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Certificate of need regulation in the nursing home industry: Has it outlived its usefulness?

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by

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Dedication

This dissertation is dedicated to a very special friend and most especially to my family, without whose love, support, and patience I would not be where I am today.

To Josefina Ramoni: Even though we are separated by many miles you have been a constant source of inspiration to me. Your friendship is irreplaceable.

To my parents, William and Rosalie Johnson: Mom and Dad you taught me the value of hard work, perseverance, and dedication. Because of you I have been able to forge through whatever obstacles have come my way. Thank you for loving and supporting me along my life's journey.

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ABSTRACT

The primary goals of the National Health Planning and Resources Development Act (P.L. 93-641) of 1974 were to (1) contain health care costs and (2) increase the accessibility and quality of health services. Certificate of need (CON) regulation is one attempt to constrain health care costs by limiting the supply of certain medical care facilities. With respect to the nursing home industry, prospective nursing home owners/operators are required to demonstrate that a "need" exists for more nursing home beds. Some States also imposed a construction moratorium that prevented any expansion of existing facilities or construction of new facilities regardless of whether or not a "need" existed. These CON/moratorium programs impose a supply side constraint that creates a potential barrier to entry and in the presence of excess demand may cause a nursing home bed shortage for those residents covered by Medicaid.

Even though the Federal CON requirement lapsed in 1986, forty-two States and the District of Columbia continue to have a CON, a construction moratorium, or both for nursing home facilities. Yet maintaining these regulations comes with a cost.

This paper investigates if differences exist in the quality of care and the access to care between nursing homes in those States without CON and/or construction

moratorium and those States that still have such policies. Using data for the years 1991 through 2003 for all freestanding Medicaid-/Medicare-certified nursing home facilities in the United States and employing state and facility fixed effects models we find that Medicaid-eligible residents in those states without CON and/or construction moratorium policies have more access to a nursing home bed than those individuals in states with these policies. With respect to quality of care the results are mixed depending on the measure of quality that is employed. With the risk of becoming a nursing home resident at the age of 65 at 44 percent and at the age of 85 at 53 percent (Spillman and Lubitz 2002) coupled with the aging of the current population, the areas of quality of care and access to care remain important policy issues in the nursing home industry.

Chapter One

Introduction

1.1 What is Certificate of Need Regulation?

In 1974, the United States Congress passed The National Health Planning and Resources Development Act (P.L. 93-641). The primary goals of this legislation were to (1) contain health care costs and (2) increase the accessibility and quality of health services (Harrington, et al. 1997a; Spillman and Lubitz 2002). This federal regulation was passed at a time when health care costs were escalating at an alarming rate and accessibility to services for those who "needed it the most" as well as the quality of health services were considered poor. Most importantly, the escalating health care costs, and the federal government's growing proportion of these costs, were the driving force behind the certificate of need (CON) regulation requirement imposed by this Act.

CON was one approach to containing health care costs by limiting the supply of certain medical care facilities. In general, a CON program involves the regulation of the building, expansion, and modernization of health care facilities and capital equipment on the part of institutional health care providers, including hospitals, nursing homes, and home health agencies. Oversight of these programs is provided at the state level through designated agencies who at their discretion set the specific criteria within the program for their State (Blumstein and Sloan 1978). During the mid-1960's and early 70's, some

states began establishing CON programs. The National Health Planning and Resources Development Act required that all states adopt a certificate of need program and by 1980 all states had some form of CON regulation.

The impetus for this Act was the escalation of public medical care expenditures following the passage of the 1965 amendments to the Social Security Act. These amendments established the Medicare and Medicaid programs that are responsible for certain medical care requirements of the elderly and the needy. The primary explanation for this rapid increase in costs is the presence of third-party payment for medical care expenses through Medicare and Medicaid, which enabled what has become known as the Medical Arms Race (MAR).

Even though Medicare and Medicaid require deductibles or co-payments, a resident does not pay the full marginal cost of the last unit of care received. CON regulation imposed a supply side constraint that limited capacity, with the intention of reducing the growth of fee-for-service reimbursements and combating the classic problem of moral hazard. Implicit in this regulation, (as noted by Norton (2000)), is the assumption that an unregulated market results in an excess of capital expenditure and capacity.

The MAR hypothesis is considered a special case of quality competition in which it is asserted that quality is overproduced by competitors in medical care markets. This hypothesis supports the idea of increased expenditures due to excessive capital investment. It begins by noting that physicians, acting as agents for residents in search of hospital care, influence their residents' choice of hospital. Hospitals, wanting to increase their admissions, attempt to attract physicians by offering the latest technology. Under

this scenario, duplicate services, i.e., services that are in excess of what the market would demand, become the norm (Dranove, et al. 1992). During the time of the MAR, a retrospective payment system was the prevailing method of cost reimbursement by Medicare and Medicaid. This type of system pays providers on the basis of incurred costs. Hence, the costs of these additional services were passed through to insurers who then cost-reimbursed the hospitals (Dranove and Satterthwaite 2000). With widespread coverage of medical care services for new, technically sophisticated services as well as the increase in the proportion of elderly and indigent individuals qualified for care through Medicare and Medicaid, CON regulation was considered to be the countervailing force needed to offset this rapidly expanding segment of governmental expenditures.

1.2 The Nursing Home Industry and CON

In the decade following the establishment of Medicare and Medicaid, public medical care expenditures on nursing homes alone, just one part of what is termed long-term care, exceeded that for any other medical care service, accounting for 25 percent of total health expenditures in 1975 as compared to 15 percent in 1966 (Feder and Scanlon 1980). Additionally, between 1965 and 1973, the number of nursing home beds increased by 650,000, an increase of 139 percent in less than a decade (Hawes and Phillips 1986). By 1977, the U.S. government, through Medicare, Medicaid, and other smaller government-funded programs, had purchased approximately 62 percent of all nonprofit nursing home services and 60 percent of all proprietary nursing home services (Gertler and Andreano 1982).

With the passage of P.L. 93-641, in order to be eligible for federal funds available through the U.S. Public Health Service prospective nursing home owners/operators are required to demonstrate that a "need" exists for more nursing home beds. Additionally during the same time frame, some states imposed a construction moratorium that prevented any expansion of existing facilities or construction of new facilities regardless of whether or not a "need" existed. These CON/moratorium programs protect existing nursing homes from potential entry by new competitors.

Most of the economic research studying nursing homes employs the work of Scanlon (1980b) which views the industry as monopolistically competitive with nursing homes providing the same level of quality to both Medicaid and private-pay residents. Scanlon hypothesizes that CON and construction moratorium policies act as a binding bed constraint, leaving certain individuals who demand nursing home services unable to gain access to care. Since nursing homes typically charge a higher rate for private-pay residents than the Medicaid reimbursement rate, private-pay residents will be admitted first and then Medicaid residents will fill any remaining empty beds[1]. Since the private-pay demand is still met under a binding bed constraint, the literature has referred to this unmet demand as "excess Medicaid demand" (Nyman 1985).

During the period of federal CON, the issues of quality, access, and cost came under deeper scrutiny. Many proponents of the nursing home industry declared that quality was "low" because Medicaid reimbursement rates were too low. Raising the

[1] According to the MetLife Market Survey of Nursing Home & Home Care Costs, the statewide average private-pay per diem rate in 2005 was $191in 2003 dollars (MetLife 2005). The statewide average Medicaid per diem rate for 2003 in this study was $122. The average per diem rate for 2003 for each state in this sample was less than the statewide average private pay per diem rate (Alaska's private pay per diem was $500 in 2003 dollars and its Medicaid per diem rate in this sample was $321).

reimbursement rate seems to be the obvious solution. However, early studies find that an increase in the reimbursement rate, under conditions of excess demand, actually leads to the counterintuitive result of lower quality. When the number of prospective residents is greater than the supply of nursing home beds, the nursing home provides care to private-pay residents first since the private-pay price is typically greater than the Medicaid payment rate. Therefore, raising quality only benefits the nursing home by attracting additional private-pay residents since at any quality level a sufficient number of Medicaid residents are available to fill an empty nursing home bed. However, in order to attract an additional private-pay resident, a Medicaid resident must be displaced. The foregone Medicaid payment associated with that displaced resident becomes a cost to the nursing home attributed to increasing quality. Furthermore, an increase in the reimbursement rate increases this opportunity cost of providing higher quality. Therefore an increase in the reimbursement rate may actually lower quality (Nyman 1985).

With respect to the goal of supply-side constraint, between 1976 and 1980 the supply of nursing home beds increased at an annual rate of approximately 3 percent, but between 1981 and 1983 the growth rate was only about 1.75 percent (Hawes and Phillips 1986). However, one result of this supply constraint is that under conditions of excess demand access to nursing home care is constrained for Medicaid residents but not for private-pay residents (Ettner 1993; Holahan and Cohen 1987; Nyman 1985; Scanlon 1980b). Again, this is due to the fact that with a limited supply of beds nursing homes prefer to admit the higher paying private resident than the Medicaid resident.

With respect to cost containment, between 1960 and 1983 nursing home expenditures increased from $480 million to $28.8 billion, with Medicaid's share

increasing from 28 to 55 percent over the same time period (Holahan and Cohen 1987). One explanation given for this increase was that the certificate of need cost containment initiative led to higher private-pay prices. These higher prices then resulted in private-pay residents becoming Medicaid-eligible sooner than they would otherwise. As a consequence, any cost saving from CON will in actuality be net of an increase in the proportion of nursing home days-of-care paid for by Medicaid (Nyman 1994).

1.3 The Period After Federal CON Elimination

In 1986, during the deregulation era of the Reagan administration, Congress allowed the federal CON requirement to lapse due to its perceived anticompetitive and excessively regulatory nature. However, even after its removal forty-five States and the District of Columbia continued to have a CON, a construction moratorium, or both a CON and construction moratorium for nursing home facilities (Harrington, et al. 1997a). Yet maintaining these regulations comes at a cost. Since quality remains a controversial subject, access to care for Medicaid-eligible individuals remains an issue in many States, and medical care expenses for nursing homes continue to climb, one might question the effectiveness of retaining these regulations.

Today eight states no longer have certificate of need or construction moratorium regulations in effect for nursing home facilities.[2] The existing literature concerning the nursing home industry does not tell us if any differences in quality of care or access to care exist between those states without CON policies and those States that have the

[2] The eight states are Arizona, California, Colorado, Idaho, Indiana, Kansas, New Mexico, and Pennsylvania. Nevada has no regulation in its two largest counties.

regulation. With the risk of becoming a nursing home resident at the age of 65 at 44 percent and at the age of 85 at 53 percent (Spillman and Lubitz 2002), coupled with the aging of the current population, the areas of quality of care and access to care remain important policy issues in the nursing home industry.

The results from this study show that Medicaid-eligible individuals in those states without have some type of CON regulation have more access to a nursing home bed than in those states with this type of supply constraint. The results of the models measuring the quality of care are not as consistent; each result is dependent on the choice of quality measure which supports the idea that there is no real standard by which to measure quality of care. In conjunction with the work of Grabowski et al.(2003) that shows the repeal of CON regulations has not significantly increased the Medicaid cost of nursing home care, the results of this research further suggest that perhaps the use of supply-side constraints are not as effective in increasing the accessibility of nursing home care for Medicaid-eligible individuals and that there are still some aspects of the quality of nursing home care that remain questionable.

The remainder of this dissertation is organized as follows: Chapter 2 provides a detailed look at the background and legislative history of the nursing home industry; Chapter 3 reviews the relevant literature with regard to the issues of quality of care and access to care in nursing homes; Chapter 4 states the objectives of this study and describes the data and methodology, including the specification of the models utilized in this research; Chapter 5 presents and describes the results of the analysis; and Chapter 6 summarizes the main findings of this study, potential policy implications, limitations of the study, and areas for further research.

Chapter Two

The Background of the Nursing Home Industry

Today's nursing home industry originates from the development during the late 19th and early 20th centuries of five types of facilities classified as county poorhouses, state mental hospitals, voluntary homes for the aged typically run by religious organizations, proprietary boarding houses, and hospital-affiliated nursing homes (Waldman 1983). The county poorhouse, or the county "almshouse," was operated and financed by local governments for those children and adults who were poor, old, disabled, and mentally challenged. Later in the nineteenth century reformers were able to segregate the occupants of these almshouses into specialized institutions such as orphanages and mental hospitals. The remaining occupants of these poorhouses were primarily the poor and the aged.

2.1 Legislative History

The initial, most significant influence on the nursing home industry was the passage of the Social Security Act in 1935, which provided income maintenance to the disabled and aged. The Old Age Assistance (OAA) program was a means-tested old age pension fund financed by states on a matching basis with the federal government for persons age 65 and over. Through this income assistance, these residents of the

poorhouses were able to afford alternative living arrangements (Waldman 1983). However, this legislation specifically disallowed funding to public institutions, thus encouraging the development of the proprietary nursing home sector (Vladeck 1980).

The 1950 amendments to the Social Security Act eliminated the restriction on OAA payments to residents of public medical facilities and allowed payments to be made directly to the vendors of medical care. These direct medical vendor payments were limited under a sharing formula used to determine the federal portion of the cost of the assistance program. These payments were available only to persons whose income was at or below the eligibility level for the assistance program. Many states used a "spend-down" method to determine who was eligible for the payments. Persons whose income was above the specified level were ineligible for money payments but could become eligible for medical vendor payments if the amount they spent for medical care from their own funds brought their net income down to the eligibility levels. The methods of reimbursing nursing homes under this program were left to the states. Additionally, the amendments also mandated that states establish licensing requirements for nursing homes (Giacalone 2001; Waldman 1983).

Enacted in 1960, the Medical Assistance for the Aged (MAA) program began as a possible substitute for the Medicare program that was under consideration at the time. The MAA was an expansion of the direct vendor payment program that included two important differences. The first allowed states to provide assistance to those whose income was above the OAA standard but below what was considered insufficient to pay for medical care. The second difference was that the federal matching contributions had no ceiling. Between 1960 and 1965, vendor payments associated with nursing home care

had risen tenfold and the number of persons receiving nursing home care under MAA had reached 300,000 (Vladeck 1980; Waldman 1983).

Other important legislation of the 1940s and 1950s impacted the supply side of the nursing home industry. Several pieces of important legislation were enacted to encourage the construction and modernization of nursing homes in the proprietary, nonprofit and public sectors. First, the 1954 amendment to the Hill-Burton Act provided financial support for the construction and renovation of government and nonprofit nursing homes based on the ability to show need. Additionally, this amendment required that certain construction and operational standards be met in order to provide "quality" care (Vladeck 1980).

In 1956, under the auspices of the Small Business Administration (SBA), proprietary nursing homes became eligible for government loans (Giacalone 2001). Probably the most important piece of legislation for the proprietary sector was the passage of Section 232 of the Housing Act of 1959, which provides a program of mortgage insurance for proprietary nursing homes. The Federal Housing Administration (FHA) insures lenders against losses for loans for construction or renovation of nursing homes. However, a condition of the loan insurance is that the proposed project receives a certificate of need from the appropriate state agency indicating that a need exists for the proposed beds (Waldman 1983).

Perhaps the most influential impact on the nursing home industry was the passage of the 1965 amendments to the Social Security Act establishing the Medicare and Medicaid programs. Medicare is a federal health insurance program for people 65 years of age and older, some people with disabilities under age 65, and people with End-Stage

Renal Disease. Specific to nursing home care, Part A of Medicare provides skilled nursing care on a limited basis to those individuals recently discharged from a hospital. The intent is to provide continued care to those who still require assistance during their recovery but not at the same level provided in a hospital. In order to participate as a Medicare provider, a nursing home must be certified as a Skilled Nursing Facility (SNF). SNFs typically serve post-operative residents requiring a considerable amount of therapy and nursing assistance to facilitate the recovery of an acute illness. Certified nursing homes are paid the reimbursement rate set by the Federal government.

Replacing the medical vendor payment and MAA programs, Medicaid is a federal/state vendor payment program that pays for medical assistance for certain individuals and families with low incomes and limited resources. While restricted by guidelines established by federal statutes, each state establishes its own eligibility standards, determines the type, amount, duration and scope of services, sets the payment rate for services, and administers its own program. Additionally, states have the option of providing care to those considered "medically needy." These individuals are eligible for Medicaid except that their income and/or resources are above the eligibility level set by their state. They may qualify immediately or may "spend down" by incurring medical expenses that reduce their income to or below their state's medically needy income level.

Under Medicaid nursing home care must be provided for individuals aged 21 or older who qualify as "categorically needy." For those who qualify as "medically needy," residents must pay all of their income except for a small spending allowance. A Medicaid-certified nursing facility may be classified as either a SNF, as an Intermediate Care Facility (ICF), or as dually certified. An ICF typically provides less rehabilitative

care and assistance while providing basic nursing care, therapy, and social activities to those considered chronically ill.

In 1972 Public Law 92-603 established the Supplementary Security Income (SSI) program, replacing the OAA program. Similar to OAA, SSI is an income maintenance program which provides monthly payments to aged and disabled persons but, unlike OAA, it is a federally financed and administered program (Waldman 1983). Eligibility for SSI automatically assures Medicaid eligibility. Additionally, Section 249 of the law required states to reimburse nursing home care under Medicaid on a "reasonable cost-related basis," as was required by Medicare (Vladeck 1980; Waldman 1983). This reimbursement requirement was later repealed and states were then given the authority to set their own reimbursement method with the stipulation that the rates be "reasonable and adequate to cover the costs of an efficiently operated facility" (Waldman 1983).

Although not originally intended to be the mechanism for paying for long-term care, Medicaid has become the major public method for funding nursing home care. Between 1965 and 1973, the number of nursing home beds increased by 650,000, an increase of 139 percent (Hawes and Phillips 1986). Expenditures grew even more rapidly. Just prior to the implementation of Medicare and Medicaid, expenditures on nursing home care totaled $1.328 billion. By 1978, the nation spent $15.8 billion on nursing homes, with the government paying 53 percent of the total (Hawes and Phillips 1986).

In an attempt to control the escalating health care costs, and the federal government's growing proportion of these costs, the United States Congress passed the National Health Planning and Resources Development Act (P.L. 93-641) of 1974. As a

part of this Act, states required potential nursing home operators as well as existing nursing homes that were interested in expansion to acquire a certificate of need (CON) prior to new construction. This legislation has a supply side effect on the industry by limiting the number of nursing home beds available to prospective residents. Even though this federal legislation was repealed in 1986, today 42 States and the District of Columbia still maintain CON and/or construction moratorium policies.

The Nursing Home Reform Act of the Omnibus Budget Reconciliation Act of 1987 (OBRA 87) mandated extensive legislative requirements affecting the delivery of care to residents in nursing homes (Marek, et al. 1996). This Act repealed the SNF and ICF benefits (except for the ICF benefits for persons with mental retardation or related conditions) under Medicaid and replaced them with a mandatory nursing facility (NF) benefit that combines the total services previously covered under the ICF and SNF benefits. This change became effective in 1993. This legislation also imposed the standards of care that facilities must meet in order to receive both federal and state funding. It also defined the state survey and certification process that determines compliance with the federal standards. Additionally, sanctions were established for facilities that fail to meet the established standards (Harrington and Carrillo 1999). Many of the requirements under OBRA 87, most significantly the survey inspection procedures and the required nurse's aide training, increased the cost structures of nursing home facilities (Giacalone 2001).

