***
NA HPRD	1.94	(0, 10.65)	0.68	2.20	1.66	***
Total HPRD	2.93	(0.5, 11.98)	0.95	3.33	2.51	***
Quality of Care:						
% Pressure sores	6.47	(0, 100)	4.77	6.38	6.57	***
% Contractures	25.72	(0, 100)	20.47	27.98	23.38	***
% Incontinence	54.50	(0, 100)	15.91	56.33	52.61	***
% Catheter use	6.05	(0, 100)	4.91	6.07	6.04	
% Restraint use	11.87	(0, 100)	13.02	11.34	12.43	***
Total deficiencies	5.91	(0, 50)	5.88	5.16	6.68	***
Policy: Staffing Standards						
Transition effect	0.101		0.301	0.083	0.119	***
Steady state effect	0.103		0.304	0.070	0.136	***
Facility:						
Ownership						
For-profit	0.73		0.44	0.64	0.82	***
Nonprofit	0.23		0.42	0.30	0.15	***
Government	0.04		0.21	0.06	0.03	***
Chain	0.58		0.49	0.53	0.63	***
Payer mix						
% residents paid by Medicare	7.48	(0, 100)	8.68	8.37	6.56	***
% residents paid by Medicaid	67.89	(0, 100)	19.82	65.58	70.28	***
% residents paid by others	24.63	(0, 100)	18.78	26.06	23.16	***
Total beds	114.82	(5, 1231)	65.98	118.57	110.95	***
Occupancy rate	84.63	(1.56, 100)	15.28	85.29	83.95	***
Case mix						
Acuity index	10.08	(3, 21.70)	1.54	10.28	9.86	***
% Pressure sores on admission	3.10	(0, 100)	4.17	3.105	3.102	
% Contractures on admission	16.21	(0, 100)	17.13	17.88	14.49	***
% Catheter use on admission	4.24	(0, 93.02)	4.30	4.24	4.23	
% Restraint use on admission	3.82	(0, 100)	8.17	3.46	4.19	***
Low-staff	0.49		0.50	0	1	
Market:						
Herfindahl-Hirschman index	0.196	(0.004, 1)	0.228	0.190	0.203	***
Empty beds per 1,000 elderly (65+)	13.08	(0, 173.91)	13.06	11.28	14.93	***
Per capita income (in $1,000s)	26.87	(0, 92.98)	7.62	27.59	26.13	***
Unemployment rate (16+)	4.51	(0.70, 29.90)	2.10	4.42	4.61	***
Population 85+ (in 1,000s)	9.88	(0.01, 114.98)	19.63	7.64	12.20	***

Female population 15-44 (in 1,000s)	160.84	(0.12, 2210.65)	373.79	114.91	208.28	***
State:						
Medicaid rate	108.70	(69.55, 285.01)	23.18	115.37	101.80	***
Number of observations	55,248			28,073	27,175	
Number of facilities	15,217			7,969	7,248	

Notes: HPRD=hours per resident day. SD indicates standard deviation.
Mean comparison tests (t-test) by low-staff status. * significant at 10%; ** significant at 5%; *** significant at 1%

6.3. Empirical Models

A big challenge to estimating the effect of minimum staffing standards is controlling for the unobserved heterogeneity at the facility, market, and state level associated with staffing/quality changes over time. The observed differences in staffing/quality are likely to be influenced by unobserved characteristics such as the organizational cultures, practice skill of the nurse workforce, overall population health needs, and state political, regulatory, or fiscal conditions. Ignoring this heterogeneity may result in biased estimates if these unmeasured factors are correlated with the variation in minimum staffing standards.

If an unobserved measure of state political culture or ideology is positively associated with staffing/quality of care but negatively related to the implementation of staffing standards, then the estimated effect of staffing standard changes on staffing/quality of care will be understated due to downward bias. Although state fixed effects would control for unobserved time-invariant factors at the state level, the estimates are biased if unobserved heterogeneity remains at either the level of the service area (e.g., county) or facility. For example, if unobserved time-invariant county specific health needs or treatment norms for vulnerable people are positively correlated with implementation or expansion of staffing standards and staffing/quality of care, the coefficient of the policy variable will be biased upward and the true effect of the policy will be understated. Alternatively, the existence of unobserved administrative efficiency associated with staffing choice or quality of care will

also cause bias. Therefore, a facility-level fixed effects model was chosen to account for as many sources of heterogeneity as possible.

Since the policy changes occurred at diverse times across states, the present study provides unique new evidence by exploiting a natural experiment approach. Over the last decade, natural experiments have become especially popular in analyzing the effects of policy changes (Dow and Schmeer, 2003: Konetzka et al., 2004a, 2004b). The approach used in this study is a difference-in-differences (DD) model to estimate the effect of staffing standard changes on staffing/quality of care with pre-post and treatment-control groups. The average treatment effect can be calculated as the pre-post difference between the treatment and control group mean difference, assuming that the pre-difference is a good estimate of what the post-difference would have been had the treatment group not actually been treated (Woodridge, 2001). To avoid possible omitted variable bias, a set of facility, market, and state level time-varying covariates were added to the model. To explore variation in the effect of MSS by facility staffing level, the extended model included two policy variables and their interactions with the indicator of low-staff facility.[8] Furthermore, additional triple interaction terms with facility ownership (i.e., for-profit status) were included to assess the differential behavior of nursing homes in response to policy changes. The model specification is as follows:

$$Y_{ist} = \alpha_0 + \beta MSS_{st} + \gamma X_{ist} + \delta YearD_t + \mu_i + \varepsilon_{ist} \qquad (6.1)$$

[8] The identification here is not the same as a difference-in-differences-in-differences (DDD) strategy. A key assumption of DDD approach is that the policy changes should not affect the staffing level among the third control group.

where the subscript i indexes the nursing home, s indexes state, and t indexes year. Y_{ist} is the actual level of nursing home staffing (i.e., RNs, LPNs, NAs, and total staff) or measures of quality of care. MSS_{st} is a vector of the main treatment effects specified by two policy variables (transition and steady state effects) and their interactions with the indicators of low-staff facility and for-profit status. X_{ist} is a vector of facility, county, and state level time-varying covariates. A vector of year dummy variables ($YearD_t$) accounts for unobserved time fixed effects that might have an effect on staffing/quality of care and are possibly correlated with the implementation or expansion of state staffing standards. The error term consists of a facility-specific error component (μ_i) to control for time-invariant facility and area characteristics and a mean zero random error component (ε_{ist}).

Statistical tests were used to compare fixed and random effects specifications.[9] The parameters of Equation (6.1) were estimated by using an ordinary least squares (OLS) model for the rates of pressure sores, contractures, bladder incontinence, catheter use, and restraint use. A negative binomial (NB) model was used for the total number of deficiencies which is a count of specific negative events since OLS does not generate consistent estimates given the skewed nature of count data.

6.4. Results

6.4.1. Effect of state minimum staffing standards on staffing

Table 6.2 provides OLS regression estimates for the models using staffing levels (hours per resident day by type of staff) as the dependent variables. The significant positive

[9] The Breush-Pagan and the Hausman specification tests strongly suggested that there were the facility-specific effects, thus fixed effects models were analyzed in order to control for time-invariant facility characteristics.

coefficients on the interaction terms between policy changes and a low-staff indicator on NA hours and total staff hours indicated that increased minimum staffing standards were more likely to influence the facilities with relatively low staffing levels than those facilities that already operated at or above the mandated levels. However, the opposite signs on the triple interaction terms indicated that the response might differ by facility ownership type.

As expected, having a higher proportion of Medicare residents and a higher severity index value had significant positive impacts on staffing levels. High occupancy rates were negatively associated with all of the staffing types. The size of the female population in the market which may represent availability of long-term care workers were positively associated with higher LPN and total staffing levels.

Table 6.2 Effect of State Minimum Staffing Standards on Staffing: DD Models

	RN HPRD	LPN HPRD	NA HPRD	Total HPRD
Policy: Staffing Standards				
Transition effect	0.013*	-0.002	-0.000	0.011
	(0.007)	(0.009)	(0.017)	(0.021)
Steady state effect	0.016*	0.006	-0.029	-0.007
	(0.008)	(0.011)	(0.021)	(0.026)
Transition × Low-staff	0.005	0.009	0.065**	0.079**
	(0.011)	(0.016)	(0.028)	(0.035)
Steady × Low-staff	0.018	0.021	0.174***	0.212***
	(0.013)	(0.018)	(0.032)	(0.041)
Transition × For-profit	-0.015*	-0.007	-0.014	-0.036
	(0.009)	(0.012)	(0.022)	(0.027)
Steady × For-profit	-0.027**	-0.021	0.006	-0.042
	(0.011)	(0.015)	(0.028)	(0.035)
Transition × Low-staff × For-profit	-0.006	-0.006	-0.040	-0.052
	(0.013)	(0.018)	(0.033)	(0.041)
Steady × Low-staff × For-profit	0.002	-0.006	-0.126***	-0.130***
	(0.016)	(0.022)	(0.039)	(0.049)
Facility:				
For-profit	-0.010	0.022	0.029	0.041
	(0.013)	(0.017)	(0.031)	(0.039)
Chain	-0.010*	0.015*	0.007	0.012
	(0.006)	(0.008)	(0.014)	(0.017)
% Medicare	0.001***	0.000**	0.003***	0.005***

	(0.000)	(0.000)	(0.000)	(0.001)
Total beds	-0.003***	-0.004***	-0.009***	-0.016***
	(0.000)	(0.000)	(0.001)	(0.001)
Total beds × Total beds	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Occupancy rate	-0.006***	-0.008***	-0.014***	-0.027***
	(0.000)	(0.000)	(0.000)	(0.000)
Acuity index	0.000	0.003**	0.018***	0.022***
	(0.001)	(0.002)	(0.003)	(0.004)
Market::				
Herfindahl-Hirschman index	0.026	0.051	-0.052	0.026
	(0.049)	(0.066)	(0.120)	(0.151)
Empty beds per 1,000 elderly (65+)	-0.000**	0.000	-0.001	-0.001
	(0.000)	(0.000)	(0.001)	(0.001)
Per capita income (in $1,000s)	-0.002**	0.003***	-0.001	-0.000
	(0.001)	(0.001)	(0.002)	(0.003)
Unemployment rate (16+)	-0.006***	-0.003*	-0.004	-0.013***
	(0.001)	(0.002)	(0.003)	(0.004)
Population 85+ (in 1,000s)	-0.002*	0.004***	0.008***	0.010***
	(0.001)	(0.001)	(0.002)	(0.003)
Female population 15-44 (in 1,000s)	0.000	0.001***	0.001	0.002***
	(0.000)	(0.000)	(0.001)	(0.001)
State:				
Medicaid rate	-0.000**	-0.000	-0.001**	-0.002***
	(0.000)	(0.000)	(0.000)	(0.001)
Year:				
1999	-0.006***	-0.003	-0.013**	-0.023***
	(0.002)	(0.003)	(0.006)	(0.007)
2000	-0.020***	-0.003	-0.021***	-0.045***
	(0.003)	(0.004)	(0.007)	(0.009)
2001	-0.019***	-0.002	-0.018**	-0.039***
	(0.004)	(0.005)	(0.009)	(0.011)
Constant	1.258***	1.324***	3.728***	6.310***
	(0.060)	(0.081)	(0.146)	(0.184)
Mean (HPRD)	0.34	0.65	1.94	2.93
Number of observations	55,248	55,248	55,248	55,248
Number of facilities	15,217	15,217	15,217	15,217
R-squared	0.06	0.05	0.05	0.11

Notes: HPRD=hours per resident day. Standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%

Among different levels of policy effects, the main measure of effect pertains to whether changes in staffing standards had persistent effects on staffing levels. Table 6.3

presents the marginal steady state effects of state minimum staffing standards on staffing by staffing level prior to the new standards and ownership status. The magnitude of the steady state effects was greater than the transition effects (summary results not shown in Table 6.3), indicating that the change in staffing standards had a cumulative and persistent effect in increasing staffing levels.[10] The results showed significant variation in response across the subset of facilities. Only nonprofit facilities increased RN staffing levels in response to the change in staffing standards. The LPN regression showed significant policy effects following increased state minimum staffing standards only for the low-staff nonprofit facilities. Nonprofit facilities with relatively low staffing levels made large changes in both licensed and unlicensed staffing levels. Increased minimum staffing standards led to a statistically significant steady state increase in RN, LPN, NA and total staff hours by 0.034 HPRD (2.04 minutes), 0.027 HPRD (1.62 minutes), 0.145 HPRD (8.7 minutes) and 0.206 HPRD (12.36 minutes), respectively. About two-thirds of the increase in total staff hours was due to an increase in NA hours. The steady state effect among for-profit facilities with relatively high staffing levels, however, was associated with a decrease in total staffing hours by 0.049 HPRD (2.94 minutes). As noted by other authors (Kovner and Heinrich, 2000; Mueller et al., 2006), facilities where staffing exceeded the minimums may decrease their staffing if those facilities treat the minimum standards as if they were maximum required (i.e., that nursing homes assume they only have to comply with the minimum levels to ensure safe practice). The recent introduction of PPS for Medicare skilled nursing care in 1998 may also mean that nursing homes may have faced extra pressure to reduce professional staffing levels, in particular, to avoid financial shocks from PPS (Konetzka et al., 2004b).

[10] For example, policy changes led to a first year (transition) increase in total staff hours by 0.09 HPRD (5.4 minutes), with a steady state increase of 0.206 HPRD (12.36 minutes). These results were statistically significant at the 1% significance level.

Table 6.3 Marginal Effect of State Minimum Staffing Standards on Staffing: DD Models

		RN HPRD	LPN HPRD	NA HPRD	Total HPRD
Panel A: Low-staff (=1)					
	For-profit	0.009	-0.0004	0.025*	0.033*
		(0.006)	(0.0076)	(0.014)	(0.017)
				[1.5min]	[1.98min]
	Nonprofit	0.034***	0.027*	0.145***	0.206***
		(0.011)	(0.014)	(0.026)	(0.033)
		[2.04min]	[1.62min]	[8.7min]	[12.36min]
Panel B: Low-staff (=0)					
	For-profit	-0.011	-0.015	-0.022	-0.049*
		(0.008)	(0.011)	(0.020)	(0.025)
					[-2.94min]
	Nonprofit	0.016*	0.006	-0.029	-0.007
		(0.008)	(0.011)	(0.021)	(0.026)
		[0.96min]			

Notes: HPRD=hours per resident day. Standard errors in parentheses. Minutes in brackets.
* significant at 10%; ** significant at 5%; *** significant at 1%

6.4.2. Effect of state minimum staffing standards on quality of care

Table 6.4 presents the main results from DD models for each quality indicator. The main hypothesis was whether increases in state staffing standards have improved the quality of care. If the hypotheses were correct, coefficients on the policy variables would be negative since the quality of care measures were all constructed as adverse outcomes. The magnitude and direction of policy variables could vary since the program effect may be apparent after some time. The magnitude and direction could also vary by different groups of facilities based on the various facility, market, and state circumstances.

Once again, the magnitude of the steady state effects was greater than the transition effects for effects that were statistically significant, indicating that the change in staffing standards had a cumulative and persistent effect in reducing the number of deficiencies (results not shown). None of the steady state effects for resident outcomes was significantly associated with increases in minimum staffing standards (Table 6.5). This lack of effect for

resident outcome measures may be due to the fact that it is difficult to control accurately for case mix when using annual facility level data. Increases in minimum staffing standards showed consistent positive effects on the rate of restraint use and the number of total deficiencies regardless of the staffing status or ownership type.

Staffing standards changes led to a steady state reduction in restraint use among nonprofit facilities with relatively low staffing levels of 1.27 percentage points. This result was statistically significant at the 1% significance level and was relative to an overall level of restraint use of 11.9%. For low-staff for-profit facilities, the steady state effect was associated with facilities being less likely to have total deficiency citations (incidence rate ratios (IRR)=0.94, $p<0.01$) which was relative to an overall mean number of survey deficiencies of 5.9. The deficiency results for facilities with relatively high staffing levels showed similar results to the low-staff. The effect of increases in minimum staffing standards on substandard care[11] and nursing deficiencies[12] showed the same effects (results not shown).

Some facility, market, and state control variables had statistically significant effects, but the effects differed substantially across the different quality regressions (Table 6.4). Although not all of those variables showed consistent effects on quality of care, the negative coefficients on the number of total beds showed some evidence of the economies of scale for resident outcomes. As expected, resident case mix variables had significant negative impacts

[11] A deficiency in any of the three Quality of Care (quality of care=F309-333, quality of life=F240-256, resident behavior and facility practices= F221-226) categories that has a scope and severity ratings such as F, H, I, J, K, and L (Cowles, 2002).

[12] Any of the 48 F tags (F154, 164, 176, 221-224, 240-242, 246, 252, 272, 276, 279, 280, 283, 284, 309-333, 369, 444) which are related to quality of care, modeled after Jean Johnson-Pawlson's doctoral dissertation (Cowles, 2002).

on quality of care and should be taken into account in implementing or expanding staffing standards.

If nursing homes compete on the basis of quality, facilities in more competitive areas may maintain higher quality than those in low-competition areas. The coefficients on HHI, as a proxy variable for market competition, did not have statistically significant effects for any of the quality measures in this study.

Occupancy rate and the empty beds per 1,000 elderly (65+), as proxies for market tightness, showed mixed results across quality measures. Facilities with higher occupancy rates, indicating a tighter nursing home market, may have less incentive to provide high quality of care. High occupancy rates were negatively associated with the rate of restraint use and total deficiency citations, but were positively associated with the outcome-based quality measures. Similarly, the number of empty beds per 1,000 elderly in the county has been used to identify excess demand or market tightness, and having more empty beds in the county would be expected to be associated with higher quality of care. The result for the analyses showed unexpected significant negative effects of this variable on the care process and overall quality indicators. The demand for nursing home services would be thought to be higher in areas with high per capita income. The wealthier, more economically developed areas are more likely to support the provision of needed services. As expected, higher per capita income in the county suggested better quality of care as reflected by lower levels of contractures and restraint use.

Among other market factors, higher unemployment rates reduced the total number of deficiency citations, possibly because higher unemployment rates could probably encourage more nursing staff into nursing home labor market. Since the demand for and use of nursing

home services increase for those aged 85 and older, the size of the elderly population may be positively related to quality of care. The size of the elderly population in the county was positively associated with the outcome-based quality measures and the number of deficiencies.

Medicaid program generosity may be positively related to outcomes. Results for the analyses of Medicaid rate were mixed and inconclusive across quality measures, but showed small positive effects on total deficiency citations which were consistent with the recent studies about Medicaid rate and quality of care (Cohen and Spector, 1996; Grabowski, 2001a, 2001b, 2002, 2004).

Table 6.4 Effect of State Minimum Staffing Standards on Quality of Care: DD Models

	Resident Outcome			Care Process		Overall
	Pressure Sores	Contractures	Incontinence	Catheter Use	Restraint Use	Deficiencies[†]
Policy: Staffing Standards						
Transition year effect	0.138	0.074	-0.690	0.036	-1.156***	-0.054*
	(0.132)	(0.392)	(0.428)	(0.107)	(0.310)	(0.029)
Steady state effect	0.263	0.530	-0.598	-0.052	-2.450***	-0.182***
	(0.162)	(0.481)	(0.526)	(0.131)	(0.380)	(0.037)
Transition × Low-staff	-0.128	-0.415	0.686	0.170	0.326	0.030
	(0.221)	(0.659)	(0.719)	(0.179)	(0.520)	(0.046)
Steady × Low-staff	-0.397	-0.374	0.100	0.147	1.183**	0.034
	(0.253)	(0.753)	(0.822)	(0.205)	(0.594)	(0.054)
Transition × For-profit	-0.164	-0.191	0.880	0.034	0.377	0.023
	(0.170)	(0.506)	(0.552)	(0.138)	(0.399)	(0.037)
Steady × For-profit	-0.244	-0.670	0.826	0.099	1.297**	0.023
	(0.217)	(0.646)	(0.705)	(0.176)	(0.510)	(0.047)
Transition × Low-staff × For-profit	0.433*	-0.264	-1.270	-0.234	0.016	-0.030
	(0.259)	(0.770)	(0.841)	(0.210)	(0.608)	(0.053)
Steady × Low-staff × For-profit	0.548*	0.080	-0.396	-0.272	-0.713	0.064
	(0.307)	(0.913)	(0.997)	(0.248)	(0.721)	(0.064)
Facility:						
For-profit	-0.174	-0.329	0.889	0.123	-0.173	-0.012
	(0.242)	(0.722)	(0.788)	(0.196)	(0.570)	(0.029)
Chain	0.402***	-0.156	0.069	-0.004	-0.221	0.014
	(0.109)	(0.324)	(0.354)	(0.088)	(0.256)	(0.018)
% Medicare	0.025***	-0.001	-0.107***	0.021***	-0.034***	0.003***
	(0.003)	(0.010)	(0.011)	(0.003)	(0.008)	(0.001)
Total beds	-0.010**	-0.024*	-0.038**	-0.001	0.048***	0.002***
	(0.005)	(0.014)	(0.016)	(0.004)	(0.011)	(0.000)
Total beds × Total beds	0.000*	0.000	0.000	0.000	-0.000***	-0.000*

	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Occupancy rate	-0.005*	-0.042***	-0.050***	-0.002	0.021***	0.008***
	(0.003)	(0.008)	(0.008)	(0.002)	(0.006)	(0.000)
Acuity index	0.329***	0.790***	2.298***	0.285***	0.487***	0.019***
	(0.023)	(0.070)	(0.076)	(0.019)	(0.055)	(0.004)
% on admission	0.332***	0.733***		0.421***	0.594***	
	(0.005)	(0.005)		(0.005)	(0.006)	
Market:						
Herfindahl-Hirschman index	0.609	0.576	-0.595	0.864	2.018	0.004
	(0.942)	(2.806)	(3.063)	(0.763)	(2.215)	(0.068)
Empty beds per 1,000 elderly (65+)	-0.003	-0.010	-0.003	0.010***	0.018*	0.002***
	(0.005)	(0.014)	(0.015)	(0.004)	(0.011)	(0.001)
Per capita income (in $1,000s)	-0.002	-0.212***	-0.086	0.007	-0.186***	-0.002
	(0.018)	(0.054)	(0.058)	(0.015)	(0.042)	(0.002)
Unemployment rate (16+)	0.021	0.029	-0.107	0.006	-0.017	-0.016***
	(0.024)	(0.070)	(0.077)	(0.019)	(0.056)	(0.004)
Population 85+ (in 1,000s)	-0.045**	-0.177***	-0.079	-0.007	-0.046	-0.011***
	(0.019)	(0.057)	(0.063)	(0.016)	(0.045)	(0.002)
Female population 15-44 (in 1,000s)	-0.002	-0.026*	-0.014	-0.003	-0.009	0.001***
	(0.005)	(0.015)	(0.017)	(0.004)	(0.012)	(0.000)
State:						
Medicaid rate	-0.000	0.049***	-0.008	-0.008***	0.021**	-0.005***
	(0.004)	(0.011)	(0.012)	(0.003)	(0.009)	(0.001)
Year:						
1999	0.072	0.805***	1.375***	-0.050	-0.886***	0.168***
	(0.045)	(0.135)	(0.147)	(0.037)	(0.107)	(0.009)
2000	0.150***	2.026***	2.061***	-0.061	-1.655***	0.304***
	(0.055)	(0.165)	(0.180)	(0.045)	(0.131)	(0.010)
2001	0.165**	2.642***	2.181***	-0.073	-1.512***	0.388***
	(0.071)	(0.212)	(0.232)	(0.058)	(0.168)	(0.012)
Constant	3.732***	17.112***	44.973***	2.420***	4.153	0.669***

	(1.148)	(3.419)	(3.733)	(0.930)	(2.699)	(0.112)
Mean	6.5%	25.7%	54.5%	6.1%	11.9%	5.9
Number of observations	55,248	55,248	55,248	55,248	55,248	52,679
Number of facilities	15,217	15,217	15,217	15,217	15,217	13,868
R-squared	0.11	0.39	0.03	0.19	0.21	

Note: Standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%
[†]Estimates were generated with NB rather than OLS.

Table 6.5 Marginal Effect of State Minimum Staffing Standards on Quality of Care: DD Models

	Resident Outcome			Care Process		Overall
	Pressure Sores	Contractures	Incontinence	Catheter Use	Restraint Use	Deficiencies†
Panel A: Low-staff (=1)						
For-profit	0.170	-0.434	-0.067	-0.077	-0.682***	-0.062***
	(0.108)	(0.322)	(0.351)	(0.088)	(0.254)	(0.020)
						[0.94]
Nonprofit	-0.134	0.156	-0.497	0.095	-1.266***	-0.149***
	(0.204)	(0.606)	(0.662)	(0.165)	(0.479)	(0.042)
						[0.86]
Panel B: Low-staff (=0)						
For-profit	0.019	-0.140	0.228	0.047	-1.152***	-0.159***
	(0.157)	(0.467)	(0.510)	(0.127)	(0.369)	(0.032)
						[0.85]
Nonprofit	0.263	0.530	-0.598	-0.052	-2.450***	-0.182***
	(0.162)	(0.481)	(0.526)	(0.131)	(0.380)	(0.037)
						[0.83]

Notes: Standard errors in parentheses. Incidence rate ratios in brackets.
* significant at 10%; ** significant at 5%; *** significant at 1%
†Estimates were generated with NB rather than OLS.

6.5. Discussion

The findings for effect of state minimum staffing standards on staffing levels suggest that increased staffing standards matter particularly for the subset of nursing homes with staffing levels previously below or close to new standards. Mandated staffing standards seem to only affect staffing at facilities at the low-end of staffing spectrum. Among those facilities with relatively low staffing levels, only nonprofit facilities appear to respond to regulatory pressures by increasing both licensed and unlicensed staffing levels consistent with many of the expectations from property rights theory.

Reduced-form analyses of the total effects of state minimum staffing standards show that increased staffing standards result in better quality of care at all facilities as measured by the rate of restraint use or the deficiency. Resident outcomes, however, show no change in response to increased staffing standards. There may be several reasons in the lack of consistent findings across quality measures. On the one hand, staffing may be a better predictor of high-quality facility care processes than the clinical resident outcomes examined. On the other hand, quality and resident outcome characteristics aggregated at the facility level may not reflect the true resident-level case mix and severity, or quality of care.

Contrary to the staffing findings, more interestingly, effects for the facility quality measures do not vary by the staffing status or ownership type. In other words, even though facilities with relatively high staffing levels do not show the evidence of improving staffing levels in response to new staffing standards, the results for those facilities show much greater quality improvements than facilities with relatively low staffing levels.

The findings for improvement in quality even without increases in staffing are possibly due to a general response to increased standards or to other quality improvements

implemented at the same time as minimum staffing standards. Many states indeed put in place other quality initiatives at the same time as they changed their staffing standards, and major payment changes in Medicaid and Medicare also occurred during the study period.

Results also may be explained by the fact that the amount of nursing staff alone is not the only factor contributing to quality of care received by residents. Quality of nursing home care is influenced by other factors such as physical environment, different methods of treatment, efficient use of staff and non-staff inputs, and their productivity differences.

The nursing homes which had relatively high staffing levels and did not increase staffing levels in response to new staffing standards may, for example, improve the productivity level of their nursing home workers by increasing job satisfaction or decreasing turnover rates, particularly under the nursing shortage and staff recruitment and retention difficulties. In this case, nursing homes could increase service quality without changing the resources needed to produce nursing services.

Nursing homes may be forced to become more efficient under the recent competitive nursing home market. From the perspective of providers, both profit and quality are fundamental but also potentially conflicting objectives. Implementation or expansion of staffing standards in nursing homes may place further financial pressures on nursing homes. Nursing homes may respond to the staffing standard changes and environmental pressures differently not only by altering the amount of input use but also by utilizing their scarce resources more efficiently. For example, nonprofit homes may respond to environmental pressures by increasing staffing levels or other resources to improve quality of care, whereas for-profit facilities may choose to operate at a high level of efficiency in response to the environmental and regulatory pressures. For this reason, those facilities may want to

maintain or achieve a higher level of quality as a means of improving their financial performance. Differences in efficiency may result in the observed differences in quality of care produced.

Further understanding of the effects of minimum staffing standards may be obtained by assessing financial performance in response to staffing standard changes and by exploring the causal pathways between nursing home staffing and quality outcomes as well. Assessment on how staffing standard changes affect the financial performance is provided in Chapter VII, and the relationship between nursing home staffing and quality is further explored in Chapter VIII.

CHAPTER VII

THE EFFECTS OF STATE MINIMUM STAFFING STANDARDS ON FINANCIAL PERFORMANCE IN SKILLED NURSING FACILITIES

7.1. Introduction

While many states have set minimum requirements for nursing staff, the cost of increasing staffing levels under the current nursing workforce shortage can be substantial for both the government and nursing facilities. As described earlier, the government is the dominant purchaser of nursing home care by means of Medicare and Medicaid programs, with state Medicaid programs covering approximately 50% of all nursing homes expenditures and 70% of all bed days (Zhang and Grabowski, 2004). The call for greater staffing suggests that additional government funds could be required. Many states increased Medicaid rates in an attempt to encourage nursing facilities to increase their nursing staff. For example, California increased Medicaid rates of approximately $2.96 per resident day to pay for increased labor costs required to meet the new mandatory staffing standards in 2000 (Horowitz et al., 2003).

Moreover, staffing is the main input in the production of care, accounting for nearly two-thirds of all nursing home costs. By increasing demand for nurses (at least at some facilities), increased mandated staffing standards may generate an industry-wide cost increase and cause at least some facilities to face severe financial constraints. With a limited

supply of nursing staff, overall improvement in wages or benefits may also be required to retain current nursing staff and to keep salaries or benefits competitive.

Several early studies examined the impacts of state staffing standards on non-financial outcomes such as the level of staffing or quality of care (Harrington, 2005a, 2005b; Mueller et al., 2006), but no studies directly examine whether or to what extent state staffing standards affect financial performance in nursing homes. This study analyzes data from the 1998-2001 freestanding SNF MCR, and investigates how recent changes in state minimum staffing standards affect the financial performance in SNFs by comparing financial measures before and after the changes in staffing standards.

The purpose of this analysis is as follows: first, to assess the effects of state minimum staffing standards on the financial performance as reflected by profit, revenue, and cost during the period 1998 to 2001; and second, to determine whether the behavior of skilled nursing facilities in response to policy changes differed by staffing level prior to the new standards or ownership type.

7.2. Data and Study Sample

7.2.1. Data sources

All Medicare-certified SNFs are required to file cost reports annually in order to receive payments for treating Medicare residents. The MCR data contain provider information such as facility characteristics, utilization data, cost and charges by cost center (in total and Medicare), Medicare settlement data, and financial statement data (http://www.cms.hhs.gov). The data used for the financial performance analysis came from 1998 through 2001 freestanding SNF MCR that were in the CMS files released in June 2004.

Since hospital-based nursing facilities are very different in terms of resident severity, care practice, and cost accounting system (i.e., allocation of hospital overhead costs to the SNF units), this study only analyzes cost report data from freestanding skilled nursing facilities.

The MCR data were supplemented with a file containing facility characteristics from the OSCAR. The OSCAR data are from state surveys of all federally certified Medicare skilled nursing facilities and Medicaid nursing facilities in the U.S. The OSCAR system includes about 96% of nation's nursing homes, and information from the system is used to determine whether nursing homes are complying with federal regulations. Although most OSCAR data elements are self-reported, OSCAR is the most comprehensive national source of facility level information on the operations, resident characteristics, and regulatory compliance of nursing homes in the U.S. (Cawley et al., 2004; Zinn, 1993).

The merged MCR and OSCAR were linked to the data on specific state staffing standards, state Medicaid per-diem rates, and market conditions. State minimum staffing standards and Medicaid policy variable were constructed from various published sources. State minimum staffing standards came from two published reports which have collected state nurse staffing standards for nursing homes from state statutes, regulations, and administrative policies via the Internet and telephone survey.[13] State Medicaid per-diem rates were obtained from the Brown University Survey of State policies (1999-2002) and Harrington's 1998 State Data Book on Long-Term Care Program and Market Characteristics: State Medicaid Policy. Market-level variables were obtained from the ARF, which is a publicly available dataset containing more than 7,000 economic and demographic variables

[13] (1) Harrington, C. (2002). Nursing Home Staffing Standards. *The Kaiser Commission on Medicaid and the Uninsured.* (2) U.S. Department of Health and Human Services Assistant Secretary for Planning and Evaluation Office of Disability (2003). *State Experiences With Minimum Nursing Staff Ratio For Nursing Facilities: Finding From Case Studies of Eight States.*

for each of the nation's counties. Data on the population for each county came from the U.S. Census Bureau.

7.2.2. Study sample

By using freestanding SNF MCR, Medicaid-only-certified facilities and hospital-based SNFs are automatically eliminated from the data file. The original database merged MCR and OSCAR included 12,510 freestanding SNFs, 808 facilities with intermediate care facilities for the mentally retarded (ICF/MR), hospice, or other long-term care components besides skilled nursing or nursing facility were also excluded from the analysis (6.5%). If facilities were in the top and bottom one percentile of each of three financial variables in a given year, which seemed highly unlikely and probably reporting errors, the observations were eliminated. On the basis of theses criteria, 241 facilities were excluded. Financial uncertainty threatened by introducing new staffing standards could cause some facilities to leave the market. In addition, SNFs have faced extra financial pressure due to recent introduction of Medicare PPS in 1998. Only facilities with 4 years of cost reports were included in the analysis to prevent possible bias due to market entry-exit during the study period. A total of 28,840 facility-year observations from 7,210 freestanding SNFs were analyzed (Table 7.1).