2.2 The Market for Nursing Home Care

The nursing home industry has many properties of a perfectly competitive market. Information failures common to other sectors of the medical care industry (Arrow 1963) seem rare in nursing home care. Consumers have the ability to observe many of the features of a nursing home's services, such as room conditions, staff and resident interaction, organized activities and other available services. Start-up costs are not a significant barrier to entry, as plant and equipment costs are significantly below those of a hospital (Bishop 1988). In addition, substitutes such as family or in-home care are readily available for many individuals.

However, other features of the nursing home industry deviate from the perfectly competitive standards. The decision to enter a nursing home often occurs at a time of crisis, thus dramatically reducing the ability to gather and process existing information. Location quite often is an important criterion when selecting a nursing home. Residents want to remain close to family and friends making it unlikely that they will "vote with their feet" and move to a new nursing home. Additionally there are also switching costs, termed the "transfer trauma," resulting in much less movement between homes than expected (Bishop 1988; Nyman 1985; Weisbrod and Schlesinger 1986). It follows then that most researchers have modeled the nursing home industry as monopolistically competitive. Homes differentiate themselves with respect to location and types of services offered.

Another important feature of the nursing home industry is the major presence of the government, both as the largest purchaser of services (through Medicaid) and as the industry's regulator. As regulator, the government imposes the reimbursement rate on

those homes that meet the certification requirements. This rate becomes a price ceiling for the home for its public-pay residents. When this rate is below the market-clearing price, a shortage of nursing home beds will exist. Moral hazard resulting from the Medicaid subsidy increases demand for nursing home care, while CON and moratorium policies restrict supply. It is very common for the nursing home market not to clear, with a shortage of beds the norm.

Nursing homes typically have a mixture of private-pay and public-pay (Medicaid) residents. With two types of customers, price discrimination arises. The firm (a nursing home) faces a downward-sloping demand curve for its private-pay residents and a perfectly elastic demand at the government reimbursement rate for its public-pay residents. The nursing home then chooses its total output, how to allocate this output between private-pay and public-pay residents, and what price to charge its private-pay residents (Palmer and Vogel 1983).

For-profit homes are assumed to maximize profits by equating marginal revenue and marginal cost while equalizing the level of marginal revenue of private-pay and public-pay residents. Nonprofit homes are assumed to maximize output subject to a break-even constraint and a quality constraint (Palmer and Vogel 1983; Scanlon 1980b). This is accomplished by equating average revenue and average cost and allocating the total output between private-pay and public-pay residents such that the marginal revenue from each is equal. For both types of homes, the result is typically the private-pay price being higher than the Medicaid reimbursement rate.

Scanlon (1980b) hypothesizes that CON and construction moratorium policies act as a binding bed constraint where there exist certain individuals who demand nursing

home services yet are unable to gain access to care. Since nursing homes typically charge a higher rate for private-pay residents than the Medicaid reimbursement rate, private-pay residents will be admitted first and then Medicaid-eligible individuals will fill any remaining empty beds. Since the private-pay demand is still met under a binding bed constraint, the literature has referred to this unmet Medicaid demand as "excess Medicaid demand" (Nyman 1985).

The nursing home industry is comprised of for-profit, nonprofit and government facilities. As of June 2005, there were 16,023 total facilities, of which 65.86 percent were for-profit, 28.04 percent were nonprofit, and 6.1 percent were government owned; 5.31 percent were Medicare-certified only, 6.72 percent were Medicaid-certified only, and 87.97 percent were both Medicare- and Medicaid-certified. These facilities provided 1,748,001 beds of which 71,960 were Medicare-certified only, 225,710 were Medicaid-certified only, 1,382,395 were dually certified, and 67,936 were non-certified. The mean occupancy rate of these facilities was 85.58 percent while the median rate was 88.61 percent (AHCA 2005).

2.3 Payment for Nursing Home Care

National health expenditures for nursing home care in 2003 were $110.8 billion. Private payment accounted for 39 percent of these expenditures, Medicare accounted for 12 percent while both federal and state Medicaid payments were 46 percent of the total (CMS 2003). Nursing homes typically do not charge the same rate for all payer types (private, Medicare, or Medicaid residents). Traditionally, private-pay rates are based upon charges determined by the nursing homes themselves while the federal government

determines the Medicare rate and each state determines its own Medicaid rate; each rate is dependent on the type of reimbursement method utilized. Due to the differences between Medicare and Medicaid in the determination of rates, the difference between the care needs of acute and chronic care residents, as well as the differences in the methods of defining reimbursable costs, most often the private-pay rate is higher than both the Medicare and Medicaid rates and the Medicare rate is higher than the Medicaid rate.

2.3.1 Reimbursement Methods

Reimbursement methods refer to the way in which Medicare and Medicaid programs pay for nursing home care. Medicare reimbursement for nursing home services was originally based upon the "reasonable cost" formula that originated for hospital payments. This methodology covers retrospectively the actual costs of providing care and places no ceilings on reimbursement rates (Hawes and Phillips 1986; Swan and Harrington 1985).

Escalating health care costs during the 1970s, fueled by the MAR and moral hazard caused the government to reassess its Medicare payment system. In 1983, a Prospective Payment System (PPS) was put in place for hospitals. This type of reimbursement method sets the rate to be paid for each type of service prospectively with the intent of providing an incentive to reduce costs. The Balanced Budget Act of 1997 implemented this same method for nursing homes such that today the Medicare reimbursement system is a prospective method of payment (Dranove and Satterthwaite 2000).

When Medicaid was first established, states were given much discretion in setting nursing home rates while remaining within the federal guidelines. In 1972, the Social Security Amendments required states to implement "reasonable cost-related" reimbursement plans for nursing homes (Social Security Amendments of 1972). However, there was no specific requirement for this method to be a retrospective reimbursement method (Cotterill 1983). Part of the reason these changes were implemented was because providers complained that states were too restrictive in their policies (Harrington and Swan 1984; Swan and Harrington 1985) and that nursing homes were not able to cover the cost of providing care to their public-pay residents. While the method of reimbursement was not clearly defined in order to meet the reasonable cost-related criteria, most states chose their own reimbursement policies while some states used the Medicare reimbursement formula to meet the Medicaid requirement.

With the ensuing escalation in health care costs as well as pressure from states to allow more discretion in interpreting reasonable costs, the Federal Boren Amendment of the Omnibus Reconciliation Act of 1980 gave states the authority to set rate methods and standards that are

> "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" (Omnibus Budget Reconciliation Act of 1980).

This reimbursement policy increased the authority as well as the flexibility of states by giving them greater discretion in setting rates. The intent was to provide the incentive to constrain costs while still recognizing the concept of cost-related rates (Cotterill 1983).

States typically used this discretion by setting their Medicaid rates below those of Medicare and private payers (Swan and Harrington 1985).

Medicaid expenditures for nursing home services are usually described on a cost per diem basis. The rates that are paid are determined in part by the reimbursement method chosen. States attempt to control these rates by developing reimbursement methods that restrain their overall expenditures on nursing homes. Several reimbursement methods exist under Medicaid. While state Medicaid programs are required to set reimbursement policies with some relationship to cost which requires a periodic adjustment for inflation, much discretion is allowed in what other options they include in the per diem rate that results from the reimbursement method of choice.

A retrospective system utilizes a reimbursement formula that pays after the services have been provided, based on the actual costs incurred by the nursing home. This type of system tends to encourage providers to increase their expenditures in order to increase their revenues (Swan and Harrington 1985). Additionally, states that have this type of reimbursement system face little incentive to minimize costs.

Prospective reimbursement systems utilize a formula, usually based on past costs, that sets the payment rate for services prior to the provision of care and before the costs are actually incurred. This type of methodology gives providers an incentive to keep their costs aligned with or lower than the reimbursement allowances. However, one criticism of this type of reimbursement method is that it may also provide incentives for services and quality to be lowered in order to stay within the allowable costs. Prospective methods have been shown to lower the per diem rate as compared to retrospective methods (Harrington and Swan 1984; Swan, et al. 1993).

Within the prospective methods of reimbursement, a distinction may be made as to whether facilities are reimbursed based on an individual basis (facility-specific) or on a class or group basis (flat-rate). States using a facility-specific method apply a reimbursement formula based on historical cost reports that results in a reimbursement rate for each facility in the state. States using flat-rate methods also use a formula usually based on past expenditures to set the reimbursement rate. States with this type of system then pay each facility a per diem rate that is based on the median per diem rate of the group of facilities in the class. Consequently, each individual facility cannot significantly adjust the rate it receives by adjusting its own costs (Cotterill 1983). An "adjusted" prospective method allows the rate to be adjusted upward during the rate period (Harrington, et al. 2000b).

Some states have implemented what are called combination methods. This method of reimbursement is often based on cost centers, some of which are reimbursed prospectively and some of which are paid retrospectively (Harrington, et al. 2000b; Swan, et al. 1993). In addition, some states have moved to a "case-mix" reimbursement method. This type of system allows a state to adjust their rates for resident characteristics. The intent of this type of method is to recognize the level of care that is required for different types of residents and to compensate providers accordingly.

Regardless of the method of reimbursement, the intent is to provide an incentive to nursing home owners or operators to lower their cost of providing care to public-pay residents. The Balanced Budget Act (BBA) of 1997 repealed the Boren Amendment giving states even more flexibility in setting nursing home payment rates and causing the

nursing home industry to raise concerns that lower Medicaid reimbursement rates would adversely affect quality of care (Wiener and Stevenson 1998).

In 2003, no states were using a retrospective reimbursement method, twenty-one states were using a facility-specific method, four states were using a prospective class (flat-rate) method, twenty-four states were using a prospective-adjusted method, and one state was using a combination method. The dilemma for most states in deciding upon which type of reimbursement method to employ and the subsequent rate setting is how to ensure quality and access while controlling costs (Swan and Harrington 1985).

Chapter Three

Literature Review

This chapter is intended to provide an overview of the literature relating to two distinct characteristics of the nursing home industry investigated in this dissertation; quality of care and access to care. Each section summarizes those studies that have analyzed the effects of CON and/or moratorium policies with separate subsections that describe some of the other variables considered important predictors of nursing home quality and access within the relevant literature. Additionally, a brief description of the impact of supply regulations on the cost of nursing home care is included to support the findings of this research that CON/moratorium policies may no longer be achieving their original intent.

3.1 Nursing Homes and Quality

Quality of nursing home care has been a concern for the public as well as policymakers for the last thirty years and still remains a concern today. Providing the first real insight into the problems that were occurring throughout the industry, Vladeck (1980) documents instances of abuse, neglect, and a general "lack of concern" in the care of nursing home residents. During the 1980s, reports still found the quality of nursing home care to be low (IOM 1986; GAO 1987). As of November 1985, 25 percent of

SNFs and 16 percent of ICFs were noncompliant for two or more of the requirements to be Medicare and Medicaid certified (GAO 1987). As a result of the Institute of Medicine's (IOM) report in 1986 (IOM 1986), the Nursing Home Reform Act of OBRA 87 altered the focus of the standards that nursing homes were required to meet in order to participate in Medicare and Medicaid. Not only were the standards for the delivery of care emphasized but also the results of that care. Stricter requirements were established to maintain compliance along with an expansion of enforcement sanctions that could be placed on those homes found to be noncompliant.

Although improvement has been documented in some instances after the passage of OBRA 87 (IOM 1996), throughout the last decade many reports continue to document what is considered unacceptable treatment of nursing home residents (CMS 2001; U.S. House of Representatives 2002; GAO 1998; GAO 1999; GAO 2002). Between July 1995 and February 1998, 407 of 1,370 nursing homes in California were cited for care violations considered as "serious" under federal or state deficiency categories (GAO 1998).[3] The number of abuse violations of all homes increased every year from 5.9 percent in 1996 to 16 percent in 2000 (CMS 2001). Between March 2001 and August 2002, 39 percent of nursing homes in Texas were cited for "potential-to-harm" violations and 47 percent had "actual harm" violations or worse (U.S. House of Representatives 2002).

A recently issued report states that for the 18-month period ending January 2002, 20 percent of nursing homes "were cited for deficiencies involving actual harm or

[3] Prior to 2001, CMS was known as the Health Care Financing Administration (HCFA). The Centers for Medicare and Medicaid Services (CMS) has regulatory authority overseeing nursing homes' compliance with Medicare and Medicaid participation requirements. See Table A.1 in Appendix A for the list of CMS's Deficiency Classification System.

immediate jeopardy to residents" (GAO 2003). Although this percentage is down from 29 percent in the previous survey period, violations continue to occur and residents are still being harmed. Nursing home quality continues to be an important issue of concern worthy of continued assessment and analysis.

Often considered a value-based construct, a universally accepted definition of health care quality does not exist. Policymakers, health care professionals, administrators, owners, investors, third-party insurers, and consumers base their definition of quality on their own subjective criteria resulting from their preferences for desired outcomes from such care (Davis 1991). It is often difficult to reach a consensus on what defines technical medical quality. It is even harder to define the less tangible characteristics of what is considered "caring and decent" treatment of residents in nursing homes (Nyman 1987). Consequently the literature on nursing home quality is widely disparate in its measurement of quality as well as in the results of measuring the effects of different policies and facility characteristics on nursing home quality.

The following subsections discuss the measurement of nursing home quality, the effect of CON and/or construction moratorium on the quality of care, the effect of a change in the reimbursement rate under excess demand on the quality of care, and the effect of other predictor variables commonly used in the literature on the quality of care in nursing homes.

3.1.1 Measuring Nursing Home Quality

Perhaps the most widely accepted paradigm for measuring health care quality was developed by Donabedian and describes three distinct categories of quality assessment: structure, process, and outcome (Donabedian 1966, 1988). This framework was originally developed for the study of medical care delivery and has been widely used in the literature on nursing homes. Structural evaluation looks at the attributes of the setting in which the care is being provided. Examples of this type of measurement include the physical amenities of the facility, qualifications of the staff, and the administrative organization of the facility (Ullmann 1981). Process evaluation measures the types and quantities of services actually provided to residents against the professionally accepted standards of appropriate care for specific problems or conditions. Included in this type of measurement are the therapy services offered, the use of physical restraints, and the use of urethral catheterization. Outcome evaluation assesses the actual health and well being of the resident. Measurements of this type include mortality, change in functional status, and facility-acquired pressure sores.[4]

According to Donabedian, his three-part approach to quality measurement does not depend more heavily on one aspect than another but that its effectiveness is possible "only because good structure increases the likelihood of good process, and good process increases the likelihood of a good outcome" (Donabedian 1988). Most of the nursing home literature focuses on structural and process measures of quality. Ideally the use of outcome measures of quality is considered the "gold standard." However, data on these types of measurements have been difficult to obtain. Furthermore, care must be given in

[4] Table A.2 in Appendix A details common measurements of structure, process, and outcome as referenced by the Institute of Medicine (1996).

recognizing that measures such as mortality and a decline in health status are often natural occurrences with the elderly and frail residents in nursing homes. Additionally, often times the same variable is used as a predictor of quality in one study and as an indicator of quality in another (Davis 1991). Staff-to-resident ratios and expenditures are two examples of variables that have served both as predictors of quality as well as indicators of quality. Higher staff-to-resident ratios are often considered an indicator of higher quality in some studies (Birnbaum, et al. 1981; Bishop 1980; Elwell 1984; Fottler, et al. 1981; Nyman 1988b) while used as a predictor of higher quality (e.g., lower mortality) in another (Linn, et al. 1977). Likewise, expenditures on nursing home care is considered an indicator of higher quality, i.e. higher expenditures implies higher quality, in some studies (Meiners 1982; Nyman 1988a; Ullmann 1984) while used as a predictor of higher quality (e.g., use of rehabilitation services) in others (Birnbaum, et al. 1981; Ullmann 1985). As a result, no consensus really exists on a comprehensive set of outcome measures of quality of care in nursing homes to be used as a substitute for structure or process measures (Shaughnessy, et al. 1990). While not necessarily true measures of health status, process measures are often considered measures of substandard care (IOM 1986; Spector and Takada 1991) and therefore, most of the early studies on quality in nursing homes utilize structural and process measures of quality while more recent work includes several outcome measures of quality.

3.1.2 Nursing Home Quality and CON

Most of the early empirical research on nursing home quality utilizes Scanlon's model of a monopolistically competitive market providing the same level of care to both

private-pay and public-pay residents. When the number of prospective residents is greater than the supply of nursing home beds, the nursing home provides care to private-pay residents first since the private-pay price is typically greater than the Medicaid payment rate. Therefore, under the conditions of a binding CON policy, a nursing home has no real incentive to compete for Medicaid residents on the basis of quality since at any quality level a sufficient number of Medicaid residents are available to fill an empty nursing home bed.

Currently, the literature does not include any investigation into the differences in quality, if any, between those states without CON and/or moratorium policies and those states that have such a policy in place for nursing homes. In one study that analyzes the effects of competition on nursing home quality, the presence of a statewide nursing home construction moratorium results in a lower level of quality of care (Zinn 1994). Viewed as a barrier to entry, a moratorium reduces competition and provides no incentive to provide higher quality. Using data from the 1987 Medicare and Medicaid Automated Certification Survey (MMACS) and the method of two-stage least squares (2SLS), Zinn finds that a moratorium on nursing home construction leads to lower RN staffing and a higher percentage of residents physically restrained thus implying lower quality while controlling for market concentration, area demographics, and Medicaid policies as well as resident and facility characteristics (Zinn 1994).

3.1.2.1 Nursing Home Quality and Medicaid Reimbursement Rates

During the period of Federal CON many proponents of the nursing home industry declared that quality was "low" because Medicaid reimbursement rates were too low.

One part of the literature on nursing home quality investigates the effects of Medicaid reimbursement rates and CON on nursing home quality. Although not employing a direct measure of the presence of a CON and/or moratorium policy, but rather a measure of excess demand (indicating the presence of a binding CON policy), an influential series of papers assess the impact of a change in the Medicaid reimbursement rate on nursing home quality. Because a binding CON policy provides no incentive to nursing homes to compete for Medicaid residents on the basis of quality, the theory argues that under such a binding constraint a higher payment level actually leads to lower quality (Gertler 1989, 1992; Nyman 1985, 1988a, 1988b, 1989b).

Under conditions of excess demand, the proportion of Medicaid and private-pay residents in a nursing home are found to be endogenous with quality. Recognizing the joint determination of quality and the number of private-pay residents and the bias that would result from using ordinary least squares (OLS), two studies using 1978-79 data from the state of Wisconsin employ the method of 2SLS (Nyman 1985, 1988b). Additionally, Nyman uses OLS for comparative purposes since most of the early literature studying the nursing home industry uses OLS. The main equation of interest, the quality equation, estimates the weighted number of Medicaid certification violations in a home (a negative measure of quality) as a function of the number of private-pay residents in the home, the average number of unfilled beds in the county in which the home is located (represents the likelihood that a home is not operating in a market with excess demand), a measure for the Medicaid reimbursement rate, as well as several demographic and facility characteristics as control variables. Nyman's results show that, under excess demand, an increase in the Medicaid reimbursement rate decreases quality.

Using 1983 data from Wisconsin, Nyman (1988a) uses OLS to estimate the relationship between excess demand and nursing home expenditures. In this study, nursing home expenditures serve as a proxy for quality. When excess demand exists, nursing homes are able to lower costs by lowering quality without reprisal since prospective residents, especially Medicaid-eligible individuals, are usually forced to accept the first bed that becomes available regardless of the quality of the home. Separating the data into two groups, those homes in a county with a tight bed supply and those homes in a county with a surplus bed supply, the results show that nursing homes in counties with a tight bed supply spend significantly less on resident care than those with a surplus bed supply. Utilizing the same data set and employing OLS as well as 2SLS, Nyman (1989b) finds that nursing homes in counties with a tighter bed supply have more Medicaid violations than those counties with a surplus bed supply.