Table 7.1 Numbers of Observations, MCR 1998-2001

	Number of Facility-Year	Number of Facilities
Original sample:	46,532	12,510
After dropping facilities with ICF/MR, hospice, or other long-term care facilities	40,480	11,702
After dropping 1% on each end (of three financial measures)	38,674	11,461
Final sample (with 4 years of cost reports):	28,840 (62%)	7,210 (58%)

7.2.3. Descriptive statistics

Table 7.2 provides descriptive statistics on the variables in the model. The values for facility characteristics, utilization, and financial information are similar to values reported by other studies using MCR and OSCAR data (Castle and Engberg, 2005; Cowles, 2002; GAO, 2003; Grabowski, 2004; Harrington et al., 2000b). By the definition of low-staff facilities in this study, 48 percent of the facilities (N=3,461) were low-staff, while 52 percent of the facilities (N=3,749) were consistently above subsequent year standards over the study period. About 77 percent of freestanding SNFs belonged to for-profit facilities and the average occupancy rate was 86 percent. The rightmost three columns in Table 7.2 compare the mean values of all variables for facilities by ownership type. Compared to for-profit homes (N=5,616), on average, nonprofit homes (N=1,691) experienced 0.64 percent annual total margin losses because of their higher cost structure. Interestingly, nonprofit homes had a lower proportion of Medicaid and a higher proportion of private pay residents than for-profit homes.

Table 7.2 Summary Statistics by Ownership Type, 1998-2001

	Full Sample			NFP	FP	
Variables	Mean	Range	SD	Mean	Mean	t-test
Financial Performance:						
Total margin	0.62	(-63.91, 26.78)	10.57	-0.64	1.00	***
Revenue per diem	141.61	(75.04, 428.93)	40.95	150.17	139.09	***
Expense per diem	144.14	(75.15, 568.45)	46.70	163.52	138.44	***
Policy: Staffing Standards						
Transition effect	0.10			0.11	0.10	
Steady state effect	0.11			0.12	0.11	
Output:						
Total resident days	39125	(785, 323352)	22613	46490	36956	***
Input Price:						
CMS SNF wage index	0.99	(0.62, 1.56)	0.17	1.02	0.98	***
Facility:						
Ownership						
For-profit	0.77					
Nonprofit	0.19					
Government	0.03					
Chain	0.65			0.41	0.73	***
Payer mix						
% residents paid by Medicare	9.81	(0, 100)	10.66	8.42	10.22	***
% residents paid by Medicaid	66.69	(0, 100)	19.55	61.96	68.09	***
% residents paid by others	23.50	(0, 100)	17.28	29.62	21.70	***
Total beds	126.26	(15, 1920)	69.78	141.22	121.85	***
Occupancy rate	85.87	(0.81, 100)	14.58	89.38	84.84	***
Acuity index	10.31	(3, 19.41)	1.35	10.20	10.34	***
Low-staff	0.48			0.30	0.54	***
Market:						
Herfindahl-Hirschman index	0.174	(0.004, 1)	0.216	0.18	0.17	
Empty beds per 1,000 elderly (65+)	10.84	(0, 163.93)	10.86	9.51	11.24	***
Per capita income (in $1,000s)	27.90	(0, 92.98)	8.11	28.29	27.78	***
Unemployment rate (16+)	4.50	(0.9, 29.9)	2.13	4.30	4.55	***
Population 85+ (in 1,000s)	11.70	(0.006, 114.98)	21.30	8.97	12.50	***
Female population 15-44 (in 1,000s)	190.19	(0.18, 2210.64)	409.21	131.15	207.57	***
State:						
Medicaid rate	112.72	(69.55, 178.70)	24.18	119.27	110.80	***
Number of observations	28,840			6,560	22,280	
Number of facilities	7,210			1,691	5,616	

Notes: NFP=nonprofit. FP=for-profit. SD indicates standard deviation.
Mean comparison tests (t-test) by ownership type. * significant at 10%; ** significant at 5%; *** significant at 1%

7.2.4. Validation of MCR

Since the MCR has been underutilized in nursing home research and concerns about the usefulness of some of the data from the MCR (as described in Section 4.2.) also exist, it is important to check whether the MCR is a valid and reliable dataset for this study.

The financial information is also found in yearly state cost reports (SCR) that nursing homes are required to file with the state health department. The MCR data quality was checked by comparing with the SCR. To check the validity and reliability of the MCR data and determine whether the different types of cost reports (Medicare and state) were filled out consistently, three financial measures from the MCR and the SCR for California and Texas were compared. California and Texas were selected for comparison because California and Texas led in the nation in the number of nursing homes.[14] Furthermore, cost reports data are publicly available from those two states. The SCR data are cleaned and reviewed by state officials, and are generally considered to be accurate and among the best and most comprehensive available in any states.

The numbers of observations before and after cleaning data (i.e., eliminating extreme outliers on key variables) are presented in Table 7.3. In California, the comparison is limited to exactly the same facility and year observations. An exact facility comparison is not possible for Texas due to the lack of common facility identifying numbers between the MCR and the SCR.

[14] The numbers of California and Texas nursing homes in 2003 are 1,291 and 1,094, respectively, which represent almost one-fifths of nation's nursing homes.

Table 7.3 Numbers of Facility-Year Observations: California and Texas

	California		Texas	
	MCR (CY98-CY01)	SCR (CY98-CY01)	MCR (CY99-CY00)	SCR (FY99-FY00)
Before exclusion	3,971	4,156	2,469	2,050
After exclusion			1,532 (62%)	1,923 (94%)
Limited to the same facility-year	3,425 (86%)	3,425 (82%)	N/A	N/A

Notes: In Texas state cost reports, year refers to fiscal year. CY=calendar year. FY=fiscal year.

Tables 7.4 and 7.5 show the three financial measures from the MCR and the SCR for California and Texas: (1) total margin, (2) revenue per diem, and (3) expense per diem (Texas only has the revenue and expense measures). Total resident days are also compared. Overall, the validity analyses support that the MCR and the SCR for two states are relatively consistent in terms of mean values of three measures and total resident days for many facilities. Ranges on the variables also seem reasonable. The MCR, therefore, seems to be best national data for assessing the effects of minimum staffing standards on financial performance.

Table 7.4 Financial Performance from MCR and SCR: California

	MCR (CY98-CY01)			SCR (CY98-CY01)		
	Mean	Range	SD	Mean	Range	SD
Total margin	1.24	(-98.20, 89.90)	10.89	1.13	(-89.91, 79.87)	10.28
Revenue per diem	137.59	(65.83, 1154.61)	41.37	133.94	(50.93, 222.93)	24.88
Expense per diem	137.49	(64.44, 1031.31)	44.11	134.34	(53.92, 266.96)	27.86
Total resident days	32,588	(1798, 106075)	15,079	33,288	(5200, 106964)	15,055
# facility-year	3,425			3,425		
# facility	872			872		

Notes: CY=calendar year. FY=fiscal year. SD indicates standard deviation.

Table 7.5 Financial Performance from MCR and SCR: Texas

	MCR (CY99-CY00)			SCR (FY99-FY00)		
	Mean	Range	SD	Mean	Range	SD
Revenue per diem	105.54	(42.99, 509.01)	35.75	98.02	(68.86, 131.14)	11.77
Expense per diem	112.39	(41.29, 557.82)	47.23	93.57	(53.75, 139.04)	14.75
Total resident days	31,056	(4373, 100753)	14,735	29,541	(1436, 103125)	14,456
# facility-year	1,532			1,923		
# facility	861			1,090		

Notes: In Texas state cost reports, year refers to fiscal year. CY=calendar year. FY=fiscal year. SD indicates standard deviation.

In addition, the formula for calculating and analyzing SNF total margin is the same as developed by the Medicare Payment Advisory Commission (MedPAC) and CMS's Office of the Actuary (OACT). A GAO analysis with the MCR data (2002b) used the similar methods developed by MedPAC and CMS's OACT and reported freestanding SNF median total margin from FY1999 and FY2000. The median values are not substantially different from total margin calculated in this study (Table 7.6). This comparison also confirms that the MCR provide the best national data for this analysis and financial measures constructed in this study are comparable across other studies using MCR.

Table 7.6 Comparison of Median Total Margin with a GAO Report

	MCR		GAO Analysis with MCR*	
	After dropping 1% on each end	Keeping facilities with 4 years of cost reports		
CY98	1.91	2.28		
CY99	1.20	1.50	FY99	1.3
CY00	1.08	1.42	FY00	1.8
CY01	1.49	1.67		

Notes: Year from a GAO analysis refers to fiscal year. CY=calendar year. FY=fiscal year.
Source: GAO (2002b). *Skilled Nursing Facilities: Medicare Payments Exceed Costs for Most but Not All Facilities.* Washington DC.

7.3. Empirical Models

A big challenge to estimating the effect of minimum staffing standards is controlling for the unobserved heterogeneity at the facility, market, and state level associated with

financial performance changes over time. The observed differences in financial performance are likely to be influenced by unobserved characteristics such as the organizational cultures, practice skill of the nurse workforce, overall population health needs, and state political, regulatory, or fiscal conditions. Ignoring this heterogeneity may result in biased estimates if these unmeasured factors are correlated with the variation in minimum staffing standards.

If an unobserved measure of state political culture or ideology is positively associated with financial performance but negatively related to the implementation of staffing standards, then the estimated effect of staffing standard changes on financial performance will be understated due to downward bias. Although state fixed effects could control for unobserved time-invariant factors at the state level, the estimates are biased if unobserved heterogeneity remains at either the level of the service area (e.g., county) or facility. For example, if unobserved time-invariant county specific health needs or treatment norms for vulnerable people are positively correlated with implementation or expansion of staffing standards and financial performance, the coefficient of the policy variable will be biased upward and the true effect of the policy will be understated. Alternatively, the existence of unobserved administrative efficiency associated with financial performance will also cause bias. Therefore, a facility-level fixed effects model was chosen to account for as many sources of heterogeneity as possible.

Since the policy changes occurred at diverse times across states, the present study provides unique new evidence by exploiting a natural experiment approach. Over the last decade, natural experiments have become especially popular in analyzing the effects of policy changes (Dow and Schmeer, 2003: Konetzka et al., 2004a, 2004b). The approach used in this study is a DD model to estimate the effect of staffing standard changes on

financial performance with pre-post and treatment-control groups. The average treatment effect can be calculated as the pre-post difference between the treatment and control group mean difference, assuming that the pre-difference is a good estimate of what the post-difference would have been had the treatment group not actually been treated (Woodridge, 2001). To avoid possible omitted variable bias, a set of facility, market, and state level time-varying covariates were added to the model. To explore variation in the effect of MSS by facility staffing level, the extended model included two policy variables and their interactions with the indicator of low-staff facility.[15] Furthermore, additional triple interaction terms with facility ownership (i.e., for-profit status) were included to assess the differential behavior of nursing homes in response to policy changes. The model specification is as follows:

$$Y_{ist} = \alpha_0 + \beta MSS_{st} + \gamma X_{ist} + \delta YearD_t + \mu_i + \varepsilon_{ist} \qquad (7.1)$$

where the subscript i indexes the nursing home, s indexes state, and t indexes year. Y_{ist} is indicators of financial performance classified into profit, revenue, and cost. MSS_{st} is a vector of the main treatment effects specified by two policy variables (transition and steady state effects) and their interactions with the indicators of low-staff facility and for-profit status. X_{ist} is a vector of facility, county, and state level time-varying covariates. A vector of year dummy variables ($YearD_t$) accounts for unobserved time fixed effects that might have an effect on financial performance and are possibly correlated with the implementation or expansion of state staffing standards. The error term consists of a facility-specific error

[15] The identification here is not the same as a difference-in-differences-in-differences (DDD) strategy. A key assumption of DDD approach is that the policy changes should not affect the staffing level among the third control group.

component (μ_i) to control for time-invariant facility and area characteristics and a mean zero random error component (ε_{ist}). Statistical tests were used to compare fixed and random effects specifications.[16] The parameters of Equation (7.1) were estimated by using an OLS model.

7.4. Results

As described in Section 6.4, the main measure of effect pertains to whether changes in staffing standards had persistent effects (i.e., steady state effects) on financial performance. Table 7.7 presents the full results from DD models for 3 financial indicators. The marginal steady state effects of MSS on financial performance vary by facility staffing status prior to new MSS and ownership type (Table 7.8). Increases in MSS resulted in a decline in total margin by 1.61 percentage points only at nonprofit facilities with relatively low staffing prior to new MSS ($p<0.05$). No significant MSS effects on total margin were shown at for-profit facilities or facilities with already high staffing prior to new MSS.

New staffing standards led to much greater increases in net expense per diem than net revenue per diem at nonprofit facilities. Among nonprofit facilities with relatively low staffing prior to new MSS, the effect of new staffing standards was about 5.8% (i.e., $9.49 increase relative to the mean of $163.52) increases in net expense per diem, whereas 2.7% (i.e., $4.03 increase relative to the mean of $150.17) increases in net revenue per diem. With relatively greater increases in costs (possibly in part due to increasing labor costs), those

[16] The Breush-Pagan and the Hausman specification tests strongly suggested that there were the facility-specific effects, thus fixed effects models were analyzed in order to control for time-invariant facility characteristics.

facilities were likely to experience declines in margins even with an increase in net revenue per day.

With respect to results for other variables, some facility, market, and state control variables had statistically significant effects, but the effects differed substantially across the different regressions (Table 7.7). Higher proportion of Medicare residents and higher occupancy rate had significant impacts on higher profitability. Output products reflected by the natural log of total resident days showed significant positive association with total margin, whereas the price of inputs was not statistically associated with any of financial measures.

Better financial performance would be expected in more competitive market, the coefficients on HHI, as a proxy variable for market competition, showed mixed results across financial measures. Similarly, the number empty beds per 1,000 elderly in which the facility was located would represent the market demand, market tightness, or availability of other long-term care providers in the market. Having more empty beds in the county would be expected to be negatively associated with financial performance. As expected, the result for the analysis showed significant negative effect of this variable on total margin. Among other market factors, the size of the elderly population as a proxy for the demand for and use of nursing home services was positively associated with total margin. Higher Medicaid reimbursement rate had statistically significant positive impact on total margin.

Table 7.7 Effect of State Minimum Staffing Standards on Financial Performance: DD Models

	Total Margin	Revenue Per Diem	Expense Per Diem
Policy: Staffing Standards			
Transition effect	0.552	5.153***	4.740***
	(0.456)	(0.771)	(0.880)
Steady state effect	0.405	7.924***	8.642***
	(0.538)	(0.910)	(1.038)
Transition × Low-staff	-2.109***	-2.611**	2.406
	(0.768)	(1.299)	(1.482)
Steady × Low-staff	-2.017**	-3.890***	0.849
	(0.873)	(1.477)	(1.685)
Transition × For-profit	0.053	-4.880***	-5.342***
	(0.567)	(0.959)	(1.095)
Steady × For-profit	0.241	-7.594***	-9.432***
	(0.667)	(1.128)	(1.287)
Transition × Low-staff × For-profit	1.434	2.475*	-1.519
	(0.876)	(1.481)	(1.691)
Steady × Low-staff × For-profit	1.493	6.111***	1.976
	(1.007)	(1.703)	(1.944)
Output:			
Ln (total resident days)	3.860***	-4.921***	-10.971***
	(0.218)	(0.368)	(0.420)
Input Price:			
Ln (CMS SNF wage index)	2.871	-5.336	-7.625
	(2.894)	(4.894)	(5.585)
Facility:			
For-profit	2.151**	1.958	-1.041
	(0.839)	(1.419)	(1.619)
Chain	-0.545	0.705	1.899***
	(0.346)	(0.585)	(0.668)
% Medicare	0.044***	0.142***	0.073***
	(0.008)	(0.014)	(0.016)
Total beds	-0.001	-0.011**	-0.009
	(0.003)	(0.005)	(0.006)
Total beds × Total beds	-0.000*	0.000	0.000
	(0.000)	(0.000)	(0.000)
Occupancy rate	0.117***	-0.082***	-0.242***
	(0.008)	(0.013)	(0.015)
Acuity index	-0.120	0.155	0.252*
	(0.073)	(0.124)	(0.142)
Market::			
Herfindahl-Hirschman index	0.758	14.078**	14.247**
	(3.556)	(6.014)	(6.863)
Empty beds per 1,000 elderly (65+)	-0.057***	-0.008	0.048

	(0.018)	(0.030)	(0.034)
Per capita income (in $1,000s)	-0.259***	0.236***	0.572***
	(0.052)	(0.087)	(0.100)
Unemployment rate (16+)	0.015	0.134	0.120
	(0.079)	(0.134)	(0.153)
Population 85+ (in 1,000s)	0.096*	0.120	0.056
	(0.058)	(0.099)	(0.113)
Female population 15-44 (in 1,000s)	-0.009	-0.142***	-0.119***
	(0.015)	(0.026)	(0.030)
State:			
Medicaid rate	0.045***	0.201***	0.090***
	(0.012)	(0.020)	(0.023)
Year:			
1999	-0.936***	-5.738***	-4.775***
	(0.145)	(0.245)	(0.279)
2000	-1.136***	-4.451***	-3.229***
	(0.174)	(0.295)	(0.337)
2001	-0.773***	1.547***	2.673***
	(0.217)	(0.368)	(0.420)
Constant	-46.320***	191.311***	269.833***
	(4.120)	(6.967)	(7.951)
Number of observations	28,840	28,840	28,840
Number of facilities	7,210	7,210	7,210
R-squared	0.04	0.12	0.13

Note: Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7.8 Marginal Effect of State Minimum Staffing Standards on Financial Performance: DD Models

		Total Margin	Revenue Per Diem	Expense Per Diem
Panel A: Low-staff (=1)				
	For-profit	0.12	2.53***	2.02***
		(0.35)	(0.59)	(0.67)
	Nonprofit	-1.61**	4.03***	9.49***
		(0.71)	(1.21)	(1.38)
Panel B: Low-staff (=0)				
	For-profit	0.65	0.34	-0.78
		(0.44)	(0.74)	(0.85)
	Nonprofit	0.41	7.95***	8.67***
		(0.54)	(0.91)	(1.04)

Notes: FTE=full-time equivalent. Standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%

7.5. Discussion

Consistent with the hypotheses, the main results indicate that increases in minimum staffing standards had significant negative impacts on total margin for some facilities. In particular, an increase in MSS results in a decline in total margin by 1.61 percentage points at nonprofit facilities with relatively low staffing prior to new MSS ($p<0.05$).

An increase in staffing inputs in face of increased staffing standards increases a direct component of nursing home costs. The analyses presented here depict worse financial status for some facilities (e.g., nonprofit with low staffing) by introducing new mandatory staffing regulations. Many states increased Medicaid nursing home reimbursement rates at the same time as introducing new minimum staffing standards through a variety of mechanisms. For example, California increased Medicaid rates of approximately $2.96 per resident day to pay raises for staffing in 2000 (Horowitz et al., 2003). Many states (26 states by 2003) also have funded a wage or benefit pass-through to keep salaries or benefits competitive. But the state efforts to increase public funding may be countered by higher labor costs required to meet the mandatory staffing standards. In order to achieve the benefits of mandatory staffing standards, the federal and state governments may need to determine the additional costs and develop a plan to adequately fund the required increases in staffing levels.

The declines in profit margin, however, were not found in for-profit facilities regardless of their staffing status prior to new standards. These findings are consistent with hypothesis 2c, and support the existence of behavioral differences between nonprofit and for-profit homes. As described in Chapter VI, for-profit homes, especially those with high staffing, did not show the evidence of improving staffing levels, but they showed quality improvements in response to new staffing standards. Those results together may suggest that

for-profit facilities have focused more on enhancing their quality of care as a means of improving their financial performance in recent competitive market. Their efforts to improve quality in ways other than increasing staffing levels (e.g., by improving wages or benefits to retain highly qualified workers) also may have generated additional costs. For-profit homes might squeeze out more productivity from their staff in order to offset the additional costs or maintain profits even if they are affected by the staffing standards.

Another plausible explanation is that those facilities may generate higher revenues especially from their private pay residents to compensate for the additional costs associated with new staffing standards. Private pay resident reimbursement is much greater than the reimbursement received from Medicare, Medicaid, and long-term care insurance for the same service, therefore, attracting private pay residents can provide a very lucrative means of increasing the financial performance of the home. Consumers satisfied with the quality of care are more willing to pay for the benefits they receive and are more likely to tolerate price increases (Weech-Maldonado et al., 2004). However, the data in this analysis do not allow for investigating any changes in private payment rates or revenues.

Conventional wisdom suggests that there may be a trade-off between output quality and firm's financial performance. Increases in quality may improve financial performance up to some point, though declines could set in after that. The relationship between quality of nursing home care and financial performance needs to be investigated as more nursing homes focus on enhancing their quality of care as a means of improving their financial performance. Further understanding of the effects of minimum staffing standards may be obtained by examining the relationship between profit levels and quality in nursing homes.

CHAPTER VIII

NURSING HOME STAFFING AND QUALITY OF CARE: AN ANALYSIS OF CAUSAL PATHWAYS

8.1. Introduction

Considerable research has been devoted to the issues of the number and composition of nursing staff required to meet the needs of nursing home residents. An issue of particular importance is the relationship between staffing and quality of care. Not surprisingly, most findings have suggested that a higher nursing staff level (i.e., more care hours per resident day) and more highly skilled nursing staff mix (i.e., a greater proportion of professional nursing staff such as registered nurses) are associated with higher quality of care in nursing homes measured by various process and outcome indicators. Examples include improved survival (Cohen and Spector, 1996; Porell et al., 1998), better functional status (Cohen and Spector, 1996), less incontinence (Porell et al., 1998), fewer pressure sores (Cohen and Spector, 1996; Kayser-Jones et al., 2003; Weech-Maldonade et al., 2004), less hospitalization (Carter and Porell, 2003), lower rates of physical restraint use (Castle, 2000; Weech-Maldonade et al., 2004), and fewer facility deficiencies (Harrington et al., 2000b).

While most studies have found that higher nursing home staffing leads to higher quality of care, whether and to what extent increased staffing improves quality of care is inconclusive. Previous studies have used a variety of staffing and quality measures, data sources, and estimation strategies. More importantly, existing estimates of the effect of

staffing on quality may be biased because the relationship between staffing and quality has been identified by cross-sectional variation, and the potential endogeneity of staffing has not been fully controlled for.

The lack of valid control for the potential endogeneity of staffing prevents determination of consistent estimates of the causal effect of staffing on quality of care and misleads policy implications. Therefore, identification of the unbiased relationship between staffing and quality of care becomes an important policy question for the determination of specific staffing standards to improve quality of care.

To address the issues above, this study employs a facility-level fixed effects with instrumental variables (IV-FE) approach to test for and correct for the potential endogeneity of staffing. State minimum staffing standards, market (county) level nurse supply and demand shifters are chosen as instruments to predict the staffing changes over time. This study helps to resolve the gaps in the previous literature on the underlying relationship between staffing and quality of care. Furthermore, by linking state minimum staffing standards to identify the exogenous variation in staffing, this study contributes to an improved understanding of the relationship between state minimum staffing standards, the level of staffing, and quality of care in nursing homes.

8.2. Data and Study Sample

8.2.1. Data sources

As described in more detail in Chapter IV, the data on facility characteristics, staffing, and quality measures came from the OSCAR system from 1998 through 2001. The OSCAR data are from state surveys of all federally certified Medicare skilled nursing facilities and Medicaid nursing facilities in the U.S. The OSCAR system includes about 96% of nation's

nursing homes, and information on the system is used to determine whether nursing homes are complying with federal regulations (Grabowski, 1999). Although most OSCAR data elements are self-reported, OSCAR is the most comprehensive national source of facility-level information on the operations, resident characteristics, and regulatory compliance of nursing homes in the U.S. (Cawley et al., 2004; Zinn, 1993).

The OSCAR data were linked to the data on specific state staffing standards, state Medicaid per-diem rates, and market conditions. State minimum staffing standards and Medicaid policy variable were constructed from various published sources. State minimum staffing standards came from two published reports which have collected state nurse staffing standards for nursing homes from state statutes, regulations, and administrative policies via the Internet and telephone survey.[17] State Medicaid per-diem rates were obtained from the Brown University Survey of State policies (1999-2002) and Harrington's 1998 State Data Book on Long-Term Care Program and Market Characteristics: State Medicaid Policy. Market-level variables were obtained from the ARF, which is a publicly available dataset containing more than 7,000 economic and demographic variables for each of the nation's counties. Data on the population for each county came from the U.S. Census Bureau.

8.2.2. Study sample

The quality of measures in the OSCAR has been issued in previous studies (Abt, 2000, 2001; Zhang and Grabowski, 2004). In particular, staffing data have skewed distributions. To eliminate possibly erroneous outliers for the analytic data, the exclusion

[17] (1) Harrington, C. (2002). Nursing Home Staffing Standards. *The Kaiser Commission on Medicaid and the Uninsured.* (2) U.S. Department of Health and Human Services Assistant Secretary for Planning and Evaluation Office of Disability (2003). *State Experiences With Minimum Nursing Staff Ratio For Nursing Facilities: Finding From Case Studies of Eight States.*

criteria developed by CMS (Abt, 2000) for its study of minimum nurse staffing ratios were adopted in this study.

All facilities that reported more residents than beds were excluded. Current federal regulations require that all certified nursing homes with 60 or more beds have a registered nurse on duty for 8 hours a day seven days a week and a licensed nurse on duty evenings and nights. Facilities with fewer than 60 beds can obtain a waiver that exempts them from this requirement. Thus, all facilities that reported no registered nurse hours and had 60 or more beds were also excluded. The facilities that reported more than 12 hours per resident day and less than 0.5 total hours per resident day were eliminated to avoid the unrealistically high or low staffing hours. Facilities that reported zero residents were excluded, and facilities with incomplete information were also removed from the analysis. The original database included 18,275 facilities; on the basis of the criteria above, 436 facilities (2.39 %) were excluded.

Since hospital-based nursing facilities are very different in terms of resident severity and care practice, an additional 2,271 hospital-based facilities were also eliminated. Although Medicare-only-certified facilities are affected by state regulations, those facilities are primarily for short-stay residents after hospitalization. Thus, an additional 343 Medicare-only facilities were eliminated, so that only nursing homes with Medicaid-only or dually certified facilities were analyzed. Eight more facilities were excluded due to missing values. As a result of cleaning process, a total of 55,248 facility-year observations from 15,217 facilities were analyzed.

8.2.3. Instrumental variables

Finding good instruments for staffing is the key in instrumental variables estimation. The valid instruments should affect staffing significantly, but affect quality of care only through their direct effect on staffing. Two sets of instruments are employed in this analysis.

Among multiple instruments available in this study, important policy changes in state minimum staffing standards are used as the primary instruments for staffing. Since nursing staff is the dominant input in the production of nursing home care and the compliance to minimum staffing standards is monitored for the certification purpose, nursing homes are most likely to respond to the staffing standard changes. Several recent studies provide evidence that the actual staffing levels vary substantially by state staffing standards, in that the facilities in states with high staffing standards had somewhat higher staffing on average than states with no standards or low standards (Harrington, 2005a, 2005b; Mueller et al., 2006). Thus, state-specific staffing standard changes are hypothesized to most likely affect staffing choice, but do not always affect quality of care directly. In other words, the changes in state standards will influence facilities' choice of staffing and non-staffing inputs under the interaction with facilities' internal resource allocation criteria, and such changes in staffing levels will lead to changes in quality of care. Two dummy variables are created from the various timing of implementation or expansion of state minimum staffing standards as described in Section 5.1.4: 'transition effects' and 'steady state effects'.

Since a number of facilities operate at staffing levels far above the mandated levels, nursing homes with current staffing levels below or close to new standards are more likely to have responded to the increased state staffing standards. This study exploits this variation by allowing the interactions of two policy variables and the indicator of low-staff facility. To create the indicator of low-staff facility, both licensed and unlicensed staffing in each year

were compared to the required staffing in the next year to see if current staffing was lower than what was required in the next year. A facility was defined as low-staff if current (t) staffing was less than next year (t+1) required staffing in any one year. These instruments may explain some of the actual variation in staffing levels and provide additional information on the potential relationship between staffing and quality of care.

The second set of instruments consists of market-level variables. In addition to state staffing standards, nursing homes respond to the relative competitiveness of the market and local resource constraints. Market supply shifters should have an impact on the relative size of the groups in the population constituted by possible long-term care workers, but may not necessarily affect quality of care. These factors include the local unemployment rate and the female population aged 15-44 in the county. The population of the elderly aged 85 and over in the county is the primary determinant of potential demand, and is included as a market demand shifter for staffing.

8.2.4. Descriptive statistics

The first three columns in Table 8.1 show summary statistics for all facilities. The values for the quality, staffing and other covariates are similar to values reported by other studies using these variables (Castle and Engberg, 2005; Cowles, 2002; Grabowski, 2004; Harrington et al., 2000b). The rightmost three columns in Table 8.1 compare the mean values of all variables for facilities with relatively low staffing and those with relatively high staffing. It is important to remember that the low-staff variable in this study does not represent facilities that were below current standards, but instead identifies facilities that had to increase staffing to become compliant with new standards in the next period. By this definition, 49 percent of the facilities (N=7,248) were low-staff, while 51 percent of the

facilities (N=7,969) were consistently above subsequent year standards over the study period. The low-staff facilities were more likely for-profit and chain-affiliated, and had slightly fewer residents on Medicare and fewer beds than their counterparts. The low-staff facilities were more likely to be in counties with relatively greater elderly and female population, while the states where low-staff facilities were located were more likely to increase staffing standards and have less generous Medicaid reimbursement rates.

Table 8.1 Summary Statistics by Staffing Status, 1998-2001

	Full Sample			Low-Staff		
				No(=0)	Yes(=1)	
Variables	Mean	Range	SD	Mean	Mean	t-test
Staffing:						
Total HPRD	2.93	(0.5, 11.98)	0.95	3.33	2.51	***
Quality of Care:						
Incidence rate of pressure sores	3.45	(0, 13.73)	2.96	3.36	3.55	***
Incidence rate of contractures	9.52	(0, 60)	12.20	10.06	8.96	***
Incidence rate of catheter use	1.92	(0, 11.76)	2.39	1.89	1.94	
Incidence rate of restraint use	8.13	(0, 47.73)	9.50	7.93	8.33	***
Facility:						
Ownership						
For-profit	0.73		0.44	0.64	0.82	***
Nonprofit	0.23		0.42	0.30	0.15	***
Government	0.04		0.21	0.06	0.03	***
Chain	0.58		0.49	0.53	0.63	***
Payer mix						
% residents paid by Medicare	7.48	(0, 100)	8.68	8.37	6.56	***
% residents paid by Medicaid	67.89	(0, 100)	19.82	65.58	70.28	***
% residents paid by others	24.63	(0, 100)	18.78	26.06	23.16	***
Total beds	114.82	(5, 1231)	65.98	118.57	110.95	***
Occupancy rate	84.63	(1.56, 100)	15.28	85.29	83.95	***
Acuity index	10.08	(3, 21.70)	1.54	10.28	9.86	***
Market:						
Herfindahl-Hirschman index	0.196	(0.004, 1)	0.228	0.190	0.203	***
Empty beds per 1,000 elderly (65+)	13.08	(0, 173.91)	13.06	11.28	14.93	***
Per capita income (in $1,000s)	26.87	(0, 92.98)	7.62	27.59	26.13	***
State:						
Medicaid rate	108.70	(69.55, 285.01)	23.18	115.37	101.80	***
Instruments:						
Transition effect	0.101		0.301	0.083	0.119	***
Steady state effect	0.103		0.304	0.070	0.136	***
Low-staff	0.49		0.50	0	1	
Unemployment rate (16+)	4.51	(0.70, 29.90)	2.10	4.42	4.61	***
Population 85+ (in 1,000s)	9.88	(0.01, 114.98)	19.63	7.64	12.20	***
Female population 15-44 (in 1,000s)	160.84	(0.12, 2210.65)	373.79	114.91	208.28	***
Number of observations	55,248			28,073	27,175	
Number of facilities	15,217			7,969	7,248	

Notes: HPRD=hours per resident day. SD indicates standard deviation.
Mean comparison tests (t-test) by low-staff status. * significant at 10%; ** significant at 5%; *** significant at 1%

8.3. Empirical Models

8.3.1. Specification

This study used a facility-level fixed effects and a fixed effects with instrumental variables approach in estimates of the effect of staffing on four measures of quality of care: the incidence rates of pressure sores, contractures, catheter use, and restraint use. Although state fixed effects could eliminate unobserved time-invariant factors at the state level, the estimates are biased if unobserved heterogeneity remains at either the level of the service area (e.g., county) or facility. Therefore, a facility-level fixed effects model was chosen to account for as many sources of heterogeneity as possible. The instrumental variables analysis was conducted using a traditional two-stage least squares regressions (2SLS).

The first stage estimated staffing as a function of instruments and other control variables using a facility-level fixed effects model. Staffing was measured by total nursing staff hours per resident day. Instruments included the variables that are not present in the main equation: (1) two dummy indicators of state minimum staffing standard changes and their interactions with the indicator of low-staff facility, and (2) market-level nurse supply and demand factors. A vector of facility, county, and state level characteristics was also controlled for.

The quality equations were estimated as a function of predicted staffing from the first stage regression, and the same control variables as in the first stage except the instruments. The variable of primary interest is the predicted staffing variable, which is assumed to be exogenous in the second stage. Its coefficient indicates the effect of changes in staffing identified by the variation of instruments in the first stage (i.e., the exogenous state policy shock and the relative competitiveness of the market and local resource constraints) on changes in quality of care over time. The basic model specification is as follows:

First stage: $S_{ist} = \alpha_0' + \beta' W_{ist} + \gamma' X_{ist} + \delta' YearD_t + \mu_i' + \varepsilon_{ist}'$ (8.1)

Second stage: $Q_{ist} = \alpha_0 + \beta \hat{S}_{ist} + \gamma X_{ist} + \delta YearD_t + \mu_i + \varepsilon_{ist}$ (8.2)

where the subscript i indexes the nursing home, s indexes state, and t indexes year. S_{ist} is the actual level of total nursing staff hours per resident day. Q_{ist} is the outcome and process measures of quality of care. $\hat{S}_{ist}$ is the predicted value of staffing variable. W_{ist} in the first stage regression is the instrumental variables for staffing described above. X_{ist} is a vector of facility, county, and state level time-varying covariates. $YearD_t$ represents time fixed effects. The error term consists of time-invariant facility fixed effects (μ_i) and a mean zero random error component (ε_{ist}).