To account for the same endogeneity issue but using 1980 New York state-level data, two studies estimate a reduced-form equation of the effect of a change in reimbursement rate on quality (Gertler 1989, 1992). At the time of the studies, New York utilized a cost-plus method of reimbursement. Additionally, even though no direct or proxy measure for CON was utilized, the data were from a time when New York was under CON regulation and was considered as facing excess demand conditions. Gertler (1989) uses three input measures of quality: hundreds of nursing labor hours, hundreds of other labor hours, and a supplies quantity index. The two labor hours measures are adjusted for productivity differences across the nursing homes to eliminate the concern that a nursing home spending more labor hours on care may not necessarily mean the home is of higher quality; perhaps the nursing home is simply more inefficient. While

controlling for resident, facility, economic, demographic, and market characteristics, the results show that an increase in the Medicaid reimbursement rate improves access for Medicaid residents but lowers quality. Similarly, Gertler (1992) finds the same result using total Medicaid expenditures as the measure of quality.

In later work, Cohen and Spector (1996) use the 1987 Institutional Population Component (IPC) of the National Medical Expenditure Survey (NMES) to assess the effect of the Medicaid reimbursement rate on quality. The NMES IPC is a nationally representative sample of residents in or admitted to nursing and personal care homes as well as homes for the mentally retarded. In this study, two different strategies are used to assess the effects of the Medicaid reimbursement rate on quality. First, the effect of the Medicaid reimbursement rate on staff intensity is estimated, and then the effect of staff intensity on resident outcomes is examined to see if more intense staffing results in better outcomes. Second, the authors estimate a "global effect" of reimbursement on outcomes by measuring the direct effect of the Medicaid reimbursement rate on outcomes without using staff intensity as a right-hand side variable.

Quality is first proxied by three structural measures adjusted for case-mix: RNs per 100 residents, licensed practical nurses (LPNs) per 100 residents, and total nursing staff per 100 residents. Then three outcome measures are estimated: mortality, the presence of a pressure sore, and a change in functional status. The three staffing equations are estimated with 2SLS to account for the endogeneity of the Medicaid reimbursement rate. The other explanatory variables include the number of empty beds per 1,000 aged 75 and over by county (used as a measure of market tightness to represent excess demand), the statewide average level of Medicaid reimbursement, a vector of

facility characteristics, a vector of supply and demand factors, and several policy variables. The mortality and pressure sore models are estimated using logistic regression while the functional status model is estimated using OLS with resident health and demographic characteristics, RN, LPN, and aide staffing levels, state quality regulation policies, and ownership type serving as control variables. The "global" effect is estimated for each of the outcome measures including as right-hand side variables the reimbursement variables and the exogenous variables from the staffing and outcome equations. The results indicate that an increase in the Medicaid reimbursement rate has a positive and significant impact on the number of LPNs per 100 residents but not RNs or total staffing. The results of the outcome equations indicate that a higher RN staffing intensity leads to lower mortality, fewer pressure sores, and improvements in functional status, all indicating higher quality. However, in the "global" effects model, an increase in the reimbursement rate does not have a significant impact on outcomes.

More recent work employs a three-part methodology to empirically test the effect of a change in the Medicaid reimbursement rate on nursing home quality (Grabowski 1999, 2001a, 2001b). Noting that the previously cited work by Scanlon, Nyman, and Gertler assumes that nursing homes are integrated facilities, i.e., they serve both private-pay and public-pay residents, the first stage of Grabowski's methodology models the choice of payer mix regime (public-only, integrated, private-only); the second stage models the choice of payer mix conditional on the home choosing to be an integrated facility, and finally, the third stage models the quality decision. In these studies quality is proxied by an outcome measure: the proportion of residents with facility-acquired pressure sores (Grabowski 1999, 2001b); structural measures: the number of RNs

(Grabowski 2001b) and professional and non-professional staffing levels (Grabowski 2001a); process measures: medication error rates, use of physical restraints, use of catheters, and use of feeding tubes (Grabowski 2001a) and a composite of process and outcome measures: the number of nursing home deficiency citations (Grabowski 1999, 2001a). The explanatory variables include measures of resident case-mix, various facility characteristics, state-level Medicaid reimbursement policies, and market-based (county) characteristics including the number of empty beds per elderly population to represent the measure of excess demand.

Using 1995-96 data on all U.S. Medicaid-certified nursing homes, Grabowski's results show that an increase in the Medicaid reimbursement rate leads to a small, but significant increase in nursing home quality. Additionally, replicating Gertler's reduced-form model using all U.S. nursing homes in 1981 and all nursing homes in the state of New York for the 1995-96 time period, the OLS results also indicate that an increase in the Medicaid reimbursement rate increases quality. These results are contrary to the results obtained by Nyman and Gertler. Grabowski attributes this result in part to the fact that occupancy rates of nursing homes, an indirect measure of excess demand, have been declining over the time period between the earlier studies and his studies. Using multiple waves of the National Nursing Home Survey (NNHS), the national occupancy rate was 92.9 percent in 1977, 91.8 percent in 1985 and 87.4 percent in 1995 (Strahan 1997). This shift in the tightness of the market, which may represent a change in the prevalence of excess demand conditions, may help to explain the differences in the results between earlier studies (Gertler 1989, 1992; Nyman 1985, 1988a, 1988b, 1989b) and Grabowski's more recent studies.

3.1.3 Other Predictors of Nursing Home Quality

The literature concerning the nursing home industry is quite extensive beyond the use of CON and the Medicaid reimbursement rate as predictors of nursing home quality. Among those reviewed in this section are the ownership, size, and staffing levels of a facility, the resident mix and case-mix of a facility's residents, and the method of Medicaid reimbursement. While recognizing that each of the studies included in this portion of the literature review utilizes different data sets and methods of analysis, this section provides a summary of the results obtained when utilizing several of the other more important predictors of nursing home quality.

3.1.3.1 Nursing Home Ownership

The ownership of a facility refers to whether the nursing home is established as for-profit, nonprofit, or government-owned. A subset of the for-profit classification is corporate nursing home chains. Economic theory provides a framework for analyzing the effect of ownership on nursing home behavior. For-profit nursing homes' motivation is assumed to be profit maximization, subject to various regulatory constraints, while a common assumption is for nonprofit homes to maximize their size, subject to quality and break-even constraints (Scanlon 1980b). The tie-in of ownership with quality is often analyzed through the costs that nursing homes experience. With higher costs indicating higher quality (and not less efficiency), cost minimization on the part of for-profit nursing homes may render profits and quality as conflicting objectives. Much of the early empirical evidence using expenditures as a measure of quality supports a pattern of lower

expenditures in for-profit nursing homes thus indicating lower quality (Birnbaum, et al. 1981; Frech III 1985; Frech III and Ginsburg 1981; Meiners 1982; Ullmann 1984).

Utilizing various structural, process, and outcome measures of quality have led to inconclusive results concerning the effect of ownership on nursing home quality. Using various structural indicators of quality, as well as various data sets and methods, some studies have found no significant difference between nonprofit and for-profit nursing homes (Cohen and Dubay 1990; Cohen and Spector 1996; Harrington, et al. 1998; Lee, et al. 1983; Winn 1974), while others have found that nonprofits have higher quality (Aaronson, et al. 1994; Elwell 1984; Grabowski and Hirth 2002; Zinn 1994). Likewise, the use of process measures of quality (Grabowski and Hirth 2002; Lee, et al. 1983; Nyman 1988c; Zinn 1994) as well as outcome measures of quality (Bliesmer, et al. 1998; Chou 2001; Cohen and Spector 1996; Harrington, et al. 2002; Harrington, et al. 2000c; Mukamel 1997; Nyman 1985, 1988c, 1989b; Porell, et al. 1998; Spector, et al. 1998; Spector and Takada 1991) have led to the same inconclusive evidence. Finally, two studies utilizing composite measures of quality, one that includes structural and expenditure measures (Greene and Monahan 1981) and one that includes structural and outcome measures (Davis 1993), find that nonprofits have higher quality than for-profits.

3.1.3.2 Nursing Home Size

The literature on the relationship between quality of care and the size of a nursing home facility also provides conflicting results. Quality of care and the size of a nursing home facility are often found to have a positive relationship. This relationship is usually justified by one of two different explanations. The first argues that larger homes tend to

have more highly trained and professional administrators, who in turn maintain higher resident standards. In this case, size is seen as a proxy for administrative professionalism. Secondly, it has been suggested that certain economies of scale exist in nursing home operations. With a greater number of beds, nursing homes should be able to attract better personnel and provide a broader selection of services and hence provide higher quality. With either explanation, size is expected to be related positively to the quality of care provided (Greene and Monahan 1981). On the other hand, quality of care and the size of a nursing home facility are often found to have a negative relationship. Larger homes may provide less personal care, experience more problems, and experience management inefficiencies (Harrington, et al. 2000c; Nyman 1985).

Most analyses of the relationship between quality and the size of nursing home facilities use the number of beds in the facility as the predictor of quality. Inconsistent results occur regardless of whether a structural, process, or outcome measure of quality is used in the analysis. Studies that have used a structural measure of quality, such as nursing hours per resident day, find that either a significant relationship does not exist (Cohen and Dubay 1990; Cohen and Spector 1996; Fottler, et al. 1981; Lee, et al. 1983) or that a negative relationship exists indicating that larger homes provide a lower level of quality (Aaronson, et al. 1994; Harrington, et al. 1998). Nyman (1988c) shows that size does not have a significant relationship with two process measures of quality, resident care plans and diet plans, while Ullmann (1981) and Lee et al. (1983) show size has a positive relationship with an index of rehabilitation services indicating that larger homes provide a higher level of quality. Size and outcome measures of quality, such as mortality and improvement in functional status are not significant in some studies (Linn,

et al. 1977; Porell, et al. 1998; Spector and Takada 1991) while size and deficiency citations or certification violations exhibit a positive relationship in other studies (Graber and Sloane 1995; Harrington, et al. 2000c; Nyman 1985, 1988b, 1989b).

3.1.3.3 Nursing Home Staffing

As a result of the IOM's 1986 report on the poor quality of care in nursing homes and the subsequent passage of the Nursing Home Reform Act of OBRA 87, increased nurse staffing became a requirement for all Medicare- and Medicaid-certified nursing home facilities. RNs, LPNs, licensed vocational nurses (LVNs), and NAs make up approximately 60 percent of total nursing home personnel (Harrington, et al. 1999) and provide the majority of care that nursing home residents receive. Many studies consistently find a positive relationship between higher nurse staffing levels, especially RNs, and outcome measures of quality of care.

One of the first studies to investigate the relationship between nurse staffing and outcome measures of quality finds that more RNs per resident are associated with lower mortality rates, improved resident health, and higher discharge rates (Linn, et al. 1977). More RN hours (Braun 1991), more RN hours per 100 residents (Cohen and Spector 1996), more licensed nursing hours (Bliesmer, et al. 1998) and more LPN staffing levels (Porell, et al. 1998) result in lower mortality rates and less likelihood of death. Higher nursing staff levels per resident (Spector and Takada 1991), more RNs and LPNs per 100 residents (Cohen and Spector 1996), and more licensed nursing hours (Bliesmer, et al. 1998) also result in improved functional status. Harrington et al. (2000c) show that more

RN hours per resident day lead to lower levels of various measures of nursing home deficiencies. While recognizing that health is not the only desirable outcome to be produced by nursing homes, Nyman (1988c) uses a measure of "quality of life" to represent good quality and finds that more nursing hours per resident day increases the quality of life. Recognizing the importance of these findings, the IOM (1996) issued a committee report recognizing the importance of nurse staffing levels and recommended adding more RNs to the staff of nursing homes.

3.1.3.4 Nursing Home Resident Mix

Resident mix refers to the proportions of public-pay (Medicaid or Medicare) and private-pay residents in a nursing home facility. Policymakers, nursing home industry proponents, and researchers often assert that nursing homes with higher numbers of public-pay residents are constrained by lower per diem rates. As a consequence, it is reasoned that these nursing homes provide a lower level of quality since the public-pay reimbursement rates are usually lower than the rate charged to private-pay residents. Many studies investigate the relationship between resident mix and nursing home quality.

Again many early studies use expenditures to represent nursing home quality. With the idea that higher expenditures imply higher quality, many of these studies find that the proportion of public-pay (Medicaid) residents results in nursing homes providing a lower level of quality (Birnbaum, et al. 1981; Elwell 1984; Nyman 1988a; Ruchlin and Levey 1972; Schlenker and Shaughnessy 1984). However, as Davis (1991) notes, a very

important question to answer is whether lower expenditures impede structural, process and outcome quality.

Assessing this relationship between quality and resident mix, some studies use various staffing measures to represent a structural measure of quality with the percentage of Medicaid, Medicare, or private-pay residents as the predictor variable. Fottler et al. (1981) and Zinn (1994) find that an increase in the percentage of Medicaid residents leads to a lower level of RN staffing, thus implying lower quality. Conversely, Harrington et al. (1998) find that an increase in the percentage of Medicaid residents leads to an increase in the average number of LVN and LPN hours per resident day implying that these two types of nursing services improve quality. Alternatively, Zinn (1993) finds that an increase in the percentage of Medicare residents as well as an increase in the percentage of private-pay residents increases the number of LPNs per resident and the number of RNs per resident, respectively.

Fewer studies have investigated the relationship between process measures of quality and resident mix. Nyman (1988c) finds no significant relationship between the percentage of Medicaid residents and ratings of resident care plans, diet plans or medication plans. Likewise, Zinn (1994) finds a nonsignificant relationship between the percentage of Medicaid residents and the percentage of residents catheterized as well as the percentage restrained but finds a positive relationship between the percentage of Medicaid residents and the percentage not toileted.

The results using outcome measures of quality, such as facility deficiencies and changes in functional status tend to be more consistent across studies. Several studies

find that the percentage of Medicaid residents is associated with worse outcomes (Harrington, et al. 2002; Harrington, et al. 2000c; Nyman 1988b) while the percentage of Medicare and/or the percentage of private-pay residents is typically associated with better outcomes (Nyman 1985, 1989b; Porell, et al. 1998; Spector and Takada 1991).

3.1.3.5 Nursing Home Case-Mix

Nursing homes serve different types of residents requiring different levels of care. Studies usually include measures of case-mix to serve as an indicator of the severity of a resident's functional condition. One of the most widely used measures of resident case-mix is the activities of daily living (ADL) index developed by Katz (1963). This index summarizes a resident's over-all performance in six functions: bathing, dressing, toileting, transferring, continence, and eating. The higher the index value the more severe is the resident's functional condition. Another measure of case-mix frequently used in the literature is the Resource Utilization Groups (RUG). The RUGs approach categorizes residents according to the amount of resources required for their care. By classifying residents into homogeneous categories based on their resource utilization, this type of case-mix index represents, at least relatively, the time or cost of the average resident in the group (Fries 1990). Now in its third version, a higher RUG index indicates a greater degree of complexity and, consequently, a greater need for input resources (Fries, et al. 1994). Additionally, certain process measures as well as the percentage of SNF residents in the nursing home facility are used in some studies as measures of resident case-mix.

Various measures of nursing home staffing are the predominant structural measure of quality within the nursing home literature when examining the effect of case-mix. One might conclude that a more severe resident case-mix requires greater staffing. However, once again the literature gives conflicting evidence. Using a long-term care index representing functional severity of nursing home residents as the indicator of case-mix, Cohen and Dubay (1990) find a positive relationship between case-mix and nurses per bed while Aaronson et al. (1994) find a negative relationship with care staff per bed. However, two studies employing a modified ADL index both find that a more severe case-mix leads to higher staffing levels (Grabowski 2001b; Harrington, et al. 1998).

Using process measures of quality, the evidence is also mixed concerning the relationship between quality of care and case-mix. Nyman finds that more residents with special needs is not a significant predictor of quality (Nyman 1988c) while Zinn (1994) finds higher functional severity has a positive relationship with the percentage of residents catheterized but a negative relationship with the percentage restrained. Two other studies find a positive relationship between a more severe case-mix and several process measures representing "poor" quality of care indicating that homes with a more severe case-mix provide lower levels of quality (Aaronson, et al. 1994; Mukamel 1997).

The use of deficiencies as an outcome measure of quality also presents opposing results. In several studies, a more severe case-mix leads to more nursing home violations ("lower" quality) (Graber and Sloane 1995; Grabowski 2001b; Harrington, et al. 2002) while leading to less deficiencies ("higher" quality) in another (Harrington, et al. 2000c).

3.1.3.6 Nursing Home Reimbursement Methods

Reimbursement methods refer to the way in which Medicare and state Medicaid programs pay for nursing home care. Setting Medicaid reimbursement rates for nursing home care is one way that states attempt to control expenditures. However, states focus not only on the overall level of reimbursement but also on the payment method by which they pay nursing home providers. As described previously in Chapter 2, section 2.3.1, reimbursement policies differ most fundamentally on two issues: whether rates are set retrospectively or prospectively and if the resulting prospective rate is based on facility-specific costs or on a flat-rate set independently of an individual facility's costs (Wiener and Stevenson 1998).

A retrospective reimbursement method provides the least cost containment incentives because the resulting reimbursement rate is based on actual costs incurred. In contrast facility-specific and flat-rate systems provide the greatest incentive for nursing home facilities to be efficient because with these methods a nursing home's profits are the difference between its payment and its expenses. However, if facilities limit their services in order to increase their profits, quality of care may be adversely affected. Additionally, with a retrospective reimbursement method Medicaid revenue increases when more quality is provided because costs are assumed to increase with quality, an incentive may exist to provide more quality. In contrast, a facility reimbursed by a facility-specific or flat-rate method does not receive an increase in the Medicaid reimbursement rate when more quality is provided and therefore has no financial incentive to increase its quality of care.

Most of the empirical studies using structural measures of quality lend support to the theoretical expectations of lower nursing home quality in states that employ a facility-specific or flat-rate reimbursement system. Cohen and Dubay (1990) find that nursing homes in states using a flat-rate reimbursement method have fewer nurses per bed than those homes in states using a retrospective reimbursement method. However, these authors find no significant difference between those homes in states using a facility-specific reimbursement method and those homes in states using a retrospective method. Compared to a retrospective method, Zinn (1994) finds this same negative relationship for both a facility-specific and flat-rate reimbursement method and the number of RNs per resident. Cohen and Spector (1996) find the same negative relationship between a flat-rate reimbursement method compared to a retrospective method for the number of RNs but a positive relationship for the number of LPNs. In a more recent study, Grabowski (2001b) finds the same negative relationship between a facility-specific reimbursement method and the number of RNs compared to a retrospective method and an even lower level of quality associated with a flat-rate method compared to a facility-specific method. However, under conditions of excess demand, Grabowski finds that the method of reimbursement becomes nonsignificant.

Studies using process measures of quality provide inconclusive results. Lee et al. find that retrospective and flat-rate methods, compared to facility-specific, lead to lower levels of rehabilitation services offered to residents. Zinn finds that a prospective method leads to a greater percentage of residents restrained while a flat-rate method leads to a greater percentage of residents not toileted.

Unlike the structural and process measures of quality, outcome measures are typically not significant different across reimbursement methods. Cohen and Spector (1996) find no significant difference between reimbursement methods and mortality, presence of a pressure sore, or a change in functional status. Likewise, Grabowski (2001b) finds similar results using the percentage of residents with facility-acquired pressure sores as the measure of quality.

Case-mix reimbursement systems are designed to mitigate the disincentives of flat-rate and facility-specific methods of reimbursement to limit nursing home services in order to lower operating costs and to limit the temptation of only admitting lighter-care nursing home residents. Under case-mix reimbursement, nursing homes receive a higher reimbursement rate when individuals require more services. The major theoretical strength of case-mix reimbursement is that it should make nursing homes indifferent to the relative care needs of the individuals they admit. One major criticism of this type of reimbursement system however is that it creates a disincentive for nursing homes to provide rehabilitation to its more disabled residents (Wiener and Stevenson 1998).

With respect to structural measures of quality, Cohen and Dubay (1990) find that use of case-mix reimbursement does not have a significant effect on the number of nurses per bed. In contrast, Zinn (1994) finds that use of case-mix reimbursement leads to an increase in the number of RNs per resident. In two separate studies, Grabowski finds that case-mix does not show a significant relationship with the number of RNs in one study (Grabowski 2001b) and finds a nonsignificant relationship for the number of RNs, a negative relationship with the number of LPNs, and a positive relationship with the number of NAs in the second study (Grabowski 2002).

With process measures of quality, Zinn (1994) finds that use of case-mix reimbursement leads to a decrease in the percentage of residents not toileted. However, Grabowski (Grabowski 2002) finds that a case-mix reimbursement method has a nonsignificant relationship with both the percentage of residents with catheters and the percentage of residents with feeding tubes but a positive relationship with the percentage of residents with physical restraints. However, when separating the data into the most and least tight markets, the number of RNs has a positive relationship with case-mix reimbursement in the most and least tight markets (the measure of excess demand), the number of LPNs is not significant in either market and the number of NAs is positive in the tightest market and negative in the least tight market. Also in the tightest market, there is a decline in the percentage of residents with catheters as well as the percentage of residents with feeding tubes when case-mix reimbursement is used (Grabowski 2002).

Few studies have investigated the relationship of case-mix reimbursement and outcome measures of quality. Two studies by Grabowski show that, although the resulting coefficient is negative, there is no significant relationship between case-mix reimbursement and the percentage of residents with facility acquired pressure sores for the full sample as well as the most and least tight markets (Grabowski 2001b, 2002).

One possible interpretation of these results between reimbursement method and quality of care is that prospective and flat-rate methods of reimbursement may result in more adverse quality of care than a retrospective method while case-mix reimbursement may not adversely affect the quality of care and in some cases improve the quality of care provided to nursing home residents.

3.2 Nursing Homes and Access to Care

Access to nursing home care is typically defined in the literature as the ability of an individual seeking nursing home care to obtain admission to a nursing home facility. As quoted by Blumstein and Sloan (1978) one of the major goals of the 1974 National Health Planning and Resources Development Act include achieving "equal access to quality health care at a reasonable cost" and improving the "maldistribution of health care facilities and manpower" and one of the Act's first priorities is the "provision of primary care services for medically underserved populations". While the main goal of CON regulation is the containment of the share of medical care expenditures paid for by the federal and state governments one of the perhaps unintended consequences of this type of regulation in the nursing home industry is reduced access to care for public-pay and "heavy-care" residents (Cotterill 1983; Feder and Scanlon 1980; Greenlees, et al. 1982; Scanlon 1980a, 1980b; Schlenker 1986). The two reasons most often cited by researchers of the nursing home industry are (1) the excess demand for nursing home beds caused by CON and/or construction moratorium and (2) the low level of the public-pay reimbursement rate.

3.2.1 Nursing Home Access and CON

Although CON and construction moratorium policies are designed to control government expenditures by limiting the number of nursing home beds, they also create potential barriers to entry for new providers. As a consequence, when a constraint such as CON is binding, excess demand for nursing home care may result in many markets. As described by Scanlon (1980b) in his excess demand model of the nursing home

market, a profit-maximizing facility first admits the higher-paying private residents and then fills the remaining empty beds with lower-paying Medicaid residents. Thus, when the number of nursing home beds is constrained the private-pay demand is satisfied first and any remaining demand becomes "excess Medicaid demand." As a result, Medicaid residents will have access to those homes least capable of competing successfully for private-pay residents, perhaps due to lower quality of care; and with such a limited choice, public-pay residents often have no option but to enter whatever facility will accept them, even though it may provide undesirable quality of care (Hawes and Phillips 1986). Additionally, there is what is referred to in the literature as "cream-skimming"; when a Medicaid-eligible individual is admitted to a nursing home, it will be the lighter-care individual that will be admitted before a heavy-care individual since the former represents a more profitable resident (Cohen and Dubay 1990; Frech III 1985; Hawes and Phillips 1986).

As with the relationship between quality of care and CON and/or construction moratorium policies, the existing literature does not provide insight into any differences in access to nursing home care that may exist between those states without CON policies and those states that have such policies. Nor does the existing literature shed much insight into the direct effect of these types of policies on nursing home access for public-pay residents. Feder and Scanlon (1980) attribute the access problem for Medicaid residents directly to the excess demand caused by CON regulation. Conducting interviews in eight states in 1978, many of the states they visited reported access problems for their Medicaid-eligible individuals, especially those with heavy-care needs.

The authors attribute the problem to a bed shortage that enables nursing home operators to discriminate in favor of light-care residents.

Early work by Lee et al. (1983) estimates a multi-equation simultaneous model of nursing home behavior using data from the National Center for Health Statistics' 1973-1974 Nursing Home Survey. One of the equations estimates the effect of the presence of CON on a nursing home's occupancy rate and then this result is used as one of the explanatory variables to estimate the percentage of total resident days provided to private-pay residents. The study finds a positive relationship between CON and occupancy rates as well as a positive relationship between occupancy rate and the percentage of total resident days provided to private-pay residents. This result indicates that, at the time, public-pay residents had less access to nursing home care relative to private-pay residents.

Again, although not a direct measure of CON, many studies estimate the effect of excess demand on access to nursing home care for public-pay residents. Many of these studies analyze data from the time of Federal CON regulation and when nursing homes were experiencing high occupancy rates (Cohen and Dubay 1990; Ettner 1993; Gertler 1992; Harrington and Swan 1987; Nyman 1989a; Reschovsky 1996). While each of these studies employs a different data set, methodology, measure of excess demand and measure of access, the results consistently show that public-pay residents have less access to nursing home care than private-pay residents.

Nyman (1989a) utilizes county-level data for nursing homes in the state of Wisconsin from 1983 to assess the impact of excess demand on access to nursing home care for Medicaid recipients. While controlling for demographic and Medicaid policy

variables as well as a measure of quality, the OLS result for the effect of excess demand (the number of beds per thousand elderly) on the number of Medicaid residents (the number of Medicaid residents per thousand elderly) is negative indicating that an increase in excess demand decreases Medicaid-eligible individuals' access to care. Gertler (1992), using data from New York State in 1980 which at the time had a high occupancy rate and what was considered a binding CON, estimates a reduced-form equation of the effect of the number of beds in a facility on the number of Medicaid residents. While controlling for several demand, supply, and policy variables as well as a measure of resident case-mix, the results indicate that a decrease in the number of beds, i.e., an increase in excess demand, leads to a decrease in the number of Medicaid residents.

Utilizing a panel data set from 42 states for the entire period of 1978-1983, Harrington and Swan (1987) estimate the effect of nursing home beds per 1,000 aged (their measure of excess demand) on the number of Medicaid nursing home recipients per 1,000 aged (their measure of access) at the state level using a fixed effects estimator. While controlling for several Medicaid policies and demographic variables, an increase in excess demand causes a decrease in nursing home access for Medicaid-eligible individuals. Performing a cross-sectional analysis, Cohen and Dubay (1990) estimate a reduced-form regression equation of the effect of the number of Medicare-certified beds per elderly population aged 65+ (a measure of the tightness of the market) on the percentage of Medicaid residents in a nursing home facility. Using data from the 1981 Medicare cost reports and Medicare/Medicaid Automated Certification System (MMACS) files for 1,020 nursing homes throughout the United States, the results indicate a negative but nonsignificant relationship.

Pursuing a different technique, Ettner (1993) uses a probit model to estimate the impact of Medicaid status on the probability of being on a waiting list for a nursing home bed while controlling for resident mix, case-mix, and bed supply. Using data from the 1982-1984 National Long Term Care Survey (NLTCS) Ettner finds that Medicaid-eligible individuals have a greater probability of being on a waiting list and that these individuals face greater access problems than non-Medicaid individuals in areas where bed supply is constrained and that on the margin, Medicaid-eligible individuals benefit the most from an increase in the bed supply.

Utilizing data from the National Long-Term Care Channeling Demonstration, Reschovsky (1996) uses a probit model to estimate the effect of the number of empty beds per 1,000 population aged 75+ on the probability of a Medicaid-eligible individual entering a nursing home, specified as the product of the probability of demand for such care and the probability that a nursing home admits the person conditional on demand. Using the interaction between the measure of bed availability and the expected net revenue from the sample person as a measure of market tightness, the results again indicate that the tighter the market condition the lower the probability of admission for Medicaid-eligible individuals.

Furthermore, by limiting the number of nursing home beds, CON and construction moratorium not only provide nursing homes with the potential ability to choose which payer type (Medicaid or private) to admit but also with the potential ability to choose which type of Medicaid resident to admit. Because every Medicaid-eligible individual will not be able to find an empty bed in the presence of excess demand, "heavy-care" Medicaid-eligible individuals may experience the most difficulty in gaining

access to nursing home care (Grabowski 2002). Using a health status index representing severity of illness and the need for heavy-care, studies show that excess demand leads to fewer heavy-care residents being admitted to nursing homes while controlling for Medicaid policies as well as facility and area characteristics (Cohen and Dubay 1990; Nyman, et al. 1987).

3.2.2 Other Predictors of Nursing Home Access

In the existing literature, several variables are consistently used as predictors of nursing home access. Among those reviewed in this section are the reimbursement rate, reimbursement method, case-mix, resident mix, and ownership of a nursing home facility. While recognizing that each of the studies included in this portion of the literature review utilizes different data sets and methods of analysis, this section provides a summary of the results obtained when utilizing several of the other more important predictors of nursing home access.

3.2.2.1 Nursing Home Reimbursement Rates and Methods

In addition to the excess demand theory many researchers have attributed the difficulty of gaining access to nursing home care for Medicaid residents to lower-than-cost Medicaid reimbursement rates. Besides providing an incentive for nursing homes to admit private-pay residents before public-pay residents, a Medicaid rate that is lower than the private-pay rate also potentially provides nursing homes with a possible incentive to selectively admit those individuals with the fewest functional disabilities. This incentive is particularly strong under reimbursement systems that provide the same Medicaid rate

for every resident regardless of the resident's degree of physical impairment (Hawes and Phillips 1986). Therefore, if all Medicaid residents in a given home bring in the same per diem reimbursement, nursing homes will be relatively reluctant to admit the most severely impaired residents, i.e., those needing "heavy care" (Holahan and Cohen 1987; Nyman, et al. 1987). Even though at least one study finds that the marginal cost of the most dependent SNF resident is lower than the average Medicaid reimbursement rate for SNF residents, most studies of nursing home access include a measure of the Medicaid reimbursement rate (Mukamel and Spector 2002; Nyman 1988d).[5] Using various measures to represent demand for nursing home care as well as measures of demographic, resident, and facility characteristics as control variables, the results from various studies suggest that an increase in the Medicaid reimbursement rate improves access to nursing home care for public-pay residents (Aaronson, et al. 1994; Gertler 1992; Greenlees, et al. 1982; Reschovsky 1996).

Other papers have looked at the effect of the reimbursement method on access to nursing home care for public-pay residents and in particular those residents considered heavy-care.[6] Many studies focus on four methods of reimbursement, retrospective, prospective-class (flat-rate), prospective-facility-specific, and prospective-case-mix adjusted, and their effect on access to nursing home care for Medicaid-eligible individuals. In contrast to a retrospective reimbursement, which encourages nursing homes to increase expenditures, flat-rate and facility-specific reimbursement methods encourage nursing homes to minimize expenditures and produce efficiently while the

[5] Nyman's study uses data from New York State in 1983, which was at the time of Federal CON while Mukamel and Spector's study uses data from New York State in 1991, which was still under CON regulation.
[6] The various Medicaid reimbursement methods are described in detail in section 2.3.1.

intended purpose of a case-mix adjusted reimbursement method is to make facilities indifferent to residents' care needs when they seek admission.

Since each state's Medicaid reimbursement rate actually results from the choice of reimbursement method, Medicaid rates tend to be higher under retrospective reimbursement and lower as cost containment incentives increase under facility-specific and flat-rate methods (Cohen and Dubay 1990; Harrington and Swan 1984). Therefore, it is expected that states with a retrospective reimbursement method will provide greater access to nursing home care than those states with a facility-specific or flat-rate reimbursement method. Furthermore, those states with a facility-specific reimbursement method are expected to provide greater access for Medicaid residents than those with a flat-rate reimbursement method.

Nyman (1990) suggests that simply covering the costs of each resident is insufficient to ensure access for heavy-care residents, particularly under conditions of excess demand. The purpose of a prospective-case-mix-adjusted reimbursement method is that the use of case-adjusted rates would permit governments to pay higher reimbursement rates for heavier-care residents, thus creating an incentive for nursing homes to admit these types of residents. Thus the main policy designed to insure that heavy-care residents gain access to nursing homes is represented by these case-adjusted prospective reimbursement systems. The expected result of case-mix reimbursement is improved access to nursing homes for heavy-care Medicaid residents (Nyman, et al. 1987; Weissert and Musliner 1992).

The results in the literature however, are inconclusive. Several studies find that states using a retrospective method actually have fewer Medicaid residents compared to

those that use a facility-specific method (Cohen and Dubay 1990; Lee, et al. 1983) but that those states that use a flat-rate method admit fewer Medicaid residents compared to those that use a retrospective method as the theory suggests (Cohen and Dubay 1990).

Several studies have researched the effect of a case-mix reimbursement method on access to nursing homes for heavy-care Medicaid residents (Cohen and Dubay 1990; Grabowski 2002; Holahan and Cohen 1987; Norton 1992; Nyman, et al. 1987; Thorpe, et al. 1991). Using various indexes to represent a measure of the severity of residents' disability levels to represent access for heavy-care Medicaid residents, most studies find that the use of a case-mix reimbursement method leads to an increase in access for heavy-care Medicaid residents (Cohen and Dubay 1990; Grabowski 2002; Holahan and Cohen 1987; Norton 1992; Thorpe, et al. 1991). However, Grabowski (2002) finds that the increase is not as large under conditions of excess demand while Nyman et al. (1987) find that under conditions of excess demand heavy-care residents have less access to nursing home care which supports the idea that homes located where they can choose among residents will select the lighter-care residents. Overall, the literature seems to provide support to the theory that reimbursement methods that pay higher rates provide greater access to Medicaid residents and in particular to those residents requiring heavy-care.

3.2.2.2 Nursing Home Resident Mix

Studies that include a measure of a nursing home's resident mix primarily use this variable to serve as an indicator of access for heavy-care residents rather than as an indicator of access for Medicaid residents in general. The idea is to test whether or not nursing homes are able to "cream-skim." If an increase in the number of Medicaid

residents leads to an increase in a measure of disability or severity of illness, for example, then it could be said that the nursing home was not practicing "cream-skimming" by admitting only lighter-care residents. On the other hand, if an increase leads to a decrease in the severity of illness or disability level then this result would support the notion that nursing homes prefer admitting lighter-care Medicaid residents for all the aforementioned reasons. The few studies that have investigated this relationship do indeed find that an increase in the percentage of Medicaid residents results in a decrease in the severity of illness of nursing homes' residents suggesting that nursing homes practice "cream-skimming" (Cohen and Dubay 1990; Nyman, et al. 1987).

3.2.2.3 Nursing Home Ownership

Studies also examine whether or not any differences exist between for-profit and nonprofit nursing home facilities with respect to the number of Medicaid residents admitted. One theory suggests that: (1) since nonprofit nursing homes tend to have higher costs than for-profit nursing homes, (2) since Medicare residents tend to cost more relative to Medicaid and private-pay residents due to the "subacute" rather than the long-term nature of their required care, and (3) since private-pay residents' demand is a function of price and quality and increasing quality increases costs, nonprofit homes will be more oriented toward private-pay and Medicare residents than Medicaid residents and that for-profit homes will be more inclined to admit Medicaid residents. Several studies support this result by finding for-profit nursing homes have more Medicaid residents compared to nonprofit nursing homes (Cohen and Dubay 1990; Lee, et al. 1983; Vladeck 1980).

Indicating a different result, another theory suggests that nonprofits may rely more heavily on Medicaid residents as a source of revenue and therefore have more Medicaid residents than private-pay. Supporting this theory, Gertler (1989) and Davis (1993) find that nonprofit nursing homes have a greater percentage of Medicaid residents compared to for-profit nursing homes while specifically accounting for nursing home case-mix.

3.3 Nursing Homes and Costs

The containment of public expenditures on medical care, due to their rapid growth after the establishment of Medicare and Medicaid, was one of the main goals of CON regulation. Specific to the nursing home industry, although studies have shown that the rate of growth of nursing home beds has slowed with the use of CON and/or construction moratorium (Harrington, et al. 1997b; Swan and Harrington 1990), the evidence is not conclusive that CON and/or construction moratorium policies have been effective in reducing public expenditures for nursing home care or for long-term care in general.

3.3.1 Nursing Home Costs and CON

Early work typically examines the effects of CON policies on bed capacity (Feder and Scanlon 1980; Harrington, et al. 1997a; Harrington, et al. 1992; Harrington, et al. 1997b) or the effects of bed capacity on Medicaid expenditures (Harrington and Swan 1987; Swan 1990). Other studies have looked at the effect of excess demand on Medicaid nursing home expenditures with most results indicating that under conditions of

excess demand nursing homes are able to lower their costs with impunity due to the lack of competition for residents (Davis and Freeman 1994; Nyman 1988a, 1988b).

Although limiting the supply of nursing home beds is intended to constrain nursing home expenditures, Medicaid expenditures for all long-term care may not decrease due to the availability of community-based care, including home health care, as a substitute for nursing home care. Two recent studies address the direct impact of nursing home supply regulations on Medicaid nursing home expenditures as well as Medicaid long-term care expenditures. The first study investigates the effect of nursing home CON and/or moratorium policies on Medicaid nursing home per capita expenditures, as well as Medicaid long-term care per capita expenditures, using a random effects model for 1991 through 1997 with the state as the unit of analysis (Miller, et al. 2002). Data on nursing home and long-term care expenditures are from annual Medicaid Financial Management Reports, CMS Form 64, and include all states except Arizona. Included in the model are several variables to control for the demand for and the supply of nursing home care as well as state policies, including the type of reimbursement method, and state political factors. The results indicate that the presence of either a nursing home CON, a nursing home moratorium or both a CON and moratorium has a positive, although not significant, effect on nursing home care per capita expenditures. Additionally, using Medicaid long-term per capita expenditures as the dependent variable and the same explanatory variables, this same study finds that the presence of a nursing home CON, a nursing home moratorium and both a CON and moratorium has a positive and significant effect on Medicaid long-term per capita expenditures.