8.3.2. Identification and specification tests

For the IV method to be valid, three conditions should be met. Specification tests were conducted to assess whether: (1) staffing decision is endogenous, (2) the IVs explain sufficient variation in the endogenous variable, and (3) the IVs are validly excluded from the main equations.

The Hausman endogeneity tests are used most frequently in the literature. However, since Hausman tests have several practical difficulties in statistical packages, several asymptotically equivalent variants of Hausman tests are implemented. In this study, the exogeneity of staffing was tested by an alternative auxiliary equation version F-test along with the Hausman tests. An alternative auxiliary equation estimates a variant of the main

equation in which quality is regressed on staffing, predicted staffing (or predicted residuals) from the first stage and other exogenous variables, and evaluates the significance on predicted staffing (or predicted residuals) with t- or F-tests. If staffing is exogenous then staffing is an appropriate estimator, so the additional predicted staffing (or predicted residuals) should have no explanatory power. The Hausman endogeneity tests (or variants of the Hausman tests) reject the null hypothesis that staffing is exogenous in each quality equation (Table 8.2).

The specification tests show that the instruments have strong explanatory power in the first stage regression and confirm that the instruments are significant predictors of staffing. A joint F-statistic for the significance of instruments is 11.54 ($p<0.01$), which satisfies the standard of 10 suggested by Staiger and Stock (1997). About 11% of variation in staffing is explained by the instruments and other control variables, having R^2 in the first stage regression 0.11 (Table 8.3).

Finding good instruments which are validly excluded from the main equation of interest is the most important and contentious assumption in the instrumental variables analysis. A test of over-identification for the IV-FE models allows a further assessment of this assumption. The null hypothesis is that the instruments together should only affect quality of care via their impact on staffing, and not through any other pathway independent of staffing. Rejection of the null hypothesis implies that some of the instruments are invalidly excluded, but the test is non-constructive in that it does not indicate which instruments are problematic. The Lagrange Multiplier (LM) version of exclusion restriction test supports that the instruments together are validly excluded from the second stage equation only for the incidence rate of catheter use.

Although the instruments do not pass the over-identification test for three other quality measures in this study, the specification tests confirm that the endogeneity of staffing is a suspected problem and correction of endogeneity is necessary. Furthermore, the instruments together have a strong explanatory power in the first stage regression and have theoretically sound justification to be valid instruments for staffing. Thus the IV-FE models are chosen as preferred models for four quality measures, though lack of evidence of over-identification means caution should be used in interpretation of these results. For comparison purposes, the estimated results with and without instruments, and naïve OLS are also reported for each quality measure.

Table 8.2 Specification Tests

Dependent Variables (Incidence Rate)	Endogeneity Test		IV Strength	Over-id Test
	Hausman $\chi 2$ [p-value]	Alternative auxiliary equation version F-test [p-value]	F-test [p-value]	LM test $\chi 2$ [p-value]
Pressure Sores	9.57[0.793]	8.32[0.004]	11.54[0.000]	22.08[0.001]
Contractures	27.16[0.018]	20.27[0.000]	11.54[0.000]	19.41[0.004]
Catheter Use	4.05[0.983]	3.93[0.047]	11.54[0.000]	9.39[0.153]
Restraint Use	0.18[1.000]	4.65[0.000]	11.54[0.000]	44.55[0.000]

Note: Instruments include transition effect, steady state effect, transition × low-staff, steady × low-staff, unemployment rate (16+), population 85+ (in 1,000s), and female population 15-44 (in 1,000s).

8.4. Results

8.4.1. Staffing result

Table 8.3 provides the first stage staffing result. As described earlier, a joint F-statistic for the significance of instruments is greater than the standard of Staiger and Stock (1997). In addition, a set of four policy variables is jointly significant, and each of market level instruments is also individually significant in the first stage regression.

The significant positive coefficient on the interaction term between steady state effect and a low-staff indicator suggests that increased minimum staffing standards are more likely to influence the facilities with relatively low staffing levels than those facilities that already operated above the mandated levels. The statistically significant positive coefficient also provides further evidence that the persistent effect of policy changes is apparent after the first implementation year. Overall, the increased minimum staffing standards led to a statistically significant steady state increase in total staff hours per resident day by 0.067 (4.02 minutes, $p<0.01$) among low-staff facilities.

Most of the long-term care (e.g., feeding, dressing, bathing, toileting, assisting with medications etc.) needed by impaired persons in nursing homes is provided by unskilled nurse aide workers. Higher unemployment rates could probably encourage more nursing staff (especially nurse aide workers) into nursing home labor market. However, the result showed unexpected significant effects in which higher unemployment rates reduced the total staff hours per resident day. There are an array of documented job factors regarding nurse aide workforce such as low wages and few benefits, physical demanding work, inadequate recognition or appreciation, and lack of opportunity for meaningful input into patient care (PHI and NCDHHS, 2004). Furthermore, wages in other low level jobs (e.g., food service, sales person, clerks/receptionists, unskilled factory workers) are often competitive with nurse aide wages. The result may suggest that the nursing home industry likely to be a competing employment option for nurse aide workers and would face the same recruitment and retention problem for potential aide workers as other competing employment fields in the same market. Since the demand for and use of nursing home services increase for those aged 85 and older, the size of the elderly population in the county was positively associated with

total staffing hours. The size of the female population in the market which may represent availability of long-term care workers were also positively associated with total staffing hours.

As expected, having a higher proportion of Medicare residents and higher severity index value had significant positive impacts on staffing levels. The negative coefficients on the number of total beds showed some evidence of the economies of scale. High occupancy rates were negatively associated with total staffing hours. None of the market variables was statistically significant.

Table 8.3 First Stage Staffing Result: FE (DD) Model

Variables	Total HPRD
Policy Instruments: Staffing Standards	
Transition effect	-0.009
	(0.014)
Steady state effect	-0.029
	(0.019)
Transition × Low-staff	0.028
	(0.018)
Steady × Low-staff	0.095***
	(0.023)
Market Instruments:	
Unemployment rate (16+)	-0.012***
	(0.004)
Population 85+ (in 1,000s)	0.009***
	(0.003)
Female population 15-44 (in 1,000s)	0.002**
	(0.001)
Facility:	
For-profit	0.018
	(0.039)
Chain	0.012
	(0.017)
% Medicare	0.005***
	(0.001)
Total beds	-0.016***
	(0.001)
Total beds × Total beds	0.000***
	(0.000)
Occupancy rate	-0.027***
	(0.000)
Acuity index	0.022***
	(0.004)
Market:	
Herfindahl-Hirschman index	0.021
	(0.151)
Empty beds per 1,000 elderly (65+)	-0.001
	(0.001)
Per capita income (in $1,000s)	-0.001
	(0.003)
State:	
Medicaid rate	-0.002***
	(0.001)
Year:	

1999	-0.022***
	(0.007)
2000	-0.043***
	(0.009)
2001	-0.038***
	(0.011)
Constant	6.371***
	(0.184)
Number of observations	55,248
Number of facilities	15,217
R-squared	0.11

Notes: HPRD=hours per resident day. Standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%

8.4.2. Quality of care results

Tables 8.4 to 8.7 present the results from the naïve OLS, FE, and IV-FE regressions for four quality measures: incidence rates of pressure sores, contractures, catheter use, and restraint use. If increases in staffing improved the quality of care, the coefficient on the staffing variable would be negative since the quality of care measures were constructed as adverse outcomes.

Even though the size of the effect of staffing varied by quality measures, the results from the preferred IV-FE models showed that the increased total staff hours significantly improved several quality of care measures after controlling for the endogeneity of staffing. A one unit increase in total staff hours per resident day[18] led to a statistically significant decrease in the incidence rates of pressure sores and contractures, by 1.5 percentage points ($p<0.01$) and 9.1 percentage points ($p<0.01$), respectively. These results were relative to an overall level of incidence rates of pressure sores of 3.45% and contractures of 9.52%, respectively. An increase in total staff time by 1 hour per resident day resulted in a decrease

[18] Given the fact that the overall mean of total staff hours per resident day is 2.93 HPRD, a one unit increase in total staff hours approximately corresponds to the optimal recommendation level suggested by CMS which equals to 3.9 HPRD.

in the incidence rate of catheter use by 0.73 percentage points, which was statistically significant at the 10% significance level and was relative to an overall mean of incidence rate of catheter use of 1.92%. The incidence rate of restraint use was not significantly associated with increases in total staff hours per resident day.

In particular, when endogeneity was taken into account, the magnitude of effects of staffing on quality became larger than estimates from non-IV models. For pressure sores, the effect of total staff hours is about 10 times greater than estimate from the naïve OLS (-0.187 versus -1.502). Controlling for endogeneity significantly raises the magnitude of staffing on contractures (from -0.196 to -9.115). The reason why the staffing showed much bigger effect on contractures in IV-FE model than non-IV model is unclear. But given the fact that facilities with sicker residents would tend to operate with higher staffing, therefore the endogeneity bias would underestimate the effect of staffing on outcomes. If this endogeneity bias is large for contractures, estimates of even larger magnitude would be expected after accounting for endogeneity. However, it is important to note that IV estimates are determined by a subset of facilities which changed staffing levels in response to the values of IVs not by all facilities in the analysis.

In sum, findings from IV-FE models provide the support for the importance of total staff hours on nursing home quality and provide the evidence that the earlier models which did not control for the potential endogeneity of staffing tend to underestimate the effect of staffing on quality of care.

Other facility, market, and state control variables in the IV-FE models did not show any distinct effects compared to results from non-IV models. As expected, resident case mix variables had significant negative impacts on quality of care. Although not all of those

variables showed consistent effects on quality of care, the negative coefficients on the number of total beds showed some evidence of the economies of scale for resident outcomes measured by pressure sores and contractures. If nursing homes compete on the basis of quality, facilities in more competitive areas may maintain higher quality than those in low-competition areas. The coefficients on HHI, as proxy variable for market competition, did not have statistically significant effects for any of the quality measures in this study. Occupancy rate and the empty beds per 1,000 elderly (65+), as proxies for market tightness, showed mixed results across quality measures. Facilities with higher occupancy rates, indicating a tighter nursing home market, may have less incentive to provide high quality of care. The result for the analyses showed unexpected significant improvement in resident outcomes. Similarly, the number of empty beds per 1,000 elderly in the county has been used to identify excess demand or market tightness, and having more empty beds in the county would be expected to be associated with higher quality of care. However, the result for the analyses showed unexpected significant increases in catheter use. The demand for nursing home services may be higher in the areas with high per capita income. The wealthier, more economically developed areas are more likely to support the provision of needed services. As expected, a higher per capita income in the county suggested better quality of care as reflected by lower levels of contractures and restraint use. Medicaid program generosity as reflected by Medicaid payment rates was associated with a statistically significant decrease in the incidence rate of pressure sores.

Table 8.4 Effect of Total HPRD on Incidence Rate of Pressure Sores

	(1) Naïve OLS	(2) FE	(3) IV-FE
Staffing:			
Total HPRD	-0.187***	-0.071***	-1.502***
	(0.015)	(0.022)	(0.522)
Facility:			
For-profit	0.006	-0.220	-0.189
	(0.030)	(0.172)	(0.181)
Chain	0.096***	0.135*	0.152*
	(0.027)	(0.078)	(0.082)
% Medicare	0.007***	0.001	0.008**
	(0.002)	(0.002)	(0.003)
Total beds	0.002***	-0.002	-0.024***
	(0.000)	(0.003)	(0.009)
Total beds × Total beds	-0.000**	0.000	0.000***
	(0.000)	(0.000)	(0.000)
Occupancy rate	-0.011***	0.001	-0.038***
	(0.001)	(0.002)	(0.014)
Acuity index	0.364***	0.224***	0.254***
	(0.008)	(0.017)	(0.021)
Market:			
Herfindahl-Hirschman index	-0.121*	0.028	0.048
	(0.063)	(0.675)	(0.709)
Empty beds per 1,000 elderly (65+)	0.002*	-0.003	-0.005
	(0.001)	(0.003)	(0.004)
Per capita income (in $1,000s)	0.005**	-0.019	-0.017
	(0.002)	(0.013)	(0.013)
State:			
Medicaid rate	-0.009***	-0.004*	-0.005*
	(0.001)	(0.002)	(0.003)
Year:			
1999	-0.001	0.038	0.014
	(0.035)	(0.032)	(0.035)
2000	-0.005	0.065*	0.014
	(0.035)	(0.039)	(0.045)
2001	0.035	0.112**	0.059
	(0.035)	(0.049)	(0.055)
Constant	1.848***	2.381***	11.715***
	(0.151)	(0.622)	(3.461)
Number of observations	55,248	55,248	55,248
Number of facilities		15,217	15,217
R-squared	0.04	0.02	0.003

Notes: HPRD=hours per resident day. Standard errors in parentheses.
*significant at 10%; ** significant at 5%; *** significant at 1%

Table 8.5 Effect of Total HPRD on Incidence Rate of Contractures

	(1) Naïve OLS	(2) FE	(3) IV-FE
Staffing:			
Total HPRD	-0.196***	-0.110	-9.115***
	(0.061)	(0.090)	(2.239)
Facility:			
For-profit	-2.035***	-0.717	-0.524
	(0.123)	(0.695)	(0.779)
Chain	-0.675***	0.011	0.120
	(0.110)	(0.314)	(0.352)
% Medicare	-0.078***	0.017*	0.059***
	(0.006)	(0.009)	(0.015)
Total beds	-0.008***	-0.010	-0.150***
	(0.002)	(0.014)	(0.038)
Total beds × Total beds	0.000***	0.000	0.000***
	(0.000)	(0.000)	(0.000)
Occupancy rate	0.009**	-0.039***	-0.285***
	(0.004)	(0.008)	(0.062)
Acuity index	0.490***	0.507***	0.699***
	(0.035)	(0.067)	(0.089)
Market:			
Herfindahl-Hirschman index	3.319***	-0.685	-0.558
	(0.262)	(2.720)	(3.042)
Empty beds per 1,000 elderly (65+)	0.050***	-0.024*	-0.034**
	(0.005)	(0.014)	(0.015)
Per capita income (in $1,000s)	-0.095***	-0.180***	-0.165***
	(0.008)	(0.051)	(0.057)
State:			
Medicaid rate	0.036***	0.022**	0.019*
	(0.003)	(0.010)	(0.011)
Year:			
1999	0.431***	0.610***	0.455***
	(0.144)	(0.129)	(0.149)
2000	1.472***	1.735***	1.416***
	(0.146)	(0.156)	(0.191)
2001	1.918***	2.294***	1.961***
	(0.147)	(0.196)	(0.234)
Constant	4.103***	11.195***	69.931***
	(0.628)	(2.507)	(14.859)
Number of observations	55,248	55,248	55,248
Number of facilities		15,217	15,217
R-squared	0.03	0.01	0.001

Notes: HPRD=hours per resident day. Standard errors in parentheses.
*significant at 10%; ** significant at 5%; *** significant at 1%

Table 8.6 Effect of Total HPRD on Incidence Rate of Catheter Use

	(1) Naïve OLS	(2) FE	(3) IV-FE
Staffing:			
Total HPRD	-0.025**	0.018	-0.729*
	(0.012)	(0.017)	(0.386)
Facility:			
For-profit	0.035	-0.070	-0.054
	(0.024)	(0.131)	(0.134)
Chain	-0.129***	-0.009	-0.000
	(0.022)	(0.059)	(0.061)
% Medicare	-0.004***	0.002	0.006**
	(0.001)	(0.002)	(0.003)
Total beds	0.001***	-0.001	-0.013*
	(0.000)	(0.003)	(0.007)
Total beds × Total beds	-0.000	0.000	0.000**
	(0.000)	(0.000)	(0.000)
Occupancy rate	-0.004***	0.002	-0.018*
	(0.001)	(0.001)	(0.011)
Acuity index	0.170***	0.118***	0.134***
	(0.007)	(0.013)	(0.015)
Market:			
Herfindahl-Hirschman index	0.404***	0.302	0.312
	(0.051)	(0.512)	(0.525)
Empty beds per 1,000 elderly (65+)	0.011***	0.007***	0.006**
	(0.001)	(0.003)	(0.003)
Per capita income (in $1,000s)	-0.015***	0.020**	0.021**
	(0.002)	(0.010)	(0.010)
State:			
Medicaid rate	-0.007***	-0.002	-0.002
	(0.001)	(0.002)	(0.002)
Year:			
1999	-0.031	-0.068***	-0.081***
	(0.028)	(0.024)	(0.026)
2000	-0.015	-0.083***	-0.110***
	(0.029)	(0.029)	(0.033)
2001	0.001	-0.120***	-0.148***
	(0.029)	(0.037)	(0.040)
Constant	1.536***	0.083	4.956*
	(0.123)	(0.472)	(2.562)
Number of observations	55,248	55,248	55,248
Number of facilities		15,217	15,217
R-squared	0.03	0.004	0.002