The second study investigates the repeal of CON or moratorium policies on Medicaid nursing home expenditures as well as Medicaid long-term care expenditures (Grabowski, et al. 2003). Unlike the study by Miller et al. (2002) that does not control for state or year fixed effects, Grabowski's study uses a fixed effects model, for 1981 through 1998, to control for the presence of unobserved state-specific as well as unobserved time-specific attributes that may influence both the elimination of CON or moratorium regulation and the level of nursing home and long-term care expenditures. The expenditure data include information on all states except Arizona from CMS' Office of the Actuary. Controlling for demographic and economic variables as well, the results indicate that those states without CON or moratorium policies have a very small, but statistically insignificant, increase in Medicaid nursing home expenditures as well as Medicaid long-term care expenditures. Additionally, when the nursing home Medicaid expenditure data are decomposed into the per diem Medicaid rate and Medicaid recipient days, the results indicate that the repeal of CON did not statistically increase the Medicaid per diem rate or the number of Medicaid recipient days.

These two studies are the first to actually investigate the effect of nursing home supply regulations on nursing home costs during the time period during which the Federal CON regulation was eliminated and in which some states eliminated their CON policy while other states kept their policy in place. These studies provide supporting evidence to early studies that suggest that CON and/or moratorium policies are not having the intended effect of controlling Medicaid nursing home expenditures (Birnbaum, et al. 1981; Lee, et al. 1983). These results also suggest that this type of regulation may not be having the intended effect of reducing Medicaid long-term care

expenditures. One possible explanation is that market conditions have changed with respect to the lessening of excess demand and the increased availability of substitutes for nursing home care (Grabowski, et al. 2003).

Chapter Four

Research Design

This chapter focuses on the data and methods utilized in this dissertation. The first section describes the objectives and hypotheses. The second section describes the various sources of data as well as the procedures utilized to clean and merge the various data files. The third section describes the variables included in each of the models. The last section describes the methodologies applied and includes the specification of the models in the analysis of the differences in the quality of nursing home care and the access to nursing home care for those states with and those states without CON and/or construction moratorium regulation.

4.1 Objectives and Hypotheses

Since the elimination of Federal CON regulation in the nursing home industry, little empirical analysis has been performed to see if the quality of care and the access to care is any different between those states without CON and/or construction moratorium policies and those states that still have these policies in place. The question remains if CON is effectively meeting its original intent of improving quality of care for nursing home residents, increasing the accessibility of nursing home care for public-pay residents, and containing public expenditures for nursing home care. The specific

objectives of this dissertation are to investigate if CON regulation is achieving the goals of improving quality and increasing accessibility by analyzing whether or not any differences exist between those states without and those states with CON and/or moratorium policies in place. These results, taken together with the results of Miller et al. (2002) and Grabowski et al. (2003) and, may shed some light on the effectiveness of retaining state-level CON and/or construction moratorium policies.

The hypotheses to be tested in this dissertation are based on Scanlon's (1980b) model of a monopolistically competitive market which provides the same level of care to both private-pay and public-pay residents and Nyman's excess demand paradigm (Nyman 1985, 1988b, 1989b). When the number of prospective residents is greater than the supply of nursing home beds, the nursing home provides care to private residents first since the private-pay price is typically greater than the Medicaid payment rate. If CON is an effective barrier to entry and excess demand exists, and since the private-pay price is typically higher than the public-pay reimbursement rate, nursing homes will not have to compete for Medicaid-eligible individuals on the basis of quality since at any quality level a sufficient number of these individuals are available to fill an empty nursing home bed. As a result, nursing homes are able to provide minimal quality of care and still attract as many Medicaid-eligible individuals as they desire.

By eliminating CON and/or moratorium policies, nursing homes may have to compete on quality in order to attract private-pay as well as public-pay individuals. Additionally, elimination of these policies will lead to an increase in supply which will increase access for public-pay individuals since these are the ones who face the excess demand condition. And since nursing homes are also able to discriminate between light-

care and heavy-care individuals, elimination of a supply constraint may also increase access for heavy-care individuals.

Formally stated, the following hypotheses will be tested in this dissertation:

Hypothesis 1: Quality of care is higher in nursing homes in states without CON and/or moratorium policies.

Hypothesis 2: Access to care for Medicaid-eligible individuals is greater in nursing homes in states without CON and/or moratorium policies.

4.2 Description of Data

The data for this dissertation comes from five main sources: (1) the On-Line Survey, Certification, and Reporting (OSCAR) system,[7] (2) state-level Medicaid reimbursement data from the *1998 State Data Book on Long Term Care Program and Market Characteristics* (Harrington, et al. 2000b), (3) surveys of state Medicaid offices and regulation departments conducted during this study, (4) the Area Resource File (ARF), and (5) the Bureau of Economic Analysis' (BEA) Regional Economic Information System (REIS). Sections 4.2.1 through 4.2.4 describe in detail each of these data sources while section 4.2.5 describes the construction of the data set utilized in this research.

[7] Prior to OSCAR, the reporting mechanism was the Medicare/Medicaid Automated Certification System (MMACS).

4.2.1 The OSCAR Data System

The OSCAR data system is a repository for data that is collected by state surveyors for all federally certified Medicare and Medicaid nursing home facilities in the United States. These data are collected and maintained by CMS in order to determine whether or not nursing homes are in compliance with federal regulatory requirements. In order to become certified every facility must have an initial survey to verify compliance. After the initial certification, states are surveyed no less than every 15 months to ensure continued compliance as well as verification of the correction of any previous deficiencies. A nursing home is also required to be surveyed when there is a change in management or organization. Finally, a home may be surveyed as part of a follow-up when a complaint has been filed that alleges substandard care (Harrington, et al. 2000a).

The OSCAR data are collected in three separate files: (1) facility characteristics and staffing data, (2) resident characteristics, and (3) survey deficiencies. Facility characteristics include measures such as size, ownership, certification status, and resident mix while staffing data consists of measures such as the number of full-time equivalent (FTE) RN, LPN, and aide nursing hours. Resident characteristics include measures such as the average number of ADLs of the nursing home's residents and the number of residents with physical restraints. Survey deficiencies are classified into 17 major categories which include resident rights, quality of life, nursing services, and quality of care (Harrington, et al. 2000c).

Recognizing the importance of the accuracy and reliability of survey data used in research, OSCAR data are collected in a two-part process. First, nursing home personnel use standardized forms to record the facility characteristics, resident characteristics and

staffing levels at the beginning of each survey. These reports are then certified by the facility as being correct. This information is given to the state surveyors who audit the data by comparing the facility report with individual resident medical records, staffing records, and observations of residents. Once the review is complete, the state staff enters the data into the OSCAR system. In the second part of the process, the state surveyors decide if the facility has or has not met each federal standard based on information from several sources including, but not limited to, interviews with a sample of residents, family members, and staff as well as a review of resident and facility records. Once a judgment concerning compliance is made, the state surveyor enters the data for each standard into OSCAR. By using standard forms as well as sampling and survey procedures to ensure accuracy, this two-part process assures that state surveyors are determining deficiencies independently of the facility's staff. Furthermore, team members and state supervisors subsequently review the decisions of the state surveyor. Additionally, facilities have the option to challenge and appeal decisions through an administrative review process (Harrington, et al. 2000a).

The use of a database such as OSCAR always brings concerns about survey procedures and the reliability of surveys both across and within states in judging the quality of nursing home facilities. In order to mitigate some of this concern, federal regulations were implemented in 1990 to improve the sampling procedures and survey methods used by the survey teams. The federal procedures require state surveyors to use a stratified random sample of residents to conduct face-to-face interviews, closed record reviews, and individual as well as group structured interviews. CMS also implemented new federal training for state surveyors. Additionally since July 1995, federal surveyors

accompany and observe state surveyors on a selected number of surveys. Through the Health Care Standards and Quality Bureau of CMS, federal survey teams resurvey a sample of facilities within sixty days of the state survey. A "survey concurrence index" is created for what are considered key components from OSCAR for each state. Any state that falls below the concurrence standards are then evaluated and monitored by CMS (Harrington, et al. 2000a).

Although OSCAR is not considered an "ideal" database for research it is currently the most comprehensive, longitudinal information available for all Medicare/Medicaid certified nursing homes in the United States.[8] Section 4.2.5 and its subsections discuss the construction of the sample used in this research, the elimination and cleaning of the OSCAR data, and the merging of the four data files.

4.2.2 State-level Medicaid Reimbursement Data and Certificate of Need and Construction Moratorium Policies

The *1998 State Data Book on Long Term Care Program and Market Characteristics* (Harrington, et al. 2000b) is a book summarizing the findings from a project on state long-term care program and market characteristics conducted by researchers at the University of California, San Francisco, and Wichita State University under a cooperative agreement with CMS and the U.S. Department of Housing and Urban Development. This 1998 version is an update of earlier releases which builds upon a cross-sectional longitudinal data set on long-term care program characteristics for

[8] The Minimum Data Set (MDS) provides a comprehensive assessment of each resident's functional capabilities in each Medicare or Medicaid certified nursing home. A Quality Indicator Report (QI) presents data on 24 "indicators" of quality at the state level. However, this information is only available beginning in 2000.

each state that includes the years 1978-1998. Collected by telephone survey, the data consist of information from three sources: (1) state long-term care providers, (2) state CON and moratorium programs, and (3) Medicaid reimbursement agencies. This book provides the state reimbursement method as well the status of any CON and/or moratorium policy by year. This dissertation uses information for the years 1991-1998 from this book.

For the years 1999-2003 I conducted a survey through telephone and e-mail of each state's Medicaid reimbursement agency and CON/moratorium regulatory agency. For every state I obtained information for each year on whether or not the state had a CON, a moratorium, both, or neither type of regulation. Additionally, I obtained the annual, average Medicaid per diem reimbursement rate for freestanding nursing facilities for every state except New Mexico.[9] Lastly, I obtained the type of reimbursement method utilized for every state for each year which included whether or not the state adjusted the rate based on the case-mix of the residents. Appendix A contains Tables A.3, A.4, A.5, and A6 which display the information on states' CON policies, Medicaid reimbursement methods, whether or not case-mix adjustment is utilized, and Medicaid reimbursement rates for the years 1991-2003, respectively.

The data utilized from these first two sources are not without drawbacks. The primary issue is that the unit of observation in the empirical analysis is the individual nursing home while the reimbursement method, reimbursement rate, and CON policy are measured at the state-level. While the reimbursement method and CON policy are typically assigned at the state-level, using the state-specific average annual

[9] The econometric strategy used to control for the unavailability of New Mexico's rate is discussed in section 4.3.4.3 of this chapter.

reimbursement rate for each nursing home in a state is not ideal. However, using the average, annual per diem rate for the state eliminates the concern of potential endogeneity with a facility's quality level, resident mix and case-mix that would exist if a facility-level reimbursement rate was utilized. The other issue associated with the rate information is that the rates are not necessarily measured with the same precision across states.

4.2.3 The Area Resource File

The Area Resource File (ARF) is a national, county-level health resources information database maintained by Quality Resource Systems, Inc. (QRS) under contract to the National Center for Health Workforce Analysis (NCHWA), Bureau of Health Professions within the Health Resources and Services Administration (HRSA), which is a part of the Department of Health and Human Services (DHHS) (QRS 2006). The file contains statistics on categories of health resources such as: health professions, health facilities, health professions training, and utilization. It also contains specific geographic codes and descriptors as well as information on economic activity, population, and environmental characteristics. These variables come from over 50 primary sources of data including the American Medical Association, the National Center for Health Statistics, and the Bureau of Labor Statistics.

ARF is updated annually and provides data on over 6,000 variables for all counties in the United States. Some variables are carried "historically" while others are "updated" and appear for only a few years. The 2003 version of ARF was used in this study. Previous to the 2001 version, data for Alaska and some independent cities in

Virginia were not assigned to a county. However beginning with the 2001 version, data are broken out for all Virginia independent cities and Alaska boroughs/census areas for all data from 1992 through the current year. Therefore as explained in section 4.2.5.3, I was able to match every OSCAR observation in the final data set with ARF data. The population aged 65 and up per county was used to construct the variable that serves as a proxy for market tightness discussed below in section 4.3.4.2.[10]

4.2.4 The Regional Economic Information System

The Regional Economic Information System (REIS) contains estimates of personal income and employment for local areas that is prepared by the Regional Economic Measurement Division of the Bureau of Economic Analysis (BEA). The variable I obtained is the county per capita personal income for the years 1991-2003 which I then adjusted using the 2003 CPI as the base. Personal income is defined as "the income received by, or on behalf of, all the residents of an area (nation, state, or county) from all sources" (REIS 2005). It consists of the income received by persons from participation in production, government and business transfer payments to persons, and government interest payments to persons. Personal income is the "sum of wage and salary disbursements, supplements to wages and salaries, proprietors' income, dividends, interest, and personal current transfer receipts, less contributions for government social insurance" (REIS 2005). County per capita personal income is then calculated as the

[10] The population data for 2003 was obtained from the U.S. Census Bureau's American Fact Finder at www.census.gov since the 2003 ARF file only contains data through 2002.

personal income of the residents of the county divided by the population of the county as of July 1 of the respective year.

The estimates of county per capita personal income used in this dissertation incorporate the results of a comprehensive revision to the national income and product accounts (NIPAs) released in December 2003 and the annual revision released in July 2004 (REIS 2005). The data come from a new table, CA04 County income and employment summary, 1969-2003, which provides one table with the entire time series of the summary estimates including per capita personal income.

4.2.5 Sample Construction

As described in section 4.2.1, the accuracy of the OSCAR data is dependent upon the accuracy of the facility personnel as well as the state survey team and data entry personnel. Even though CMS attempts to ensure accurate data collection as well as accurate data entry, there was some additional data cleaning required for the final data set. Section 4.2.5.1 describes the procedure used to identify and eliminate duplicate records in the OSCAR data and other data cleaning steps; section 4.2.5.2 describes the procedure used to examine and eliminate observations for obvious reporting errors in the OSCAR data; and section 4.2.5.3 describes the merging of the various data files.

4.2.5.1 Elimination of Duplicate Records and Data Cleaning

The OSCAR data used in this study encompass the years 1991-2003 where each yearly file is a result of a download of the database at a particular point in time. The final data set is a result of appending each of the individual years together into one file. Since

the federal requirement is for each facility to be surveyed every nine to fifteen months it is possible for the same survey date to be in more than one OSCAR file dependent on the point in time that the file download was created.

In order to identify duplicate observations the appended data set was sorted by provider number, facility name, facility address, city, state, and survey date. The observations that had matching values for each of these six variables were identified and marked for further analysis of the actual values of the variables. The record that came from the most recent survey download was kept in the final data set. Additionally, if the values of data were the same for those observations with the same provider number, facility name, and survey date the latest survey date was retained. Otherwise neither observation was eliminated. This process eliminated 16,223 observations.

The data were then analyzed for observations that came from different survey dates but were performed in the same calendar year. Since it is possible for a nursing home to be surveyed anywhere between 9 and 15 months after the initial certification (Harrington, et al. 2000c), rather than simply keeping the observation that came from the latest survey I calculated the number of months between the two surveys in the same year as well as the difference between the last survey in the current year and the last survey in the previous calendar year. If the number of months was greater than 9, both observations were retained. For those observations where the number of months between the surveys in the same year was less than 9 but the difference between the last survey of the current year and the last survey of the prior year was greater than or equal to 16, both observations were also retained. Otherwise only the latest survey in the calendar year was retained. This process eliminated 577 observations from the data set.

4.2.5.2 Data Errors

The OSCAR data were examined for missing values as well as values that appeared to be obvious errors. The means and standard deviations of the data were computed and examined for the main variables of interest. Most of the missing data and errors were found primarily in the reporting of the total number of beds, the total number of residents, and the various staffing variables.

Two problems were associated with the total number of beds. Since the focus of this study is on the Medicaid population, if the total number of beds or the total number of certified beds was equal to the number of Medicare beds the observation was eliminated. Additionally an observation was eliminated if the total number of beds was either missing or less than five.

Several problems were detected with respect to resident data. First, some facilities had missing or zero observations for their total number of residents. These observations were eliminated from the data. Second, some facilities reported extremely low numbers of residents. Observations with less than a 10 percent occupancy rate were considered to be erroneous and were eliminated from the data. Third, some facilities reported more residents than the number of beds, which suggests more than 100 percent occupancy. These observations were eliminated from the data. Finally if the percentage of Medicaid residents was zero or if the percentage of Medicare residents was greater than 70, the observation was eliminated. The latter implies that the facility is considered to be of a primarily rehabilitative care nature (Grabowski 2001a, 2001b).

Several problems were identified with facility staffing data. To create the various staffing measures, the total number of staff hours reported in a two week period was

divided by the total number of residents and by the 14 days in the reporting period to create hours per resident day for each type of staffing measure , RNS, LPNS, AIDES, LICNUR (RNs and LPNs), and NURSTAFF (RNs, LPNs, and aides). Some facilities reported very high levels of staffing hours while others reported very low or no staffing hours. The following decision rules were used to eliminate observations with values that appeared to be either too high or too low.

First, observations with values that exceeded 24 hours per resident day for the staffing variables RNS, LPNS, or AIDES were eliminated. Second, since all facilities are required to have some licensed nurses, observations with values of zero for the variables LICNUR or NURSTAFF were also eliminated because they were thought to be erroneous inputs. Lastly, since current minimum federal standards require that all certified nursing homes with 60 or more beds have an RN on duty for 8 hours a day seven days a week and a licensed nurse (either an RN or LPN) on duty evening and nights (Omnibus Budget Reconciliation Act of 1987), observations with total beds greater than 60 and RNS equal to zero were eliminated as well.

The final adjustment to the OSCAR data was the elimination of hospital-based nursing homes. Since the reimbursement rate used in this study is the annual, average per diem rate for freestanding nursing homes, 24,217 observations on hospital-based nursing homes were eliminated from the final data set.

4.2.5.3 Merging of the Various Data Files

The OSCAR, ARF, and REIS data files were merged together based on the Federal Information Processing Code (FIPS) county code and state code for each

observation. Since the OSCAR data contains a county identifier, it was possible to match the data files together based on the county name, zip code, and FIPS identifiers. The final merged panel data set contains 150,705 observations for the years 1991-2003.

Panel data corrects for several of the issues involved with working with only cross-sectional or time-series data. As noted by Kennedy (Kennedy 2003), two of the most beneficial aspects of panel data are that researchers are able to deal with omitted variable bias and that more variability is created through combining variation across units with variation across time helping to alleviate multicollinearity problems.

4.3. Description of the Variables

The following sections describe the dependent and independent variables selected for the models of quality of care and access to care for nursing homes in the United States.

4.3.1 Nursing Home Quality

Since there is no universally accepted measure of health care quality, this study follows the paradigm of Donabedian and utilizes process, structure, and outcome measures of quality. The process-based measures of quality are the proportion of residents with catheters (PROPCATHETER), the proportion of residents with feeding tubes (PROPPARENTERAL), and the proportion of residents with physical restraints (PROPMOBLREST). While these measures are not actual measures of health status, they are widely used as indicators of negative quality because they suggest that substandard care is being provided to nursing home residents (IOM 1986; Spector and

Takada 1991). For instance, urethral catheterization places residents at greater risk for urinary tract infections often leading to hospitalization while longer-term complications are associated with bladder and renal stones, abscesses, and renal failure (Zinn 1993). Spector and Takada (1991) found that residents in facilities with moderate to high use of urethral catheterization had twice the probability of functional decline compared to residents in low use facilities. The use of feeding tubes often results in complications including self extubation, infections, aspiration, clogging, and pain (Galindo-Ciocon 1993; Zinn 1993). The Institute of Medicine (2001) suggests that as little feeding tube use as possible is beneficial to residents. Finally, the immobility associated with the use of physical restraints may increase the likelihood of pressure ulcers, incontinence, and depression (Zinn 1993). One study finds that physical restraint use is associated with an increased risk of morbidity and mortality in nursing home residents (Phillips, et al. 1993). Besides physical consequences associated with restraints there are often psychological consequences as well (Castle and Mor 1998). Therefore lower levels of physical restraint use indicate higher quality of care.

The structure-based measures of quality are the number of registered nurse hours per resident day (RNS), the number of licensed practical nurse hours per resident day (LPNS), the number of aide hours per resident day (AIDES), the number of licensed nurse hours per resident day (LICNUR), and the number of nursing staff hours per resident day (NURSTAFF). The first three staffing measures are not considered substitutes for one another since they require different levels of training and certification and each type actually has various levels of care that they are permitted to administer. The second two measures of staffing are included to give a more general measure of the

types of care available to residents. Staffing intensity is often used as an indicator of positive nursing home quality since more staffing is likely to be associated with an improved quality of life for residents since they are receiving more individual attention. As is the case of most of the nursing home quality literature, the use of these structure-based measures assumes that more staffing implies higher quality rather than more inefficiency since the majority of nursing homes are for-profit facilities which focus on cost minimization (Zinn 1994).

The outcome measure of quality is the proportion of residents with pressure sores (PROPPRESSORE). Pressure sores (decubitis ulcers) are an injury to the skin and nearby tissue. They occur most often in bony areas such as the hips, heels, or tailbone and are caused by constant pressure on the skin. People confined to a bed or chair and unable to move are at greatest risk for developing pressure sores, which makes the elderly population in a nursing home vulnerable to such a condition. Pressure sores are found to be associated with an increased rate of morbidity and mortality (Allman 1989; Brandeis, et al. 1990). Pressure sores are often used as a measure of negative nursing home quality since they are treatable and preventable conditions even though they occur frequently (Grabowski 2001b; Harrington, et al. 2000c; Smith 1995).

The final measure of quality is the total number of facility deficiencies (DEFS1TOT). This measure is considered composite-based because it is based on 180 survey items that include structural, procedural, and outcome measures of quality that represent the standards of nursing home quality (Harrington, et al. 2000a). When a facility fails to meet one of the standards, a deficiency or citation is given to the facility.

Penalties are often severe depending on the type and number of deficiencies and can result in civil penalties as well as the extreme outcome of facility closure.

Unfortunately the OSCAR data do not allow a determination of how much of the proportion of residents with a urethral catheterization, with tube feeding, with a physical restraint, with pressure sores, or how many deficiencies or staffing hours are attributable to Medicaid residents and which are attributable to private-pay residents. It is assumed therefore that the measures are distributed proportionally among public and private-pay residents in a facility. This seems to be a plausible assumption since there is a legal restriction that facilities provide the same level of quality to all nursing home residents.[11]

4.3.2 Nursing Home Access

The percentage of Medicaid residents in a facility (PCTMCAID) is the measure of access in this dissertation. Based on Scanlon's model of a monopolistic competitor, a nursing home will admit a private-pay individual before a Medicaid-eligible individual due to the higher private-pay price. If a CON or moratorium is binding, excess demand will exist and it will be Medicaid-eligible individuals who are unable to obtain a nursing home bed (Scanlon 1980b). Therefore it is expected that the elimination of CON and/or moratorium policies will lead to a higher percentage of Medicaid residents.

Additionally, I use the variable ADLINDEX which is a measure of resident acuity (described in detail in Section 4.3.4.1 below) as a measure of access to care for heavy-care residents. I expect to find that if CON and/or moratorium policies are effective in

[11]The State Operations Manual Guideline §483.12(c) states "Identical policies and practices concerning services means that facilities must not distinguish between residents based on their source of payment when providing services that are required to be provided under the law" (Health Care Financing Agency 1995)

constraining supply the ADLINDEX will be lower in those states retaining these types of policies.

4.3.3 Certificate of Need and Construction Moratorium Policy

The main variable of interest in this dissertation is the presence of a CON and/or a moratorium policy. The primary goal of CON and construction moratorium policies is to retard the growth of health care costs by preventing the "unnecessary" expansion of nursing home beds. In effect these types of policies imply that fewer nursing home beds will lead to fewer Medicaid residents in the nursing homes which in turn lead to lower Medicaid expenditures. However a recent study has shown that these types of policies do not have a large impact on constraining Medicaid expenditures (Grabowski, et al. 2003).

Although these policies theoretically restrict or prohibit growth in the nursing home market it is not always the case in practice. Many states have exceptions for their moratorium policy that allows for additional beds or expansion if it is deemed a critical need. Additionally, my survey of states' regulatory agencies indicates that states vary on the restrictiveness of their CON policies. In some states the CON actually acts as a moratorium while in other states it appears that the CON is simply a formality and most applications for additional or new beds get approved. For this dissertation I use a dummy variable to represent whether or not a state does not have a CON and/or moratorium policy (CON_MORT) for each year since the time it would take to ascertain the degree of complexity of each state's policies was prohibitive. Table A.3 in Appendix A shows the compilation of information on states' regulatory policies for the years 1991-2003. I expect to find higher quality and more Medicaid residents in nursing homes in states

without a CON and/or moratorium policy relative to those states with this type of regulation.

4.3.4 Other Independent Variables

Several facility, market, and state-level exogenous variables are included to control for economic and demographic conditions that may influence the quality of care and access to care in nursing homes. The following sections describe these variables in detail.

4.3.4.1 Facility-level Characteristics

The first facility-level characteristic is the total number of beds in a facility (TOTBEDS). This variable represents the size of the facility. As described in the literature review on quality, size has been shown to be both a positive and negative indicator of quality. With respect to access, previous research has not directly controlled for the size of the facility. However, one might expect that a facility with a greater number of beds will have more Medicaid residents relative to a facility with fewer beds if excess demand is not an issue. Therefore I control for the total number of beds in the facility since the facilities in the data set are of varying sizes.

The second facility-level characteristic represents the nursing home's ownership type. Two dummy variables represent if the facility is nonprofit (CONTROL2) or government owned (CONTROL3) with for-profit the omitted category. With respect to access, previous research either supports the theory that nonprofit homes will be more oriented toward private-pay and Medicare residents than Medicaid residents and that for-

profit homes will be more inclined to admit Medicaid residents or that that nonprofits may rely more heavily on Medicaid residents as a source of revenue and therefore have more Medicaid residents than private-pay as discussed in section 3.2.2.3 of the literature review. In conjunction with ownership type, I include a dummy variable that controls for whether or not the nursing home is part of a multi-chain facility (MULTI). While there is not much literature that addresses the impact of chain ownership on quality of care or access to care, the industry has moved in the direction of mergers in the last several years and therefore I control for this feature.

The final variable to control for facility-level characteristics is really a resident-level characteristic. Nursing homes serve different types of residents requiring different levels of care. Studies usually include a measure of "resident acuity" to serve as an indicator of the severity of a resident's functional condition. One of the most widely used measures of resident acuity is the activities of daily living (ADL) index developed by Katz (1963). This index summarizes a resident's over-all performance in six functions: bathing, dressing, toileting, transferring, continence, and eating. The measure of resident acuity used in this dissertation (ADLINDEX) is calculated by summing various levels of dependencies in eating, toileting, transferring, and mobility which are weighted by the respective proportion of residents.[12] The result is an index of the average functioning level for the residents in each facility for each year. The higher the value of the index the more dependent the resident is in the functions mentioned above.

[12] This index is calculated based on the formula used in the 2002 Nursing Home Statistical Yearbook published by Cowles Research Group.

4.3.4.2 Market-level Characteristics

The county in which the nursing home is located is used to approximate the market in this dissertation. Most economic studies have used the county as a proxy for the nursing home market (Cohen and Spector 1996; Gertler 1992; Nyman 1985; Zinn 1994). Nyman found that 80 percent of residents in facilities in Wisconsin chose a nursing home in the same county in which the resident had previously lived. Gertler found that 75 percent of residents in New York facilities had previously lived in the same county as the nursing home. As noted by Banaszak-Holl, et al. (1996) the county can be considered a good approximation of the market for nursing home care based on the patterns of funding and resident origin. For instance, federal block grants for long-term care services are distributed at the county level. While it has been argued that resident-origin data are preferable to county boundaries in delineating nursing home markets (Zwanziger, et al. 2002), the OSCAR data do not provide resident-origin data.

The first market-level characteristic, EMPTYELDERLY, is the number of empty nursing homes beds per 1,000 noninstitutionalized elderly (aged 65+) in a county. This variable serves as a proxy for the presence of excess demand and attempts to account for the tightness of the market. A bed constraint is assumed to be more restrictive in those markets with fewer empty beds and less restrictive in those markets with more empty beds. While it would be desirable to control for the number of Medicaid-eligible individuals in a given market who are waiting to obtain a nursing home bed due to a CON or construction moratorium law, this information is not available in the data used in this dissertation and other economic analyses. Since it is not clear that CON and moratorium policies are always binding and that the occupancy rates in many areas are

declining, controlling for excess demand helps alleviate the concern that nursing home occupancy rates fluctuate from state to state and from year to year. In 2003, the three states with the highest occupancy rate were Hawaii (97.6%), Vermont (98.8%), and Rhode Island (92.3%) while the three with the lowest rate were Oregon (70.1%), Montana (70.1%), and Oklahoma (67.1%). It is also true that each of these states had CON or moratorium policies in place during the entire study period demonstrating that these policies do not imply a condition of excess demand for nursing home beds.

The other two market characteristics included in this analysis represent exogenous demand variables. The first is the county per capita personal income, adjusted for 2003 dollars (INCOME). The average per capita personal income during the time of this study was $27, 280. The second characteristic is a Herfindahl index to measure the concentration of the market (HHI). This index is constructed by summing the squared market shares of all nursing home facilities in the county. The index ranges from 0 to 1 with higher values signifying a more concentrated market.

4.3.4.3 State-level Characteristics

Two variables represent state-level characteristics. The first is the type of Medicaid reimbursement method utilized by the state in which the nursing home is located. The five basic methods of reimbursement are described in detail in Chapter 2, section 2.3.1. In this study a retrospective method is represented by METHOD0; prospective facility-specific is METHOD1; prospective class (flat-rate) is METHOD2; adjusted is METHOD3 (the omitted category); and combination is METHOD4. Since the retrospective method is the most generous type of reimbursement and prospective

class the least generous, these dummy variables provide a test of the effect of reimbursement on quality of care and access to care. Additionally, a dummy variable is included for those states that employ case-mix reimbursement methods which pay different rates based on a nursing home's mix of resident acuity and the costs of caring for those residents' needs. While each state's reimbursement method can be quite complex, these variables attempt to capture the main differences in reimbursement methodologies. Tables A.4 and A.5, respectively, in Appendix A display the reimbursement method and whether or not case-mix is utilized for the years 1991-2003. I expect to find that those nursing homes in states that employ a more restrictive reimbursement method have fewer Medicaid residents and lower quality than those nursing homes in states with a more generous method.

The second state-level characteristic is the annual, average per diem Medicaid reimbursement rate (RATE). The use of each facility's specific reimbursement rate would be endogenous to that facility's quality level. Since no one nursing home can influence the state's reimbursement rate, using the average state Medicaid rate is exogenous at the facility level. In order to account for the fact that I was unable to obtain 1999-2003 rates for the state of New Mexico, I created a dummy variable (RATEMISSING) that equals one for each of the observations with a missing reimbursement rate. For those same observations the variable RATE is set equal to zero.

I expect to find that an increase in the reimbursement rate leads to an increase in the access to care for Medicaid residents. With respect to quality, early literature showed that an increase in the reimbursement rate lead to a decrease in quality (Gertler 1989, 1992; Nyman 1985, 1988a, 1988b, 1989b) while more recent evidence suggests that an

increase in the payment rate leads to an increase in quality (Grabowski 2001a, 2001b, 2004). This later result has been attributed to changes over time in the market for nursing home care related to the decline in nursing home utilization (Bishop 1999) possibly due to the availability of nursing home substitutes. I expect to find that an increase in the reimbursement rate has a positive effect on quality of care. Table A.6 in Appendix A displays the average, annual Medicaid per diem rate for each state for the years 1991-2003.

4.4 Methodology

The first part of the analysis conducted is the summary statistics of the final sample. This information provides a general idea of the population under study through the means and standard deviations of the variables of the access to care and quality of care models. The next two sections describe the methods as well as the specification of the models used in this study.

4.4.1 State Fixed Effects and Model Specification

In order to examine the effect of CON and/or construction moratorium policies on quality of care and access to care, I first estimate a state fixed effects model of the following form:

$$y_{ist} = \alpha + \beta CON\_MORT_{ist} + \delta x_{ist} + d_t + \gamma_s + \upsilon_{it}, \qquad (1)$$

where y_{ist} is the outcome (quality or access) of nursing home *i* in state *s* at time *t*, CON_MORT_{ist} is a binary variable indicating if the nursing home is in a state *s* without a CON and/or moratorium policy at time *t*; x_{ist} is the vector of facility, market, and state-

level characteristics discussed above; d_t is a vector of year dummy variables, γ_s is a vector of state dummy variables; and $\upsilon_{it} \equiv c_i + \mu_{it}$ which is often referred to as the composite error term. In panel data analysis and in this model in particular c_i represents an unobserved, time-constant variable for the individual nursing home such as administrative ability or location. For each *t*, υ_{it} is the sum of the unobserved effect (c_i) and the idiosyncratic error (μ_{it}). The year dummies control for factors that are common across all states in a particular year such as federal nursing home policies and technological advances in health care. The state fixed effects control for any factors that are specific to a state that remain invariant over time such as political sentiments and geographic characteristics. This strategy purges the unobserved and potentially confounded cross-sectional heterogeneity by relying on within state variations in CON and moratorium policies over time, and by using those states that did not change policy as a control for unrelated time-series variations (Grabowski, et al. 2003).

Estimation of equation (1) is achieved by using pooled OLS which ignores the panel structure of the data and treats the observations as being serially uncorrelated for a given nursing home with homoskedastic errors across nursing homes and years. The restrictive assumption of OLS when estimating equation (1) is that not only are the idiosyncratic error terms uncorrelated with the explanatory variables in each time period but the unobserved effect, c_i, is also uncorrelated with the explanatory variables. The resulting estimated coefficient of β will be the difference over time in the average of the outcome of interest between those states without CON and/or moratorium policies and those states that still have these policies. An alternative interpretation is that β measures the change in the outcome of interest when a state eliminates its CON and/or moratorium

policy. Based on the underlying identification of the models, the resulting coefficient is the effect of CON_MORT.

4.4.2 Facility Fixed Effects and Model Specification

Quite often the point of using panel data is to allow the unobserved effect (c_i) to be arbitrarily correlated with the x_{ist}. The second method of estimating the effect of CON and/or construction moratorium policies on quality of care and access to care is based on this concept. This method starts with equation (1) written as:

$$y_{ist} = \alpha + \beta CON\_MORT_{ist} + \delta x_{ist} + d_t + c_i + \mu_{it.} \qquad (2)$$

The fixed effects transformation, also called the within transformation, is obtained by first averaging equation (2) over t = 1,…., T to get the cross section equation

$$\bar{y}_{is} = \alpha + \beta \overline{CON\_MORT}_{is} + \delta \bar{x}_{is} + \bar{d} + c_i + \bar{\mu}_i \qquad (3)$$

where $\bar{y}_{is} = \frac{1}{T}\sum_{t=1}^{T} y_{ist}$, $\overline{CON\_MORT}_{is} = \frac{1}{T}\sum_{t=1}^{T} CON\_MORT_{ist}$, $\bar{x}_{is} = \frac{1}{T}\sum_{t=1}^{T} x_{ist}$,

$\bar{d} = \frac{1}{T}\sum_{t=1}^{T} d_t$, and $\bar{\mu}_i = \frac{1}{T}\sum_{t=1}^{T} \mu_{it}$. When equation (3) is subtracted from equation (2) for each *t*, the result is:

$$(y_{ist} - \bar{y}_{is}) = \beta(CON\_MORT_{ist} - \overline{CON\_MORT}_{is}) + \delta(x_{ist} - \bar{x}_{is}) + (d_t - \bar{d}) + (\mu_{ist} - \bar{\mu}_{is})$$

or $\ddot{y}_{ist} = \beta \ddot{CON\_MORT}_{ist} + \delta \ddot{x}_{ist} + \ddot{d}_t + \ddot{\mu}_{it}$ (4)

where $\ddot{y}_{ist} = (y_{ist} - \bar{y}_{is})$ is the time-demeaned data on y, and similarly for $\ddot{CON\_MORT}_{ist}$, $\ddot{x}_{ist}$, $\ddot{d}_t$ and $\ddot{\mu}_{it}$. This fixed effects equation, referred to as the facility fixed effects

model, is estimated using the panel data fixed effects command (xtreg, fe) in Stata S/E 9. The resulting fixed effects estimator is the pooled OLS estimator from equation (4). The same results are obtained as those that would be returned if equation (2) was modified to include a vector of facility dummy variables and then estimated by OLS.

This model assumes strict exogeneity of the explanatory variables conditional on c_i: $E(\mu_{it}|x_{is},c_i) = 0$, t=1,…T. In other words, the explanatory variables in each time period are uncorrelated with the idiosyncratic error term in each time period. The difference between the state fixed effects model and the facility fixed effects model is that the fixed effects estimator allows for arbitrary correlation between c_i and the explanatory variables in any time period. However, one drawback of this type of model is that time-constant explanatory variables cannot be included in x_{ist}. The strategy for estimating β (and δ) is to transform the original equation to eliminate the unobserved effect c_i. However, this also results in the elimination of any other time-invariant variables. This is the reason why equation (2) does not include the vector of state dummy variables. This type of transformation is commonly referred to as the within transformation because the unobserved effect is differenced out of the equation and exploits the panel nature of the data set and relies on variation within facilities. While equation (4) is the estimating equation, "the interpretation of β comes from the (structural) conditional expectation $E(y_{it}|\mathbf{x}_i,c_i) = E(y_{it}|\mathbf{x}_{it},c_i) = \mathbf{x}_{it}\beta + c_i$" (Wooldridge 2002). This implies that the resulting estimated coefficient of β is interpreted based on equation (2).[13] This fixed effects estimator, referred to as the within estimator, will be the difference over time in the average of the outcome of interest between those nursing homes that are in states that do

[13] It is important to recognize that the interpretation of β is the same for equations (1) and (2).

not have a CON and/or moratorium policy and those nursing homes in states that have such a policy.

The estimation strategy in both the state fixed effects and facility fixed effects models as described above are variants of the difference-in-differences model. A study that uses a difference-in-differences model examines an outcome measure for observations in treatment groups and comparison groups that are not randomly assigned. The treatment group is the one that experiences an exogenous event, such as a policy change, and the control group is the one that does not experience the event. This method allows a researcher to examine the difference before and after the treatment between those in the treatment groups and those in the comparison groups for the outcome variable of interest. In this dissertation, the outcome variable is either quality of care or access to care and the treatment is the removal of a state's CON and/or construction moratorium policy. As a result of this definition, the treatment groups are states without CON and/or moratorium policies and the comparison groups are states with a CON and/or construction moratorium policy in place.