Notes: HPRD=hours per resident day. Standard errors in parentheses.
*significant at 10%; ** significant at 5%; *** significant at 1%

Table 8.7 Effect of Total HPRD on Incidence Rate of Restraint Use

	(1) Naïve OLS	(2) FE	(3) IV-FE
Staffing:			
Total HPRD	-0.100**	0.090	-0.532
	(0.047)	(0.066)	(1.471)
Facility:			
For-profit	0.094	-0.238	-0.225
	(0.096)	(0.510)	(0.512)
Chain	-0.894***	-0.140	-0.132
	(0.086)	(0.231)	(0.232)
% Medicare	-0.069***	-0.026***	-0.023**
	(0.005)	(0.007)	(0.010)
Total beds	-0.000	0.046***	0.036
	(0.001)	(0.010)	(0.025)
Total beds × Total beds	0.000	-0.000***	-0.000
	(0.000)	(0.000)	(0.000)
Occupancy rate	-0.020***	0.020***	0.003
	(0.003)	(0.006)	(0.041)
Acuity index	0.972***	0.383***	0.396***
	(0.027)	(0.049)	(0.059)
Market:			
Herfindahl-Hirschman index	-0.396*	2.006	2.015
	(0.204)	(1.996)	(1.999)
Empty beds per 1,000 elderly (65+)	0.012***	0.013	0.012
	(0.004)	(0.010)	(0.010)
Per capita income (in $1,000s)	-0.028***	-0.130***	-0.129***
	(0.006)	(0.037)	(0.037)
State:			
Medicaid rate	-0.026***	0.013*	0.013*
	(0.002)	(0.007)	(0.007)
Year:			
1999	-0.686***	-0.541***	-0.552***
	(0.112)	(0.095)	(0.098)
2000	-1.324***	-1.197***	-1.219***
	(0.113)	(0.114)	(0.126)
2001	-1.315***	-1.215***	-1.238***
	(0.114)	(0.144)	(0.154)
Constant	5.606***	0.630	4.688
	(0.488)	(1.840)	(9.762)
Number of observations	55,248	55,248	55,248
Number of facilities		15,217	15,217
R-squared	0.04	0.005	0.007

Notes: HPRD=hours per resident day. Standard errors in parentheses.
*significant at 10%; ** significant at 5%; *** significant at 1%

8.4.3. Robustness checks

It is important to remember that the exclusion restriction test only supports for the incidence rate of catheter use. The test does not indicate which instruments are problematic for the rest of quality measures. Therefore, it might be useful to estimate using different sets of instruments. When estimates using different sets of instruments yield substantively similar results, this may add to the plausibility of the IV models, as it is much less likely that two very different sets of instruments also could cause exactly the same biases.

The models were re-estimated using two sets of instruments with different theoretical justifications in order to check robustness of the main results (Table 8.8). The F-tests in the first stage regression also showed that either separate set of instruments or together are significant predictors of staffing in IV models. As for over-identification tests, market-level instruments (i.e., instrument set 2) appeared to be validly excluded. However, the effects of staffing on quality of care seemed robust to the choice of two very different sets of instruments with different theoretical justifications, having fairly consistent estimates in both magnitude and direction.

Table 8.8 Robustness Checks

Instrument 1: Transition effect, Steady state effect, Transition × Low-staff, Steady × Low-staff
Instrument 2: Unemployment rate (16+), Population 85+ (in 1,000s), Female population 15-44 (in 1,000s)

Dependent Variables		β	SE	Endogeneity Test: Hausman $\chi2$ [p-value]	Endogeneity Test: Alternative auxiliary equation version F-test [p-value]	IV Strength: F-test [p-value]	Over-id Test: LM test $\chi2$ [p-value]
Incidence Rate of Pressure Sores							
Naïve OLS		-0.187***	(0.015)				
FE		-0.071***	(0.022)				
IV-FE	1 and 2	-1.502**	(0.522)	9.57 [0.793]	8.32 [0.004]	11.54 [0.000]	22.08 [0.001]
	1	-0.226	(0.690)	0.05 [0.975]	0.05 [0.822]	10.48 [0.000]	8.65 [0.034]
	2	-2.217***	(0.653)	17.52 [0.230]	13.33 [0.000]	19.18 [0.000]	4.16 [0.125]
Incidence Rate of Contractures							
Naïve OLS		-0.196***	(0.061)				
FE		-0.110	(0.090)				
IV-FE	1 and 2	-9.115***	(2.239)	27.16 [0.018]	20.27 [0.000]	11.54 [0.000]	19.41 [0.004]
	1	-5.681*	(2.908)	4.61 [0.991]	4.03 [0.045]	10.48 [0.000]	14.98 [0.002]
	2	-11.950***	(2.840)	37.82 [0.001]	24.96 [0.000]	19.18 [0.000]	2.73 [0.256]
Incidence Rate of Catheter Use							
Naïve OLS		-0.025**	(0.012)				
FE		0.018	(0.017)				
IV-FE	1 and 2	-0.729*	(0.386)	4.05 [0.983]	3.93 [0.047]	11.54 [0.000]	9.39 [0.153]
	1	-1.348**	(0.564)	7.79 [0.900]	6.83 [0.009]	10.48 [0.000]	4.47 [0.215]
	2	-0.266	(0.448)	0.40 [1.000]	0.41 [0.524]	19.18 [0.000]	0.69 [0.708]
Incidence Rate of Restraint Use							
Naïve OLS		-0.100**	(0.047)				
FE		0.090	(0.066)				
IV-FE	1 and 2	-0.532	(1.471)	0.18 [1.000]	4.65 [0.000]	11.54 [0.000]	44.55 [0.000]
	1	-1.718	(2.058)	0.77 [1.000]	7.88 [0.000]	10.48 [0.000]	41.61 [0.000]
	2	-0.538	(1.743)	0.13 [1.000]	0.45 [0.720]	19.18 [0.000]	1.66 [0.435]

* significant at 10%; ** significant at 5%; *** significant at 1%

8.4.4. Extensions

Recent studies suggest that the relationship between staffing and quality may not be linear and at least some threshold must be reached before the benefits of higher staffing are seen (Abt, 2001; Kane, 2004; Mark et al., 2004; Schnelle et al., 2004; Zhang and Grabowski, 2004). It is important to explore a possible nonlinear relationship to provide further information about the effective staffing levels in ensuring quality of care. To test for a possible nonlinear relationship, the models were also estimated using a piecewise linear function of staffing splines. The cut-off points were selected based on various levels of total staff hours recommended by CMS: 2.75 HPRD (CMS minimum), 3 HPRD (CMS preferred), and 3.9 HPRD (CMS optimal).

Instead of using traditional 2SLS, two-stage residual inclusion (2SRI) is estimated by including four staffing splines and the predicted residuals from the first stage estimation, which is similar to the method to deal with endogeneity in nonlinear parametric models (Terza, 2006).[19] An F-statistic suggests that the effects of total staff hours significantly differ between the staffing groups for the incidence rates of pressure sores, contractures, and catheter use (Table 8.9). The beneficial effects on the onset of pressure sores and contractures by increasing total staff hours disappeared beyond 2.75 HPRD and 3 HPRD, respectively. The models were re-estimated using squared terms of staffing as well. The overall results, however, were not substantially different from the models with the linear splines (results not shown).

[19] A Monte Carlo experiment provides the evidence that a 2SRI generates consistent estimates.

Table 8.9 2SRI with Staffing Splines

	Incidence Rate of Pressure Sores	Incidence Rate of Contractures	Incidence Rate of Catheter Use	Incidence Rate of Restraint Use
Total HPRD				
≤ 2.75	-1.563***	-9.143***	-0.795**	-0.426
	(0.500)	(2.016)	(0.380)	(1.480)
2.75 – 3.00	0.289	-1.859**	-0.074	-0.153
	(0.229)	(0.921)	(0.174)	(0.677)
3.00 – 3.90	-0.304	2.961***	0.346*	0.013
	(0.250)	(1.008)	(0.190)	(0.740)
>3.90	0.059	-0.482	-0.235***	-0.101
	(0.100)	(0.404)	(0.076)	(0.297)
F-statistic	2.69	10.59	4.34	0.47
p-value	0.0293	0.0000	0.0016	0.7571

Notes: HPRD=hours per resident day. The coefficients represent the change in the slope from the preceding group. F-statistic for testing whether the coefficients are jointly equal to zero.
* significant at 10%; ** significant at 5%; *** significant at 1%

8.4.5. Policy simulation

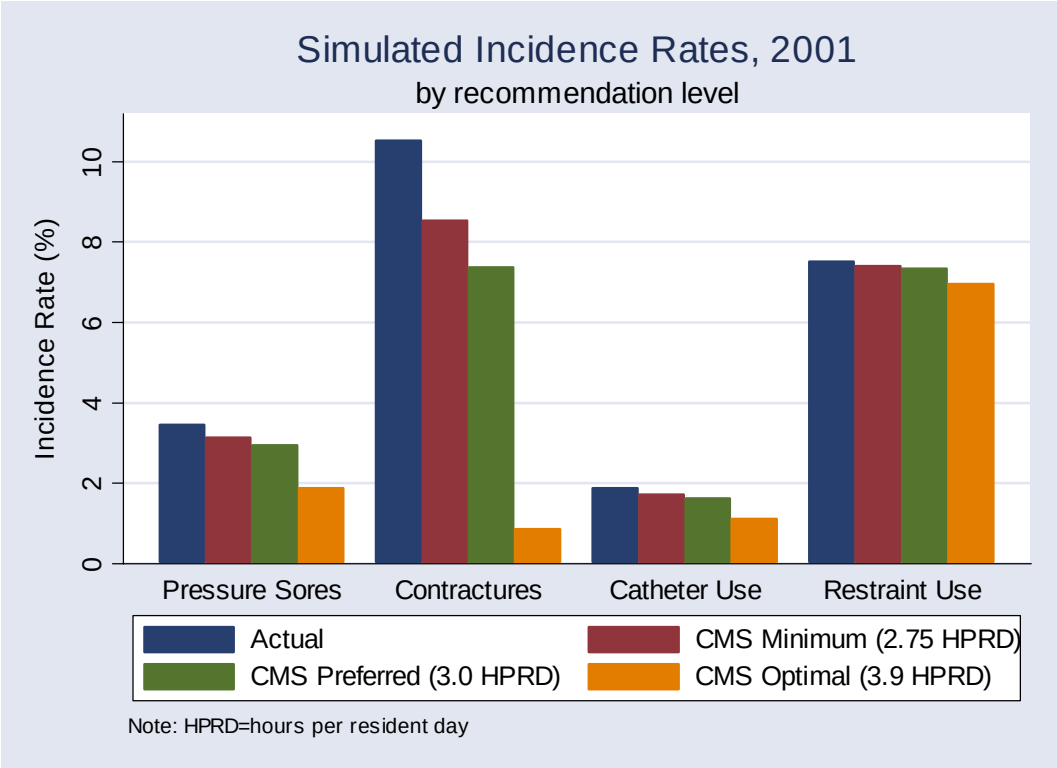
As described earlier, the CMS staffing studies recommend the minimum, preferred, and optimal staffing to ensure higher quality of care. The results from a policy simulation are useful for understanding the contributions of staffing levels to the quality of nursing home care and the potential effects of CMS recommended staffing levels.

Based on the estimated models controlling for the endogeneity of staffing, quality changes were predicted if the facilities with staffing levels below the recommendation levels would increase their staffing hours to the various CMS recommendation levels. The simulation is restricted to the year 2001 only.

A policy simulation illustrates that increasing total staff hours to CMS minimum (2.75 HPRD), preferred (3 HPRD), and optimal (3.9 HPRD) levels reduce incidence rate of pressure sores by 0.32, 0.51, and 1.58 percentage points, respectively, as compared to the actual mean (in 2001) of pressure sores of 3.46%. Equally, increasing total staff hours to CMS minimum, preferred, and optimal levels reduce incidence rate of contractures by 2.00,

3.17, and 9.67 percentage points, respectively, as compared to the actual mean (in 2001) of contractures of 10.53%. The simulation results support the persistent beneficial effects of increasing total staff hours on the onset of catheter use and restraint use as well (Figure 8.1). However, more accurate understating of the influence of particular policy would be achieved by examining the potential costs of implementing various mandated staffing ratios.

Figure 8.1 Simulated Incidence Rates, 2001



8.5. Discussion

This study employs a fixed effects with instrumental variables approach to test for and correct for the potential endogeneity of staffing. The findings in this study suggest that increased total staff hours per resident day significantly improved quality of care measured by the incidence rates of pressure sores, contractures, and catheter use. A one unit increase

in total staff hours per resident day led to a statistically significant decrease in the incidence rates of pressure sores and contractures, by 1.5 percentage points ($p<0.01$) and 9.1 percentage points ($p<0.01$), respectively. These results were relative to an overall level of incidence rates of pressure sores of 3.45% and contractures of 9.52%, respectively. An increase in total staff time by 1 HPRD resulted in a decrease in the incidence rate of catheter use by 0.73 percentage points, which was statistically significant at the 10% significance level and was relative to an overall mean of incidence rate of catheter use of 1.92%. Having larger estimates than in non-IV models, the findings from IV-FE models provide the support for the importance of total staff hours on nursing home quality and provide the evidence that the earlier models which did not control for the potential endogeneity of staffing tend to underestimate the effect of staffing on quality of care.

However, it is important to note that a one unit increase in total staff hours per resident day represents an unrealistically large increment given that the mean of total staff hours per resident day is 2.93 HPRD in the sample used for analysis. So a one unit (1 HPRD) increase would imply that almost one-thirds more of current staff hours should be provided. The results from a policy simulation shown in Section 8.4.5 thus provide a more realistic interpretation of the contribution of total staff hours to the quality of care. If the facilities with staffing below CMS preferred level would increase their staffing hours to the recommendation level of 3 HPRD, the incidence rate of pressure sores is predicted to decline by 0.51 percentage points (mean=3.46%) while the incidence rate of contractures is predicted to decrease by 3.17 percentage points (mean=10.53%) for the average facility in 2001. The smaller increases in total staff hours by the subset of facilities (i.e., low-staff facilities) also support a substantial improvement in overall quality of care. For example, an increase in

total staff hours to CMS preferred level is predicted to decrease the onset of contractures by almost 30 percent. The declines in adverse outcomes become bigger when those low-staff facilities raise their staffing hours to more stringent CMS recommendation levels. Overall simulation results support the persistent beneficial effects of increasing total staff hours on the onset of adverse outcomes.

The findings from IV models, however, should be interpreted with caution. First, the interpretation from IV models is different from the usual average treatment effects. The IV models estimate the Local Average Treatment Effect (LATE), which provide the estimates of the effect of staffing on quality of care among facilities which changed staffing levels over time in response to the instruments (i.e. the exogenous state policy shock and the relative competitiveness of the market and local resource constraints) used in the model (Harris and Remler, 1998; McClellan et al., 1994). The substantially larger IV results than non-IV results for contractures may be explained, as the variation in staffing was solely identified by the subset of nursing homes with current staffing below or close to new standards. Thus, the IV results may not be applied to all facilities (i.e., generalizability issue). Second, the most important and contentious assumption in an instrumental variables approach is that the selected instruments are validly excluded from the main equation of interest (i.e., validity issue). The exclusion restriction test supports that the instruments together are validly excluded from the second stage equation only for the incidence rate of catheter use. Therefore, estimated coefficients on staffing for the rest of quality measures may simply pick up the true direct effect of the instruments on quality. If selected instruments were not done correctly, a simple model without IVs would be best because IV models cause the variance of parameters to increase (i.e., loss in efficiency). Concerns about endogeneity bias still remain

for the rest of outcomes. Therefore, additional studies using different instruments or alternative estimation methods to deal with endogeneity would be beneficial.

In total, this study has important methodological and policy implications. From a methodological perspective, this study corrects for possible bias from the previous studies by using different model specifications. This better designed study helps to identify the causal relationship between staffing and quality of care in nursing homes. From a policy perspective, the results from the study are useful for understanding the contributions of staffing level to the quality of nursing home care. The analysis also has other dimension of assessment such that the estimation allows an assessment of the effect of state minimum staffing standards.

CHAPTER IX

CONCLUSIONS

9.1. Summary of Findings

This dissertation attempts to provide a comprehensive understanding about the impacts of state minimum staffing standards and to determine unbiased estimates of the effect of staffing levels on quality of nursing home care. Specifically, by exploiting differences in the timing of staffing standard changes for the 50 states and the District of Columbia from 1998 to 2001, this study conducts three empirical analyses to examine (1) the total effects of staffing standards on staffing choices and on quality of care, (2) the total effect of staffing standards on financial performance, and (3) the underlying (causal) relationship between staffing and quality of care. The major findings of three research questions are as follows:

Research Question 1: Do state minimum staffing standards improve the level of staffing and quality of care in nursing homes?