Using the specification in Meyer (1995), the following equation represents the general form of the difference-in-differences estimation with a treatment group and a comparison group before and after the treatment:

$$y_{it}^{j} = \alpha + \alpha_1 d_t + \alpha^1 d^j + \beta d_t^j + \delta z_{it}^j + \varepsilon_{it}^j, \qquad (5)$$

where y_{it}^{j} is the outcome of individual i at time t indexed by j for the group, $d_t = 1$ if $t = 1$ (after treatment) and 0 otherwise, $d^j = 1$ if $j = 1$ (in the treatment group) and 0 otherwise, $d_t^j = 1$ if $t = 1$ and $j = 1$ and 0 otherwise, z_{it}^j is a vector of characteristics of the unit under study, and ε_{it}^j is the random error term. The resulting estimated coefficient of β is the

difference-in-differences estimator, i.e., $\hat{\beta}$ is the difference over time in the average difference of the outcome of interest between the treatment group and the control group.

For the models in this study the term βCON_MORT_{ist} captures the intended effect of $\alpha_1 d_t + \alpha^1 d^j + \beta d_t^j$ from equation (5) since it represents whether or not the nursing home is in a state without a CON and/or moratorium policy at time *t* (whether or not the nursing home is in the treatment group at time *t*). The resulting coefficient of β represents the difference over time in the average of the outcome of interest between those nursing homes that are in states without a CON and/or construction moratorium policy and those states still retaining such policies.

One last point concerning the resulting inference statistics must be mentioned. The "grouped" nature of the explanatory variable of interest may have introduced heteroskedasticity and biased the estimates of the standard error. Moulton (Moulton 1990) shows that when aggregate variables are regressed on micro units (a "grouped" structure) the estimates of the standard errors will be biased downward. For both the state and facility fixed effects models, I use the cluster option which adjusts the standard errors using the Hubert-White robust estimator and corrects for intra-home cluster correlations. The cluster option relaxes the assumption of independence of the observations and requires that the observations only be independent across the clusters (in this study the individual nursing homes).

Chapter Five

Research Results

This chapter describes the estimation results of the quality of care and access to care models. The first section of this chapter describes the summary statistics of the final data set. Sections 5.2 and 5.3 describe the results of the effect of CON and/or construction moratorium policies on the quality of care and access to care in the nursing home market, respectively. For brevity, the partial results of the models are shown in Tables 2 through 6 in the respective sections while the full results of the models are included in Appendix A. Subsections 5.2.1.1, 5.2.2.1, 5.2.3.1 and 5.3.1 discuss other interesting findings while section 5.4 discusses the results of an alternative model and an alternative method of identifying excess demand to check for robustness.

5.1 Nursing Home, County, and State-level Characteristics (1991-2003)

Table 1 on the following page shows the descriptive statistics for the final data set. Between 1991 and 2003 there were 150,705 surveys of 15,892 free-standing nursing homes in the United States. Each facility was surveyed an average of 9.48 times between 1991 and 2003. The mean number of surveys in each year was 11,593, with a high of 12,817 in 1996 and a low of 8,623 in 2003[14]. The average number of nursing home

[14] The lower number of surveys in 2003 is due to the timing of the 2003 OSCAR file download.

Table 1

Nursing Home, County, and State-level Characteristics (1991-2003)[a]

Variable	Description	N	Mean	Overall SD	Within SD
Access Measure					
PCTMCAID	Percent of Medicaid residents	150,705	68.94	18.59	8.45
Quality Measures					
PROPPRESSORE	Proportion of residents with decubitus ulcer	150,571	0.07	0.05	0.04
PROPPARENTERAL	Proportion of residents with feeding tubes	150,571	0.06	0.06	0.03
PROPCATHETER	Proportion of residents with catheters	150,571	0.07	0.05	0.04
PROPMOBLREST	Proportion of residents with physical restraints	150,571	0.16	0.15	0.12
DEFS1TOT	Number of health deficiencies	150,670	6.81	7.24	5.81
RNS	Registered nurse (RN) hours per resident day	150,705	0.34	0.31	0.19
LPNS	Licensed practical nurse (LPN) hours per resident day	150,705	0.68	0.41	0.28
AIDES	Nurses' aides hours per resident day	150,705	2.14	1.01	0.73
LICNUR	RN and LPN hours per resident day	150,705	0.94	0.43	0.29
NURSTAFF	RN, LPN, and aide hours per resident day	150,705	2.91	1.08	0.77
Facility Characteristics					
TOTRES	Number of residents	150,705	94.17	49.69	11.50
CENMCAID	Number of Medicaid residents	150,705	65.50	41.16	11.25
CENMCARE	Number of Medicare residents	150,705	6.48	7.80	4.74
CENOTHER	Number of private-pay residents	150,705	22.19	19.49	8.62
TOTBEDS	Total number of beds	150,705	109.59	55.64	9.42
CONTROL1	=1 if for-profit facility (base)	150,705	0.74	0.44	0.12
CONTROL2	=1 if nonprofit facility	150,705	0.22	0.41	0.12
CONTROL3	=1 if government facility	150,705	0.04	0.20	0.05
MULTI	=1 if chain facility	150,705	0.56	0.50	0.24
ADLINDEX	ADL index	150,571	9.80	1.52	0.89
Market (County) Characteristics					
POP65UP	Elderly population (aged 65+)[b]	150,705	77,761	165,169	5,937
EMPTYELDERLY	Number of empty beds per 1000 noninstitutionalized elderly[d]	150,705	8.39	10.00	4.57
INCOME	Per capita personal income (2003 $)[c]	150,705	27,280	7,114	2,193
HHI	Herfindahl-Hirschman index	150,705	0.25	0.27	0.08
State-level Characteristics					
CON_MORT	State does not have CON and/or moratorium policy (=1 if yes)[e]	150,705	0.15	0.36	0.14
RATE	Average, annual Medicaid per diem reimbursement rate (2003 $)[e]	150,705	104.00	25.70	11.42
RATEMISSING	=1 when New Mexico's rate is missing	150,705	0.002	0.04	0.03
METHOD0	=1 if state uses retrospective reimbursement[e]	150,705	0.03	0.16	0.11
METHOD1	=1 if state uses prospective, facility-specific reimbursement[e]	150,705	0.34	0.47	0.24
METHOD2	=1 if state uses prospective, class reimbursement[e]	150,705	0.14	0.35	0.13
METHOD3	=1 if state uses prospective, adjusted reimbursement[e] (base)	150,705	0.43	0.49	0.20
METHOD4	=1 if states combines retrospective and prospective reimbursement[e]	150,705	0.06	0.25	0.12
CASEMIX	=1 if state uses case-mix Medicaid reimbursement[e]	150,705	0.53	0.50	0.25

[a]The data are from the Online, Survey, Certification, and Reporting (OSCAR) system unless otherwise noted.
[b]This variable is from the Area Resource File (ARF).
[c]This variable is from the Bureau of Economic Analysis' (BEA) Regional Economic Information System (REIS).
[d]This variable is constructed using OSCAR and ARF files.
[e]These variables are from the *1998 State Data Book on Long-Term Care Program and Market Characteristics* (Harrington, et al. 2000b) and the author's state surveys.

residents is 94, with 25 percent private-pay residents, 69 percent Medicaid residents, and 6 percent Medicare residents.

The percentage of for-profit, nonprofit, and government nursing homes in the sample is 74 percent, 22 percent, and 4 percent respectively. In recent years there has been quite a bit of merger activity in the nursing home industry. In this sample 56 percent of the nursing facilities were owned by a chain.

The average, annual per diem Medicaid reimbursement rate between 1991 and 2003, in 2003 dollars, was $104.00. With respect to the reimbursement method utilized to set rates, 3 percent of the sample used a retrospective method, 34 percent used a prospective, facility-specific method, 14 percent used a prospective, class method, 43 percent used a prospective, adjusted method, and 6 percent used a combination method. Additionally, 53 percent of the states in the sample adjusted for the case-mix of the facility's residents.[15]

5.2 The Effect of Certificate of Need and Construction Moratorium Policies on the Quality of Care in Nursing Homes

The results for the process, structure, and outcome measures of quality are discussed separately in the following sections. Section 5.2.1 discusses the results of the process-based measures of quality, section 5.2.2 the outcome and composite-based measures, and section 5.2.3 the structure-based measures.

[15] Descriptive statistics by CON_MORT are in table A.7 in Appendix A.

5.2.1 Process Measures of Quality

The results for each of the estimations for the process-based measures of quality in the state and facility fixed effects models show that nursing homes in those states without a CON and/or construction moratorium policy (CON_MORT) have a lower proportion of residents that have urethral catheters (PROPCATHETER), a lower proportion of residents with feeding tubes (PROPPARENTERAL), and a lower proportion of residents with physical restraints (PROPMOBLREST). Alternatively the resulting coefficient of CON_MORT in both models can be interpreted as those nursing homes in states eliminating a CON and/or moratorium policy have an improvement in quality. As shown in Table 2 on the following page, all of the results (except for the state fixed effect model for PROPPARENTERAL) are statistically significant at the 5 percent level or better. Using this type of quality measure, these results suggest that nursing homes in states without CON and/or moratorium policies have higher quality than those states with this type of regulation. These results hold while controlling for the excess demand of the nursing home's market and support the hypothesis that the elimination of CON leads to higher quality of care.

5.2.1.1 Other Findings

The annual, average per diem Medicaid reimbursement rate (RATE) is negative for all models. However, the coefficient is only statistically significant for the PROPARENTERAL facility fixed effects model and both the state and facility fixed effects for the PROPMOBLREST models. While early studies investigating the

Table 2

Main Regression Results for Process-Based Quality Models

Dependent Variable	PROPCATHETER		PROPPARENTERAL		PROPMOBLREST	
	State Fixed Effects	Facility Fixed Effects	State Fixed Effects	Facility Fixed Effects	State Fixed Effects	Facility Fixed Effects
Explanatory Variables	**Coefficient (Std Error)[a]**	**Coefficient (Std Error)[a]**	**Coefficient (Std Error)[a]**	**Coefficient (Std Error)[a]**	**Coefficient (Std Error)[a]**	**Coefficient (Std Error)[a]**
CON_MORT	-0.00957 (0.00132)***	-0.01037 (0.00133)***	-0.00096 (0.00111)	-0.00194 (0.00099)**	-0.05028 (0.00321)***	-0.04827 (0.00325)***
RATE	-0.00002 (0.00003)	-0.00002 (0.00003)	-0.00004 (0.00003)	-0.00004 (0.00002)*	-0.00061 (0.00008)***	-0.00063 (0.00008)***
CONTROL2	-0.01008 (0.00072)***	-0.00278 (0.00111)**	-0.01040 (0.00093)***	-0.00091 (0.00093)	0.00309 (0.00151)*	0.01006 (0.00324)***
CONTROL3	-0.00772 (0.00141)***	-0.00069 (0.00282)	-0.00241 (0.00252)	-0.00098 (0.00165)	0.01414 (0.00339)***	0.01138 (0.00791)
METHOD0	-0.00122 (0.00172)	-0.00133 (0.00171)	-0.00119 (0.00149)	-0.00034 (0.00127)	0.01015 (0.00451)**	0.013562 (0.00457)***
METHOD1	0.00154 (0.00080)*	0.00094 (0.00077)	-0.00275 (0.00067)***	-0.00274 (0.00057)***	0.01518 (0.00183)***	0.01701 (0.00183)***
METHOD2	-0.00370 (0.00158)**	-0.00567 (0.00154)***	0.00236 (0.00135)*	0.00121 (0.00126)	0.04824 (0.00357)***	0.04961 (0.00360)***
METHOD4	-0.00177 (0.00132)	-0.00214 (0.00129)*	0.00114 (0.00120)	0.00079 (0.00105)	0.00679 (0.00337)**	0.00772 (0.00339)**
CASEMIX	0.00195 (0.00064)***	0.00252 (0.00061)***	-0.00380 (0.00059)***	-0.00181 (0.00049)***	0.01002 (0.00166)***	0.01198 (0.00168)***
N	150,571	150,571	150,571	150,571	150,571	150,571
R^2	0.1449	0.0535[b]	0.2941	0.0785[b]	0.2351	0.1571[b]
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.

[b]This value is the R^2 within.

*p < .10 **p < .05 ***p < .02

relationship between reimbursement rate and quality found that under conditions of excess demand an increase in the rate actually decreased quality (Gertler 1989, 1992; Nyman 1985, 1988b, 1989b), these results support the findings of more recent work that uses panel data and finds that an increase in the reimbursement rate actually improves quality (Cohen and Spector 1996; Grabowski 2001a, 2001b). While the *absolute* magnitude of the results is relatively small, the *relative* size of the estimates is fairly substantial. The Medicaid rate elasticity of quality implied by the estimate from the PROPMOBLREST model is -0.40 which says that a 10 percent increase in the Medicaid rate is associated with a 4 percent decrease in the proportion of residents with physical restraints.[16]

Ownership appears to be a significant determinant of process-based quality of care. The results indicate that nonprofit nursing homes (CONTROL2) have fewer residents with catheters and feeding tubes compared to for-profit nursing homes (the base group). However, nonprofit facilities have more residents with physical restraints. Government-owned nursing homes (CONTROL3) follow the same pattern as nonprofit facilities. Perhaps these results support the belief that since nonprofit nursing homes experience higher costs and higher costs indicate higher quality (and not less efficiency) money is being spent on providing more personal care to residents rather than the use of more mechanical methods of care. The positive result on PROPMOBLREST is perhaps attributed to a higher level of resident dependency.

In the PROPCATHETER model, a prospective, facility-specific reimbursement method (METHOD1) leads to a higher proportion of residents with urethral catheters

[16] The elasticity is calculated at the mean of the Medicaid reimbursement rate.

compared to an adjusted method (the base group) but only in the state fixed effects model. A prospective, class reimbursement method (METHOD2) leads to a lower proportion in both the state and facility fixed effects models. Having a retrospective or combination method has no significant impact on the proportion of residents with catheters compared to an adjusted method.

In the PROPPARENTERAL model, states that use a prospective facility-specific reimbursement method (METHOD1) have a lower proportion of residents with a feeding tube compared to an adjusted method in both the state and facility fixed effects models. Having a prospective class method leads to a higher proportion of residents with feeding tubes but is only significant in the state fixed effects model. Once again having a retrospective or combination method has no significant impact on the proportion of residents with catheters compared to an adjusted method.

In the PROPMOBLREST model all the methods have a statistically significant higher proportion of residents physically restrained than compared to those states using an adjusted method. These results indicate that all methods other than adjusted lead to lower quality.

Additionally, the coefficients on CASEMIX tell us that states that use a case-mix adjustment in setting their rates have a lower proportion of residents with feeding tubes but a higher proportion of residents with catheters and physical restraints. The results are statistically significant at the 1 percent level in each of the state and facility fixed effects models. Based on the process-based measures of quality used in this study, the evidence is not conclusive that one method of reimbursement encourages higher quality than another or that having case-mix adjustment always improves quality of care.

5.2.2 Outcome and Composite Measures of Quality

The results for both the outcome and composite-based models are displayed in Table 3 on the following page. The results of the outcome-based model of quality show that there is no significant effect of CON and/or construction moratorium policy on the proportion of residents with pressure sores (PROPPRESSORE). These results hold for both the state and fixed effects models. This result is not consistent with the hypothesis that there will be higher quality of care in those states without CON policies. One possible explanation is that the emphasis placed on the importance of the prevention and treatment of pressure sores (IOM 2001; OEI 1999; Smith 1995) leads to more attention to this condition by nursing staff in all states.

For the composite-based facility fixed effects model, nursing homes in those states that do not have a CON and/or moratorium policy have more total deficiencies (DEFS1TOT), which indicates lower quality, than those states with these policies. This result does not support the hypothesis of higher quality in nursing homes in states without CON and/or construction moratorium policies. Perhaps those states that have CON and/or moratorium policies place greater emphasis on training nursing home staff or have strong local attitudes toward the importance of maintaining quality of care in nursing homes, such as ombudsman programs, than those states without such policies.

5.2.2.1 Other Findings

The annual, average per diem Medicaid reimbursement rate is negative in both the outcome and composite-based models. An increase in the rate decreases the proportion

Table 3

Main Regression Results for Outcome and Composite-Based Quality Models

Dependent Variable	Outcome-Based PROPPRESSORE		Composite-Based DEFSITOT	
	State Fixed Effects	Facility Fixed Effects	State Fixed Effects	Facility Fixed Effects
Explanatory Variables	**Coefficient (Std Error)[a]**	**Coefficient (Std Error)[a]**	**Coefficient (Std Error)[a]**	**Coefficient (Std Error)[a]**
CON_MORT	0.00081 (0.00109)	0.00032 (0.00104)	0.11049 (0.15330)	0.34217 (0.14785)**
RATE	-0.00018 (0.00002)***	-0.00018 (0.00002)***	-0.00801 (0.00370)**	-0.11655 (0.00366)*
CONTROL2	-0.00752 (0.00048)***	0.00036 (0.00106)	-1.33765 (0.06161)***	0.10461 (0.16863)
CONTROL3	-0.00701 (0.00102)***	0.00244 (0.00201)	-1.46497 (0.11455)***	-0.74093 (0.44590)*
METHOD0	-0.00213 (0.00144)	-0.00191 (0.00143)	-0.34340 (0.19223)*	-0.09740 (0.19073)
METHOD1	9.75e-06 (0.00073)	0.00015 (0.00072)	1.04717 (0.11105)***	1.18294 (0.11003)***
METHOD2	-0.00112 (0.00123)	-0.00165 (0.00123)	1.11955 (0.17030)***	1.32699 (0.17023)***
METHOD4	-0.00085 (0.00110)	-0.00094 (0.00111)	-0.01786 (0.16576)	0.01779 (0.16702)
CASEMIX	0.00008 (0.00058)	0.00090 (0.00057)	0.46302 (0.08352)***	0.49594 (0.08272)***
N	150,571	150,571	150,537	150,537
R^2	0.1209	0.0142[b]	0.1830	0.0441[b]
Prob > F	0.0000	0.0000	0.0000	0.0000

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.
*p < .10
**p < .05
***p < .01
[b]This value is the R^2 within.

of residents with pressure sores and the total number of facility deficiencies. This negative relationship is statistically significant at the 10 percent level or better in each of the state and facility fixed effects models. These results provide further evidence that increasing the reimbursement rate improves quality of care in nursing homes. Once again

while the absolute magnitude of the results is relatively small, the relative size of the estimates is significant. The Medicaid rate elasticity of quality implied by the estimate from the PROPPRESSORE model is -0.29 while the elasticity for the DEFS1TOT model is -.12.

Nonprofit and government-owned nursing homes have a lower proportion of residents with pressure sores than for-profit facilities. The results of the state fixed effects model are significant at the 1 percent level. The coefficients in the facility fixed effects model are positive but not statistically significant. Nonprofit and government-owned facilities also have fewer deficiencies in the state fixed effects model. Only the coefficient for government-owned facilities is negative and significant in the facility fixed effects model. Once again these results indicate that nonprofit and government-owned nursing homes provide higher quality than for-profit nursing homes.

Unlike the process-based models, in the PROPPRESSORE model the type of reimbursement method and whether or not a state uses case-mix adjustment are not statistically significant. However, in the DEFS1TOT model three of the reimbursement methods and CASEMIX are significant. Use of a retrospective method results in fewer deficiencies in the state fixed effects model and is statistically significant at the 10 percent level. The relationship is also negative in the facility fixed effects model but is not statistically significant. Both prospective, facility-specific and class reimbursement methods lead to more deficiencies than having an adjusted reimbursement method in both the state and fixed effects models. The coefficient on the combination method is not significant in either the state or facility fixed effects model.