The first analysis utilizes data from the 1998-2001 OSCAR linked to data on specific market conditions, state minimum staffing standards, and state Medicaid rates. The findings for the effect of staffing standards on staffing levels suggest that minimum staffing standards result in increased staffing primarily at nursing homes with staffing levels previously below or close to the new standards [Hypothesis 1a and 1b]. Among those facilities with relatively

low staffing levels, only nonprofit facilities appear to respond to regulatory pressures by increasing both licensed and unlicensed staffing levels [Hypothesis 1c]. Effects are modest in size, with the biggest average effect being an increase in 12.4 minutes of total staff time per resident day at nonprofit facilities with relatively low staffing levels.

With respect to the effect on quality of care, the effects of increased staffing standards vary across quality measures. Resident outcomes (rates of pressure sores, contractures, or incontinence) and catheter use are not significantly associated with increases in minimum staffing standards, possibly due to difficulty in controlling for case mix measures with using facility level data rather than resident outcomes. The effects of increased staffing standards show consistent beneficial effects for the rate of restraint use and the number of total deficiencies at all types of facilities [Hypothesis 1a], but reductions are greater at nonprofit than at for-profit nursing homes [Hypothesis 1c], and at facilities with relatively high staffing than at those with relatively low staffing [reject Hypothesis 1b].

In sum, reduced-form analyses of the total effect of state minimum staffing standards show increases in staffing at certain types of facilities. Selected facility-level outcomes show improvement at all facilities, possibly due to a general response to increased standard or to other quality improvements implemented at the same time as minimum staffing standards.

Research Question 2: What are the impacts of state minimum staffing standards on financial performance in nursing homes?

The total effect of staffing standards on financial outcomes is estimated using four years (1998-2001) of Medicare cost report data on 7,210 freestanding SNFs. Consistent with staffing findings, the results show that increases in minimum staffing standards have

significant negative impacts on total margin only at certain types of facilities [Hypothesis 2a]. Increases in MSS result in a decrease in total margin by 1.61 percentage points at nonprofit facilities with relatively low staffing prior to new MSS ($p<0.05$) [Hypothesis 2b]. With relatively greater increases in costs (possibly due in part to escalating labor costs), those nursing homes are likely to have negative margins even though they gain positive net revenue per day. No significant MSS effects on total margin are shown at for-profit facilities or facilities with already high staffing prior to new MSS [Hypothesis 2b and 2c].

The findings from the first and the second analyses together confirm that substantial behavioral differences exist between nonprofit and for-profit homes. Profit-seeking facilities may be more cost efficient than nonprofit facilities. For-profit nursing homes appear to have been able to reduce the resources needed to produce nursing services while maintaining service quality and financial performance. For-profit homes might squeeze out more productivity from their staff particularly under the nursing shortage and documented staff recruitment and retention difficulties.

Research Question 3: What is the causal relationship between nursing home staffing and quality of care?

By using the same facility-year observations used in the first analysis, the third analysis finds that increases in total staff hours per resident day are associated with significantly improved quality of care measured by the incidence rates of pressure sores, contractures, and catheter use [Hypothesis 3a].

A one unit increase in total staff hours per resident day represents an unrealistically large increment given that the mean of total staff hours per resident day is 2.93 HPRD in the

sample used for analysis. The results from a policy simulation shown in Section 8.4.5 provide a more realistic interpretation of the contribution of total staff hours to the quality of care. If the facilities with staffing below CMS preferred level would increase their staffing hours to the recommendation level of 3 HPRD, the incidence rate of pressure sores is predicted to decline by 0.51 percentage points (mean=3.46%) while the incidence rate of contractures is predicted to decrease by 3.17 percentage points (mean=10.53%) for the average facility in 2001. The smaller increases in total staff hours by the subset of facilities (i.e., low-staff facilities) also support a substantial improvement in overall quality of care. For example, an increase in total staff hours to CMS preferred level is predicted to decrease the onset of contractures by almost 30 percent. The declines in adverse outcomes become bigger when those low-staff facilities raise their staffing hours to more stringent CMS recommendation levels. Overall simulation results support the persistent beneficial effects of increasing total staff hours on the onset of adverse outcomes.

Having larger coefficients than in non-IV models [Hypothesis 3b], the findings from IV-FE models provide the support for the importance of total staff hours on nursing home quality and provide the evidence that the earlier models which did not control for the potential endogeneity of staffing tend to underestimate the effect of staffing on quality of care.

However, it is crucial to note that the findings for quality of care in the first and the third analyses vary across quality measures. There may be several reasons in the lack of consistent findings across quality measures. More importantly, as described in Section 3.4, the main mechanisms to affect quality of care are different between the first and the third analyses.

The first analysis assesses the total effect of new staffing standards on quality of care using a reduced-form FE approach. If facilities view the new staffing regulation as either increased scrutiny on their quality of care or as heralding new competition on quality, they may look for other ways to improve quality in response to new staffing standards (e.g., improvement of physical environment, differing methods of treatment, the facility's efficient use of staff and non-staff inputs, or staff quality and productivity level). In this case, the findings for quality of care in the first analysis may be influenced by not only staffing input but also other aspects determined by new staffing standards. In contrast to the first analysis, however, the third analysis directly measures the effect of a one unit increase in total staff hours on quality of care after controlling for those unobserved heterogeneity at the facility level.

This distinction may explain why the effect of staffing standards on quality of care in the first analysis show significant improvement on facility-level overall quality measure such as total deficiency citations rather than resident outcomes (e.g., rates of pressure sores, contractures, or incontinence). But increases in nurse staffing levels in the third analysis are significantly associated with high-quality facility care process and the clinical resident outcomes. Total effects of staffing standards assessed in the first analysis also explain why facilities with relatively high staffing levels show much greater quality improvements than facilities with relatively low staffing levels although those facilities do not show the evidence of improving staffing levels in response to new staffing standards.

9.2. Policy Implications

As quality of care in nursing homes is a leading public policy issue, minimum staffing standards in nursing homes have become a major subject for debate at the state and national level because of the importance of nurse staffing levels to the processes and outcomes of care (Harrington, 2005a, 2005b; PHI and NCDHHS, 2004). Despite the public policy importance, little analysis has been done to link the staffing standards to outcomes, either with regard to the level of staffing, quality of care, or financial performance in nursing homes. The analyses performed in this dissertation regarding the impacts of setting minimum staffing standards are useful to understand the benefits and pitfalls of implementing staffing standards. Furthermore, the causal effect of staffing on quality of care has been poorly understood due in part to the lack of valid control for the potential endogeneity of staffing in previous literature. The third analysis provides new and improved estimates on this relationship. In total, this dissertation is particularly relevant to the era of growth in the aged population and provides important both policy and methodological implications.

First, structural differences in the effects of minimum staffing standards on staffing by previous staffing status or ownership type constitute major finding of this study. Mandated staffing standards seem to primarily affect marginal performers at the low-end of staffing spectrum and, therefore, may not improve overall average staffing level in an appropriate way. But overall quality improvement regardless of previous staffing status or ownership type that was found suggests that the amount of nursing staff alone is not the only factor contributing to quality of care received by residents. Facilities can vary in their ability to efficiently produce quality as a result of differences in their scale of operations, or some

facilities may reinvest their profits to enhance quality of care under the current competitive market. For example, for-profit homes might increase productivity from their current staff, particularly under the nursing shortage and documented staff recruitment and retention difficulties. For-profit facilities may also have shifted their focus to using quality of care as a means of competing for patients to improve their financial performance in the recent more competitive market. The structural differences in nursing home behavior may explain why average quality between for-profit and nonprofit sectors in response to MSS does not differ significantly while average profit does.

However, current nursing home staffing policy focuses on the specific staffing regulations (i.e., increased staffing level). The qualiy of care cannot be achieved merely by increasing the staffing levels. The findings in this study suggest that differences in organizational efficiency and productivity of nursing home workers may result in observed differences in quality of care. This potential association will give a new insight into policy implications relevant to stragetic planning and operative management of scarce labor resources to achieve both better quality and greater efficiency. Future policy should be developed by emphasizing on the increased productivity or the effective use of staff and non-staff resources.

Second, it is worthwhile to note that the analyses presented in Chapter VII depict financial uncertainty threatened by introducing new mandatory staffing regulations, which may impede facility administrators' ability to provide high quality of care. In order to achieve the benefits of mandatory staffing standards, the federal and state governments should determine the additional costs and may need to develop a plan to adequately fund the required increases in staffing levels.

Third, simulation results suggest that even a small change in total staff hours among low-staff facilities is leading to a substantial impact on the onset of adverse outcomes. The findings of this study can contribute to the determination of specific staffing standards to improve quality of care, which is a priority area of workforce policy. However, the success of this policy will depend on other quality initiatives such as developing training standards, staff education, and retention strategies. Federal and state governments should continue efforts to reduce staff turnover and stabilize the workforce.

Fourth, and more importantly, the state survey process and enforcement activities are known to vary widely across states. As the findings from calculated compliance rates confirm, a number of facilities appear to operate at staffing levels below the mandated levels (though caution must be used here, as this comparison was based on the standards for the facilities with 100 beds) (see Section 5.2). Quality differences may be caused by variation in enforcement rather than directly from the effects of mandated staffing standards. It is important that the federal and state governments should conduct monitoring and enforcement of federal and state laws and regulations in order to deter poor quality of care in nursing homes.

Finally, from a methodological perspective, this study corrects for possible bias from the previous studies by using different model specifications including a facility-level fixed effects and a fixed effects with instrumental variables approach. This better designed study helps to identify the causal relationship between staffing and quality of care, and it is therefore useful for understanding the contributions of staffing level to the quality of nursing home care.

9.3. Limitations and Future Research

In each of the three analyses, the results as well as several limitations provide motivation for future research. First, the use of OSCAR data aggregated at the facility-level may not reflect the true resident-level case mix and severity, or quality of care. The use of facility-level data may mask some relationships, so research using resident-level data and a broad array of outcomes would be beneficial.

Second, the main policy variables (i.e., transition and steady state effects) appear to capture the different legislation changes. It is important to note that the dummy policy variables used in this study are not sufficient to control for the intensity of minimum staffing standards or repeated changes. For example, three states (Arkansas, Delaware, and Oklahoma) changed legislation more than once during the study period from 1998 to 2001. The measurement of state specificity in the legislation and regulations to reflect intensity or level of required staffing may produce more robust results in future studies.

Third, the main analysis strategy to assess the effects of MSS involves a facility-level DD approach, which controls for the unobserved facility-specific time-invariant factors that differ across homes over time. Even though the DD estimation strategy controls for many of the unobserved and potential confounding factors, those factors could also have contributed to improving nursing home performance (e.g., staffing, quality of care, financial performance) over the same time period. Then the inconsistency in effects (e.g., improvements in quality in some facilities without improvements in staffing) might be due to omitted time-varying facility, market, and state factors that are highly correlated with policy changes. The DD parameter estimates will be biased if states which change staffing standards in a given year are also more likely to change other public health laws. Indeed, many states put in place other quality initiatives at the same time as they changed their

staffing standards. Another concern is that the changes in state minimum staffing standards may be endogenous to some unobserved quality-related shocks such as a reaction to publicity about quality problems in nursing homes, which could cause bias in the assessment of the effect of the policies. Potential endogeneity bias regarding implementation of MSS should be tested for and controlled for in the future research.

Fourth, since financial data from MCR for nursing homes do not undergo systematic audits, financial measures might not be completely accurate and could be manipulated. Some multi-facility chains might move profits among facilities or into centralized management functions not noted in the facility-level data. Future research could examine the financial pressures with more accurate financial data to improve the validity of the assessments if such data are available.

Fifth, one important mechanism to affect nursing home performance derived within the conceptual framework in this study is whether nursing homes charge higher prices (especially to their private pay residents) to match the additional costs as quality rises. Differences in financial performance at some facilities are possibly due in part to enhancing revenues from their private pay residents either by higher prices or more intense utilization of services to private pay residents. However, the data in this analysis do not allow for investigating any changes in private payment rates or revenues. The investigation of changes in prices and revenues by payer type or cost center would be useful to understanding nursing home behavior.

Lastly, since quality and profit are fundamental but also potentially conflicting objectives, nursing homes indeed respond to minimum staffing standards differently in order to achieve the optimal combination of non-pecuniary benefits and monetary wealth for the

home. Staffing is the largest element of costs for most nursing homes and, at the same time, staffing is an obvious mechanism by which financial decisions and the nursing home's operational context can impact quality (O'Neill et al., 2003). The nursing homes' structural decisions on input uses in response to minimum staffing standards will consequently affect quality of care and the financial performance in nursing homes. Differences in financial performance may result in differences in quality of care produced and vice versa. Therefore, particular attention should be paid to the potential association between quality and financial performance.

Prior empirical works suggest two conflicting expectations as to the relationship between quality and financial performance. One view shows the conventional trade-off between quality and financial outcomes in that cost containment efforts mainly through reducing staffing levels may be producing unintended adverse effects on quality of care (Cohen and Dubay, 1990; Gertler and Waldman, 1992; Kooreman, 1994; O'Neill et al., 2003). Given that the nursing home industry is dominated by for-profit facilities, nursing homes have strong incentives to choose the cost-minimizing combination of staffing and non-staffing input resources.

The other set of prior evidence supports that health care quality could be increased without increasing costs. That is, efficiency gains could be possible. Similarly, as described earlier, facilities could differ in terms of their ability to charge higher prices (especially to their private pay residents) to match the additional costs as quality rises. Recent research support that nursing homes with higher quality may experience better financial performance through their ability to generate higher revenues and reduce costs (Blank and Eggink, 2001;

Knox et al., 2003; Laine et al., 2005; Mukamel and Spector, 2000; Weech-Maldonado et al., 2004).

Although it is important to identify any causal pathway between quality and financial performance, this relationship is not examined in this study due to difficulty in controlling for quality being endogenous with financial performance. An integrative perspective which explores the relationship between quality of care and financial performance may be insightful. Future work could explore these relationships from a cost-effectiveness perspective (e.g., cost per improvement in outcome quality attained).

REFERENCES

Abt Associates (2000). *Report to Congress: Appropriateness of Minimum Nurse Staffing Ratio in Nursing Homes Phase I Report.* Baltimore, MD: Center for Medicare and Medicaid Services.

Abt Associates (2001). *Report to Congress: Appropriateness of Minimum Nurse Staffing Ratio in Nursing Homes Phase II Final Report.* Baltimore, MD: Center for Medicare and Medicaid Services.

Abt Associates (2003). *Validation of Long-Term and Post-Acute Care Quality Indicators.* Baltimore, MD: Center for Medicare and Medicaid Services.

Blank, J. L. T., & Eggink, E. (2001). A Quality-Adjusted Cost Function in a Regulated Industry: The Case of Dutch Nursing Homes. *Health Care Management Science 4*, 201-211.

Buerhaus, P. I., Staiger, D. O., & Auerbach, D. I. (2000). Implications of an Aging Registered Nurse Workforce. *Journal of the American Medical Association, 283*(20), 2948-2954.

California Department of Health Services' Licensing and Certification Program (2001). *Nursing Staff Requirements and the Quality of Nursing Home Care: A Report to the California Legislature.* Sacramento, CA: California Department of Health Services' Licensing and Certification Program.

Carter, M. W., & Porell, F. W. (2003). Variations in Hospitalization Rates Among Nursing Home Residents: The Role of Facility and Market Attributes. *The Gerontologist, 43*(2), 175-191.

Castle, N. G. (2000). Differences in Nursing Homes With Increasing and Decreasing Use of Physical Restraints. *Medical Care, 38*(12), 1154-1163.

Castle, N. G. (2002). Low-Care Residents in Nursing Homes: The Impact of Market Characteristics. *Journal of Health & Social Policy, 14*(3), 41-58.

Castle, N. G. (2005). Nursing Home Administrators' Opinions of the Nursing Home Compare Web Site. *The Gerontologist, 45*(3), 299-308.

Castle, N. G., & Engberg, J. (2005). Staff Turnover and Quality of Care in Nursing Homes. *Medical Care, 43*(6), 616-626.

Cawley, J., Grabowski, D. C., & Hirth, R. A. (2004). *Factor Substitution and Unobserved Factor Quality in Nursing Homes.* NBER Working Paper Series.

Chou, S. Y. (2002). Asymmetric Information, Ownership and Quality of Care: An Empirical Analysis of Nursing Homes. *Journal of Health Economics, 21*(2), 293-311.

Cohen, J. W., & Dubay, L. C. (1990). The Effects of Medicaid Reimbursement Method and Ownership on Nursing Home Costs, Case Mix, and Staffing. *Inquiry, 27*, 183-200.

Cohen, J. W., & Spector, W. D. (1996). The Effect of Medicaid Reimbursement on Quality of Care in Nursing Homes. *Journal of Health Economics, 15*, 23-48.

Cowles, C. M. (2002). *2002 Nursing Home Statistical Yearbook*. Montgomery Village, MD: Cowles Research Group.

Dalton, K., Park, J., Howard, A., & Slifkin, R. (2005). *Trends in Skilled Nursing and Swing-Bed Use in Rural Areas, 1996-2003.* Working Paper No. 83. North Carolina Rural Health Research Program, Cecil C. Sheps Center for Health Services Research, University of North Carolina.

Davis, M. A., Freeman, J. W., & Kirby, E. C. (1998). Nursing Home Performance Under Case-Mix Reimbursement: Responding to Heavy-Care Incentives and Market Changes. *Health Services Research 33*(4), 815-834.

Decker, F. H. (2006). Nursing Staff and the Outcomes of Nursing Home Stays. *Medical Care, 44*(9), 812-821.

Decker, F. H., & Dollard, K. J. (2001). *Staffing of Nursing Services in Long Term Care: Present Issues and Prospects for the Future*: Health Services Research and Evaluation American Health Care Association.

Dow, W. H., & Schmeer, K. K. (2003). Health Insurance and Child Mortality in Costa Rica. *Social Science & Medicine, 57,* 975-986.

Folland, S., Goodman, A. C., & Stano, M. (2001). *The Economics of Health and Health Care* (3rd ed.). New Jersey: Prentice Hall.

GAO. (1998). *California Nursing Homes: Care Problems Persist Despite Federal and State Oversight*. Washington DC.

GAO. (1999). *Nursing Homes: Additional Steps Needed to Strengthen Enforcement of Federal Quality Standards*. Washington DC.

GAO. (2000). *Nursing Homes: Sustained Efforts Are Essential to Realize Potential of the Quality Initiatives*. Washington DC.

GAO. (2002a). *Nursing Homes: Quality of Care More Related to Staffing than Spending*. Washington DC.

GAO. (2002b). *Skilled Nursing Facilities: Medicare Payments Exceed Costs for Most but Not All Facilities*. Washington DC.

GAO. (2002c). *Skilled Nursing Facilities: Available Data Show Average Nursing Staff Time Changed Little after Medicare Payment Increase*. Washington DC.

GAO. (2003). *Medicaid Nursing Home Payments: States' Payment Rates Largely Unaffected by Recent Fiscal Pressures*. Washington DC.

Gertler, P. J. (1989). Subsidies, Quality, and the Regulation of Nursing Homes. *Journal of Public Economics, 38*, 33-52.

Gertler, P. J., & Waldman, D. M. (1992). Quality-Adjusted Cost Functions and Policy Evaluation in the Nursing Home Industry. *Journal of Political Economy 100*(6), 1232-1256.

Grabowski, D. C. (1999). *Medicaid Reimbursement and the Quality of Nursing Home Care.* Ph.D. Dissertation, University of Chicago, Chicago, IL.

Grabowski, D. C. (2001a). Does an Increase in the Medicaid Reimbursement Rate Improve Nursing Home Quality? *Journal of Gerontology: SOCIAL SCIENCES, 56B*(2), S84-S93.

Grabowski, D. C. (2001b). Medicaid Reimbursement and the Quality of Nursing Home Care. *Journal of Health Economics, 20*, 549-569.

Grabowski, D. C. (2002). The Economic Implications of Case-Mix Medicaid Reimbursement for Nursing Home Care. *Inquiry, 39*, 258-278.

Grabowski, D. C. (2004). A Longitudinal Study of Medicaid Payment, Private-Pay Price and Nursing Home Quality. *International Journal of Health Care Finance and Economics, 4*, 5-26.

Grabowski, D. C., Angelelli, J., & Mor, V. (2004a). Medicaid Payment and Risk-Adjusted Nursing Home Quality Measures. *Health Affairs, 23*(5), 243-252.

Grabowski, D. C., & Castle, N. G. (2004). Nursing Homes with Persistent High and Low Quality. *Medical Care Research and Review, 61*(1), 89-115.

Grabowski, D. C., Feng, Z, Intrator, O., & Mor, V. (2004b). Recent Trends In State Nursing Home Payment Policies. *Health Affairs* Web Exclusive, June 16, 2004.

Grabowski, D. C., & Hirth, R. A. (2003). Competitive Spillovers Across Non-profit and For-Profit Nursing Homes. *Journal of Health Economics, 22*, 1-22.

Grabowski, D. C., & Norton, E. C. (2005). Nursing Home Quality of Care. *Unpublished Manuscript.*

Harrington, C. (2002). Nursing Home Staffing Standards. *The Kaiser Commission on Medicaid and the Uninsured*.

Harrington, C. (2005a). Nurse Staffing in Nursing Homes in the United States: Part I. *Journal of Gerontological Nursing, 31*(2), 18-23.

Harrington, C. (2005b). Nurse Staffing in Nursing Homes in the United States: Part I. *Journal of Gerontological Nursing, 31*(3), 9-15.

Harrington, C., Kovner, C., Mezey, M., Kayser-Jones, J., Burger, S., & Mohler, M. (2000a). Experts Recommend Minimum Nurse Staffing Standards for Nursing Facilities in the United States. *Gerontologist, 40*(1), 5-16.

Harrington, C., Mullan, J. T., & Carrillo, H. (2004). State Nursing Home Enforcement Systems. *Journal of Health Politics, Policy and Law, 29*(1), 43-73.

Harrington, C., & O'Meara, J. (2006). Assessing California's Nursing Home Staffing Standards. *Policy, Politics, & Nursing Practice 7*(1), 11-13.

Harrington, C., & Swan, J. H. (2003). Nursing Home staffing, Turnover, and Case Mix. *Medical Care Research and Review, 60*(3), 366-392.

Harrington, C., Swan, J. H., Wellin, V., Clemena, W., & Carrillo, H. M. (1999). *1998 State Data Book on Long Term Care Program and Market Characteristics.* San Francisco: University of California, San Francisco.

Harrington, C., Zimmerman, D., Karon, S. L., Robinson, J., & Beutel, P. (2000b). Nursing Home Staffing and Its Relationship to Deficiencies. *Journal of Gerontology: Social Sciences, 55B*(5), S278-S287.

Harris, K.M., & Remler, D.K. (1998). Who is the Marginal Patient? Understanding Instrumental Variables Estimates of Treatment Effects. *Health Services Research 33*(5), 1337-1360.

Horowitz, H. J., Dickey, K., & Montalvo, C. C. (2003). *The Financial Health of the California Nursing Home Industry.* California HealthCare Foundation.

Institute of Medicine (U.S.). Committee on Nursing Home Regulation. (1986). *Improving the Quality of Care in Nursing Homes.* Washington, D.C.: National Academy Press.

Institute of Medicine (U.S.). Committee on Monitoring Access to Personal Health Care Services, Millman, M. (1993). *Access to Health Care in America.* Washington, D.C.: National Academy Press.

Institute of Medicine (U.S.). Committee on the Work Environment for Nurses and Patient Safety., Page, A. (2003). *Keeping Patients Safe: Transforming the Work Environment of Nurses.* Washington, D.C.: National Academy Press.

Janelli, L. M., Kanski, G. W., & Neary, M. A. (1994). Physical Restraints: Has OBRA Made a Difference? *Journal of Gerontological Nursing, 20*, 17-21.

Jehle, G. A., & Reny, P. J. (2000). *Advanced Microeconomic Theory* (2nd ed.). Boston: Addison Wesley.

Kaiser Family Foundation, Smith, V., Gifford, K., & Ramesh, R. (2003). *State Budgets under Stress: How Are States Planning to Reduce the Growth in Medicaid Costs?* Washington, D.C.

Kane, R. L. (2004). Commentary: Nursing Home Staffing-More Is Necessary but Not Necessarily Sufficient. *Health Services Research, 39*(2), 251-255.

Kane, N. M., & Magnus, S. A. (2001). The Medicare Cost Report and the Limits of Hospital Accountability: Improving Financial Accounting Data. *Journal of Health Politics, Policy and Law, 26*(1), 81-105.

Kayser-Jones, J., Schell, E., Lyons, W., Kris, A. E., Chan, J., & Beard, R. L. (2003). Factors That Influence End-of-Life Care in Nursing Homes: The Physical Environment, Inadequate Staffing, and Lack of Supervision. *The Gerontologist, 43*, 76-84.

Knox, K. J., Blankmeyer, E. C., & Stutzman, J. R. (2003). Organizational Efficiency and Quality in Texas Nursing Facilities. *Health Care Management Science 6*, 175-188.

Konetzka, R. T., Norton, E. C., & Stearns, S. C. (2004a). *Effect of Medicare Payment Changes on Quality of Care in Nursing Home.* University of Chicago Working Paper.

Konetzka, R. T., Norton, E. C., & Stearns, S. C. (2006). Medicare Payment Changes and Nursing Home Quality: Effects on Long Stay Residents. *Int J Health Care Finance Econ, 6*, 173-189.

Konetzka, R. T., Yi, D., Norton, E. C., & Kilpatrick, K. E. (2004b). Effects of Medicare Payment Changes on Nursing Home Staffing and Deficiencies. *Health Services Research, 39*(3), 463-487.

Kooreman, P. (1994). Nursing Home Care in the Netherlands: A Nonparametric Efficiency Analysis. *Journal of Health Economics 13*, 301-316.

Kovner, C. & Heinrich, J. (2000). State Regulation of RN-to-Patient Ratios. *American Journal of Nursing, 100*(11), 61-63.

Laine, J., Linna, M., Noro, A., & Häkkinen, U. (2005). The Cost Efficiency and Clinical Quality of Institutional Long-Term Care for the Elderly. *Health Care Management Science 8*, 149-156.

Levit, K., Smith, C., Cowan, C., Lazenby, H., & Martin, A. (2002). Inflation Spurs Health Spending in 2000. *Health Affairs, 21*, 172-181.

Marek, K. D., Rantz, M. J., Fagin, C. M., & Krejci, J. W. (1996). OBRA '87: Has It Resulted in Better Quality of Care? *Journal of Gerontological Nursing, 22*(10), 28-36.

Mark, B. A., Harless, D. W., & McCue, M. (2005). The Impact of HMO Penetration on the Relationship between Nurse Staffing and Quality. *Health Economics, 14*, 737-753.

Mark, B. A., Harless, D. W., McCue, M., & Xu, Y. (2004). A Longitudinal Examination of Hospital Registered Nurse Staffing and Quality of Care. *Health Services Research, 39*(2), 279-300.

McClellan, M.B., Newhouse, J.P., & McNeil, B.J. (1994). Does More Intensive Treatment of Acute Myocardial Infarction in the Elderly Reduce Mortality? *Journal of the American Medical Association, 272*(11), 859-866.

McCue, M., Mark, B. A., & Harless, D. W. (2003). Nurse Staffing, Quality, and Financial Performance. *Journal of Health Care Finance, 29*(4), 54-76.

Miller, E. A. (2005). State Health Policy Making Determinants, Theory and Methods: A Synthesis. *Social Science and Medicine, 61*(12), 2639-2657.

Moseley, C. (1996). The Impact of Federal Regulations on Urethral Catheterization in Virginia Nursing Homes. *American Journal of Medical Quality, 11*(4), 222-226.

Mueller, C., Arling, G., Kane, R., Bershadsky, J., Holland, D., & Joy, A. (2006). Nursing Home Staffing Standards: Their Relationship to Nurse Staffing Levels. *The Gerontologist, 46*(1), 74-80.

Mukamel, D. B., & Spector, W. D. (2000). Nursing Home Costs and Risk-Adjusted Outcome Measures of Quality. *Medical Care, 38*(1), 78-89.

Mukamel, D. B., & Spector, W. D.(2003). Quality Report Cards and Nursing Home Quality. *The Gerontologist, 43*(Special Issue II), 58-66.

Mukamel, D. B., Spector, W. D., & Bajorska, A. (2005). Nursing Home Spending Patterns in the 1990s: The Role of Nursing Home Competition and Excess Demand. *Health Services Research, 40*(4), 1040-1055.

Newhouse, J. P. (1970). Toward a Theory of Nonprofit Institutions: An Economic Model of a Hospital. *The American Economic Review, 60*(1), 64-74.

Norton, E. C. (2000). Long-Term Care. In Cuyler, A. & Newhouse, J. (Eds.), *Handbook of Health Economics* (pp. 955-994). Amsterdam: Elsevier Science.

Nyman, J. A. (1985). Prospective and Cost-Plus Medicaid Reimbursement, Excess Medicaid Demand, and the Quality of Nursing Home Care. *Journal of Health Economics, 4*, 237-259.

Nyman, J. A., & Bricker, D. L. (1989). Profit Incentives and Technical Efficiency in the Production of Nursing Home Care. *The Review of Economics and Statistics, 71*, 586-594.

Nyman, J. A., & Connor, R. A. (1994). Do Case-Mix Adjusted Nursing Home Reimbursements Actually Reflect Costs: Minnesota's Experience. *Journal of Health Economics, 13*, 145-162.

O'Neill, C., Harrington, C., Kitchener, M., & Saliba, D. (2003). Quality of Care in Nursing Homes. *Medical Care, 41*(12), 1318-1330.

Paraprofessional Healthcare Institute and the North Carolina Department of Health and Human Services Office of Long Term Care (2004). *Results of the 2003 National Survey of State Initiatives On the Long-Term Care Direct Care Workforce.*

Phelps, C. E. (1997). *Health Economics* (2nd ed.). Massachusetts: Addison Wesley.

Porell, F., Caro, F. G., Silva, A., & Monane, M. (1998). A Longitudinal Analysis of Nursing Home Outcomes. *Health Services Research, 33*(4), 835-865.

Rantz, M. J., Hicks, L., Grando, V., Petroski, G. F., Madsen, R. W., Mehr, D. R., Conn, V., Zwygart-Staffacher, M., Scott, J., Flesner, M., Bostick, J., Porter, R., & Maas, M. (2004). Nursing Home Quality, Cost, Staffing, and Staff Mix. *The Gerontologist, 44*(1), 24-38.

Rosko, M. D., Chilingerian, J. A., Zinn, J. S., & Aaronson, W. E. (1995). The Effects of Ownership, Operating Environment, and Strategic Choices on Nursing Home Efficiency. *Medical Care, 33*(10), 1001-1021.

Scanlon, W. J. (1980). A Theory of the Nursing Home Market. *Inquiry, 17*, 25-41.

Schnelle, J. F., Simmons, S. F., Harrington, C., Cadogan, M., Garcia, E., & Bates-Jensen, B. M. (2004). Relationship of Nursing Home Staffing to Quality of Care. *Health Services Research, 39*(2), 225-250.

Sexton, T. R., Leiken, A. M., Sleeper, S., & Coburn, A. F. (1989). The Impact of Prospective Reimbursement on Nursing Home Efficiency. *Medical Care, 27*(2), 154-163.

Sloan, F. A. (2000). Not-for-profit Ownership and Hospital Behavior. In Cuyler, A. & Newhouse, J. (Eds.), *Handbook of Health Economics* (pp. 1141-1174). Amsterdam: Elsevier Science.

Staiger, D., & Stock, J. H. (1997). Instrumental Variables Regression With Weak Instruments. *Econometrica, 65*(3), 557-586.

Terza, J.V. (2006). *Endogeneity in Nonlinear Parametric Models: A Guide for Applied Researchers in Health Economics.* University of Florida Working Paper.

Tsoukalas, T., Rudder, C., Mollot, R. J., Shineman, M., Lee H. Y., & Harrington, C. (2006). The Collection and Use of Funds From Civil Money Penalties and Fines From Nursing Homes. *The Gerontologist, 46*(6), 759-771.

U.S. Department of Health and Human Services Assistant Secretary for Planning and Evaluation Office of Disability (2003). *State Experiences With Minimum Nursing Staff Ratio For Nursing Facilities: Finding From Case Studies of Eight States.*

Wang, B. B., Wan, T. H., Falk, J. A., & Goodwin, D. (2001). Management Strategies and Financial Performance in Rural and Urban Hospitals. *Journal of Medical System, 25*(4), 241-255.

Weech-Maldonado, R., Meret-Hanke, L., Neff, M. C., & Mor, V. (2004). Nursing Staffing Patterns and Quality of Care in Nursing Homes. *Health Care Manage Rev, 29*(2), 107-116.

Weiner, J. M., & Stevenson, D. G. (1998). *Repeal of the "Boren Amendment": Implications for Quality of Care in Nursing Homes*. Washington DC: The Urban Institute.

Wooldridge, J. (2001). *Econometric Analysis of Cross Section and Panel Data* (1st ed.). Cambridge: MIT Press.

Zhang, X., & Grabowski, D. C. (2004). Nursing Home Staffing and Quality Under the Nursing Home Reform Act. *The Gerontologist, 44*(1), 13-23.

Zimmerman, D. R., Karon, S. L., Arling, G., Clark, B. R., Collins, T., Ross, R., & Sainfort, F. (1995). Development and Testing of Nursing Home Quality Indicators. *Health Care Financing Review Summer95, 16*(4), 107-127.

Zinn, J. S. (1993). The Influence of Nursing Wage Differentials on Nursing Home Staffing and Resident Care Decisions. *The Gerontologist, 33*(6), 721-729.

Zinn, J. S., Mor, V., Castle, N., Intrator, O., & Brannon, D. (1999) Organizational and Environmental Factors Associated with Nursing Home Participation in Managed Care. *Health Services Research, 33*(6), 1753-1767.