The coefficient on CASEMIX is positive and statistically significant at the 1 percent level in both the state and fixed effects models. Since more costs are covered when a facility is reimbursed based on a resident's level of severity, one would expect fewer residents with pressure sores and fewer facility deficiencies. While not expected, perhaps this result can be explained by the baseline level of residents' dependencies. Nursing homes in states without CON and/or construction moratorium polices have residents with a higher level of dependency as measured by ADLINDEX (see Table A.7). Due to the increased care needs of their more functionally disabled population, perhaps these homes face an increased opportunity for being cite for a violation and this in turn causes more deficiencies.

5.2.3 Structure Measures of Quality

The five structure-based measures of quality used in this study, RNS, LPNS, AIDES, LICNUR, and NURSTAFF, are all measured in hours per resident day and represent "good" quality. As seen in Tables 4 and 5 on the following pages, for each of the models in which CON_MORT is statistically significant a pattern emerges among the five measures of structure-based quality; nursing homes in those states without a CON and/or construction moratorium policy have more registered and licensed practical nurse hours per resident day and less aide hours per resident day than those states that still have a policy. These results support the hypothesis that those states without CON policies have a higher level of quality. These results indicate a possible substitution effect is occurring. For those states continuing with these supply restrictions, while maintaining the minimum requirement of RNs and LPNs, the presence of a CON restriction allows

Table 4

Main Regression Results for Structure-Based Quality Models

Dependent Variable	RNS		LPNS		AIDES	
	State Fixed Effects	Facility Fixed Effects	State Fixed Effects	Facility Fixed Effects	State Fixed Effects	Facility Fixed Effects
Explanatory Variables	**Coefficient (Std Error)[a]**	**Coefficient (Std Error)[a]**	**Coefficient (Std Error)[a]**	**Coefficient (Std Error)[a]**	**Coefficient (Std Error)[a]**	**Coefficient (Std Error)[a]**
CON_MORT	0.00638 (0.00548)	0.00998 (0.00489)*	0.02957 (0.00844)***	0.03114 (0.00705)***	-0.05294 (0.01833)***	-0.04119 (0.01646)**
RATE	0.00028 (0.00015)*	0.00050 (0.00013)***	0.00081 (0.00020)***	0.00093 (0.00018)***	-0.00203 (0.00051)***	-0.00200 (0.00049)***
CONTROL2	0.05902 (0.00472)***	-0.00428 (0.00481)	0.02486 (0.00587)***	0.00214 (0.00703)	0.24987 (0.01392)***	-0.00376 (0.01855)
CONTROL3	0.03751 (0.00909)***	0.00289 (0.00805)	0.02317 (0.01017)**	-0.00374 (0.01696)	0.25495 (0.02299)***	0.07022 (0.04590)
METHOD0	0.00055 (0.00915)	0.00417 (0.00790)	0.00711 (0.01065)	0.00382 (0.00952)	-0.21510 (0.02744)***	-0.20872 (0.02595)***
METHOD1	0.01893 (0.00407)***	0.01398 (0.00348)***	-0.00109 (0.00506)	0.00132 (0.00457)	-0.03343 (0.01333)***	-0.03751 (0.01214)***
METHOD2	0.02780 (0.00548)***	0.02154 (0.00503)***	0.03998 (0.01221)***	0.01061 (0.00933)	-0.05716 (0.02830)**	-0.12369 (0.02445)***
METHOD4	0.00961 (0.00664)	0.00950 (0.00572)*	-0.00171 (0.00865)	-0.00374 (0.00777)	-0.04944 (0.02158)***	-0.05187 (0.01879)***
CASEMIX	0.00019 (0.00391)	-0.00016 (0.00357)	-0.01649 (0.00453)***	-0.01119 (0.00427)***	-0.08810 (0.01114)***	-0.07188 (0.01076)***
N	150,571	150,571	150,571	150,571	150,571	150,571
R^2	0.1954	0.0130[b]	0.1266	0.0273[b]	0.0944	0.0105[b]
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.

[b]This value is the R^2 within.

*p < .10 **p < .05 ***p < .01

Table 5

Main Regression Results for Structure-Based Quality Models

Dependent Variable	LICNUR		NURSTAFF	
	State Fixed Effects	Facility Fixed Effects	State Fixed Effects	Facility Fixed Effects
Explanatory Variables	**Coefficient (Std Error)[a]**	**Coefficient (Std Error)[a]**	**Coefficient (Std Error)[a]**	**Coefficient (Std Error)[a]**
CON_MORT	0.03481 (0.00933)***	0.03915 (0.00788)***	-0.00769 (0.02114)	0.00704 (0.01845)
RATE	0.00111 (0.00021)***	0.00134 (0.00019)***	-0.00066 (0.00055)	-0.00052 (0.00052)
CONTROL2	0.08555 (0.00639)***	0.00402 (0.00748)	0.34693 (0.01591)***	0.00929 (0.02027)
CONTROL3	0.08903 (0.01234)***	0.01347 (0.01682)	0.39290 (0.02981)***	0.10864 (0.05227)**
METHOD0	-0.00234 (0.01300)	0.00311 (0.01167)	-0.22118 (0.03186)***	-0.20223 (0.02967)***
METHOD1	0.00896 (0.00554)	0.00934 (0.00506)*	-0.03159 (0.01429)**	-0.03033 (0.01311)**
METHOD2	0.04853 (0.01068)***	0.02981 (0.00626)***	-0.02749 (0.02894)	-0.08105 (0.02468)***
METHOD4	0.00476 (0.00962)	0.00582 (0.00880)	-0.03836 (0.02250)*	-0.03369 (0.02013)*
CASEMIX	-0.01297 (0.00288)***	-0.00810 (0.00149)***	-0.08851 (0.01241)***	-0.06977 (0.01193)***
N	150,571	150,571	150,571	150,571
R^2	0.1127	0.0174[b]	0.1193	0.0109[b]
Prob > F	0.0000	0.0000	0.0000	0.0000

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.
*p < .10
**p < .05
***p < .01
[b]This value is the R^2 within.

facilities in these states to hire less costly inputs without sacrificing market share.

5.2.3.1 Other Findings

The coefficient of the average, annual Medicaid per diem reimbursement rate is positive and statistically significant for the number of registered nurse, licensed practical nurse, and licensed nurse hours per resident day indicating that an increase in the reimbursement rate provides higher quality. Again it appears that an increase in the rate causes a substitution effect since the coefficient for the AIDES model is negative and statistically significant at the 1 percent level; facilities are able to provide a more qualified level of staffing, which costs more, when there is an increase in the payment rate.

The results of ownership on the structure-based measures of quality are very consistent; nonprofit and government-owned facilities provide a higher level of staffing than for-profit facilities. These results support the findings of earlier work (Aaronson, et al. 1994; Elwell 1984; Grabowski and Hirth 2002; Zinn 1994) and lend credence to the theory that nonprofit facilities have higher costs because they have higher quality.

The use of a retrospective reimbursement method is negative and statistically significant in the AIDES and NURSTAFF models. If costs are passed through to the insurer as is the case with retrospective reimbursement, then having fewer nurses' aides which cost less than certified nurses implies that facilities are again substituting toward more highly trained and costly inputs. However, even though all of the coefficients of the other three models are positive, none are statistically significant.

Both prospective, facility-specific and prospective class reimbursement methods lead to more RN hours and licensed nurse hours (LICNUR) and less aides and nursing staff (NURSTAFF) hours. Additionally, a class method results in more LPN hours. The

coefficient on the dummy variable for a combination method (METHOD4) is positive and statistically significant in the facility fixed effects model for RNS and is negative and statistically significant for both the AIDES and NURSTAFF models in both the state and fixed effects models. Taken together the results of the reimbursement method variables do not give a clear picture as to which method of reimbursement provides higher quality of care.

The use of case-mix reimbursement provides rather interesting results. Assuming that compensating for the case-mix of the resident population should improve the quality of care because the costs of such care are accounted for, it is surprising to find in the models for which the value is statistically significant that the coefficient is negative rather than positive. However these results are similar to ones obtained in a panel study with data from 1991 to 1998 using state fixed effects (Grabowski 2002; 2004). Perhaps the increased rate that facilities receive for the case-mix of the residents is spent on other amenities rather than providing a more professional level of nursing staff.

5.3 The Effect of Certificate of Need and Construction Moratorium Policies on the Access to Care in Nursing Homes

The results of the estimation for both the state and facility fixed effects models show that nursing homes in those states without CON and/or construction moratorium policies have a statistically significant higher percentage of Medicaid residents. As shown in Table 6 on the following page, the coefficient on CON_MORT is significant at less than the 1 percent level for both models. In the state fixed effects model, nursing

Table 6

Main Regression Results for Access and Heavy-Care Models

Dependent Variable	PCTMCAID		ADLINDEX	
	State Fixed Effects	Facility Fixed Effects	State Fixed Effects	Facility Fixed Effects
Explanatory Variables	**Coefficient (Std Error)[a]**	**Coefficient (Std Error)[a]**	**Coefficient (Std Error)[a]**	**Coefficient (Std Error)[a]**
CON_MORT	0.95788 (0.34786)***	1.55143 (0.29731)***	-0.12390 (0.02821)***	-0.10086 (0.02636)***
RATE	-0.00507 (0.00777)	0.00302 (0.00616)	0.00109 (0.00069)	0.00081 (0.00064)
CONTROL2	-9.38626 (0.34208)***	-0.91782 (0.27432)***	0.06312 (0.02116)***	0.02638 (0.02532)
CONTROL3	0.79328 (0.60256)	0.92467 (0.65133)	0.32173 (0.04918)***	0.08470 (0.06216)
METHOD0	-1.91870 (0.48414)***	-1.97860 (0.40190)***	0.04236 (0.04044)	0.02111 (0.03785)
METHOD1	-0.22563 (0.23044)	-0.40020 (0.18285)**	0.06795 (0.01859)***	0.03508 (0.01670)**
METHOD2	-1.40048 (0.37974)***	-0.78225 (0.31524)**	-0.04475 (0.03208)	-0.05763 (0.03013)*
METHOD4	0.21310 (0.36760)	0.62293 (0.29102)**	-0.11659 (0.03047)***	-0.09409 (0.02806)***
CASEMIX	-0.08600 (0.17625)	-0.09821 (0.14293)	0.20506 (0.01521)***	0.20339 (0.01400)***
N	150,571	150,571	150,571	150,571
R^2	0.2016	0.0060[b]	0.2424	0.0556[b]
Prob > F	0.0000	0.0000	0.0000	0.0000

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.
*p < .10
**p < .05
***p < .01
[b]This value is the R^2 within.

homes in states without CON and/or construction moratorium policies have .96 percent more Medicaid residents than those nursing homes in states with some type of regulation. This percentage increases to 1.55 percent in the facility fixed effects model. These results hold while controlling for excess demand in the market and support the hypothesis

that Medicaid-eligible individuals in nursing homes in those states without CON and/or moratorium policies have better access to nursing home beds than those individuals in states that still have these policies. While the magnitude of these results is not large the results do indicate that there is a difference in the access to care for Medicaid-eligible individuals between those states without CON and/or moratorium policies and those with these policies.

With respect to the access to care for heavy-care residents in a facility, facilities in those states without CON and/or moratorium policies actually have residents with a lower level of dependency in both the state and facility fixed effects models. Medicaid residents are often believed to be more dependent in their functional abilities than private-pay residents and therefore are not the type of residents that nursing homes want to have fill their empty beds. This result in conjunction with the result of the access model indicates that Medicaid residents are not necessarily more dependent than private-pay residents. Or perhaps the facilities that are in states without these polices are "cream-skimming."

5.3.1 Other Findings

Results of several of the other explanatory variables are worth mentioning. The annual, average per diem Medicaid reimbursement rate was not significant in either of the state or facility fixed effects models for the access to care (PCTMCAID) or heavy-care (ADLINDEX) models. While earlier work has shown that increasing the reimbursement rate has increased the access to care for Medicaid residents (Aaronson, et al. 1994; Gertler 1989, 1992) these results do not support the same finding. Additionally, the

results do not seem to support the theory that the Medicaid reimbursement rate is "too low" to provide nursing homes with the incentive to admit Medicaid residents. Furthermore, these results do not show that increasing the reimbursement rate will improve access for heavy-care residents.

In both the state and facility fixed effects models nonprofit nursing homes have a significantly lower percentage of Medicaid residents than for-profit facilities. This result supports the theory that to the extent higher costs and quality are associated with increased demand by private-pay and Medicare residents, nonprofit facilities are more oriented toward those residents while for-profit facilities are more oriented toward Medicaid residents.

It is relevant to also note that the effect of income on access is statistically significant in both models. However, it is negative in the state fixed effects model and positive in the facility fixed effects model. While one expects that an increase in the per capita personal income in the county in which the nursing homes is located would lead to fewer Medicaid residents, perhaps this result helps to explain why the effect of CON_MORT is rather small.

With respect to the heavy-care model, nonprofit and government-owned facilities have residents with a statistically significant higher level of dependency than for-profit facilities in the state fixed effects model. While the coefficients are positive for both nonprofit and government ownership in the facility fixed effects model they are not statistically significant. This result supports the idea that one of the reasons nonprofit and government nursing homes have higher costs than for-profit facilities is because they serve a more impaired resident population.

The effect of the reimbursement method in the access model was fairly consistent across the various measures for both the state and facility fixed effects models. For both models, nursing homes in states that employed either a retrospective or prospective class reimbursement method had a statistically significant lower percentage of Medicaid residents compared to those states that employed an adjusted method. Since retrospective reimbursement is less restrictive than an adjusted method (the base group) the result for retrospective is not of the expected sign. However the fact that those states with a prospective class method have a lower percentage of Medicaid residents is expected since that method is the most restrictive of all. While only statistically significant in the facility fixed effects model, the negative sign on the coefficient for the prospective facility-specific method is also expected since this method is more stringent than an adjusted method. Lastly, while only statistically significant in the facility fixed effects model, the positive sign on the coefficient for the combination method is also expected since this method is also more stringent than an adjusted method. Finally, having a method that accounts for resident case-mix does not appear to have any effect on the percentage of Medicaid residents in a facility. This is the same result found by Cohen and Dubay (1990).

With respect to the heavy-care model, one would expect that the more stringent the reimbursement method the less functionally dependent is the resident population since caring for more disabled residents implies higher costs for the facility. In contrast one would expect to see a more disabled resident population with a retrospective method since it is the least restrictive payment method. As expected, the coefficient on the retrospective method is positive in both the state and facility fixed effects model but

neither value is statistically significant. As expected, the coefficient on METHOD2 is negative in both models but is only statistically significant tin the facility fixed effects model. Again as expected, the coefficients on METHOD4 are negative and statistically significant in both the state and facility fixed effects model indicating that states employing a combination method have residents that have less functional disabilities than those residents in states using an adjusted method. Finally, in both the state and fixed effects models those states that use a case-mix adjustment have residents with more functional disabilities. This could be an important policy implication since one could interpret the results to mean that nursing homes reimbursed in this way are provided with an incentive to accept heavy-care residents.

5.4 Robustness Checks

In order to check for the robustness of the main findings the models were estimated without the reimbursement method to alleviate any concern over potential multicollinearity between the state fixed effects and the reimbursement method. The results of these models are consistent with the results of the main estimations for the main variable of interest, the effect of CON and/or construction moratorium policies on access to care and quality of care. Specifically, all the coefficients of CON_MORT are of the same sign and the same level or better of statistical significance in the quality, access, and heavy-care state and fixed effects models. The full results of these estimations are in Tables A.18-A.27 in Appendix A.

An alternative method to control for excess demand is to separate the data into the least and most restrictive markets. The first step was to assign a unique identifier to each

ARF state and county combination. Then the median of EMPTYELDERLY (the number of empty nursing homes beds per 1,000 noninstitutionalized elderly (aged 65+) in a county) was calculated for each county over the period 1991-2003. Next the annual median level for the entire data set was calculated for the entire period of 1991 through 2003. Those observations that were below the median value of EMPTYELDERLY for the entire data set were classified as the most restrictive markets while those observations above the median were classified as the least restrictive markets. This follows a similar method used in recent work to proxy for excess demand (Grabowski 2002, 2004).

The results for the effect of CON_MORT in both the least and most restrictive markets show that nursing homes in those states without CON and/or construction moratorium policies have a higher percentage of Medicaid residents. The coefficients are statistically significant in all of the models except for the least restrictive state fixed effects model. In the most restrictive markets nursing homes in states without CON and/or moratorium policies have 2 percent and 3 percent more Medicaid residents in the state and facility fixed effects models, respectively. This suggests that regardless of the tightness of the market, CON policies may restrict access to care for Medicaid residents. The results for the heavy-care access model are the same as the results using the full sample.

It seems logical that those nursing homes in least restrictive markets would be apt to compete for residents on the basis of quality for both private-pay and Medicaid residents while there may not be such an incentive in the most restrictive markets. However, the results of the quality models in both the least and most restrictive markets are quite similar to those in the main findings using the full sample. The two notable

exceptions are that in the most restrictive markets the proportion of residents with catheters is higher and the number of deficiencies is lower in nursing homes in those states without CON and/or construction moratorium policies. The full results of these estimations are in Tables A.28-A.47 in Appendix A.

Chapter Six

Conclusions

This chapter summarizes the main findings of the effects of certificate of need and construction moratorium policies on quality of care and access to care in the nursing home industry and discusses their potential policy implications. Additionally, the limitations of this current research as well as opportunities for future research are discussed.

6.1 Main Findings

This dissertation is the first attempt to employ panel data to analyze the differences in the quality of care and access to care in nursing homes in those states without certificate of need and/or construction moratorium policies and nursing homes in those states still retaining such policies. This data set includes observations for all Medicaid and Medicare-certified freestanding nursing homes in the United States over the thirteen year period of 1991-2003.

While controlling for excess demand in the market, the results of the quality of care estimations in this dissertation show that nursing homes in those states without CON and/or construction moratorium policies have higher quality of care than nursing homes in those states without these policies when quality is a process-based measure. Nursing

homes in states without these types of policy have residents with a lower proportion of residents with urethral catheters, feeding tubes, and physical restraints. These results support the hypothesis that the elimination of CON leads to higher quality of care. Additionally, the results of the estimations using structure-based measures of quality also support this hypothesis. Nursing homes in states without CON policies have more registered and licensed practical nurse hours per resident day while substituting away from aide hours per resident day.

The composite-based measure of quality, facility deficiencies, was positive but only statistically significant in the facility fixed effects model. This result does not support the hypothesis of higher quality of care in nursing homes in states without CON policies. The only outcome measure of quality used in this dissertation, the proportion of residents with pressure sores, was not statistically significant in either the state or facility fixed effects models. Unfortunately the data used in this dissertation for the years prior to 1997 from OSCAR do not include many other outcome measures of quality. This is one area of research where perhaps the Minimum Data Set, which provides a comprehensive assessment of each resident's functional capabilities in each Medicare or Medicaid certified nursing home, will be beneficial.

The results of the estimation for both the state and facility fixed effects access to care models show that nursing homes in those states without CON and/or construction moratorium policies have a statistically significant higher percentage of Medicaid residents. These results hold while controlling for excess demand in the market and support the hypothesis that Medicaid-eligible individuals in those states without CON and/or moratorium policies have better access to nursing home beds than those

individuals in states that still have these policies. While it may be true that the occupancy rates of nursing homes have declined over recent years, it appears that Medicaid-eligible individuals still face access restrictions in those states having CON and/or moratorium policies.

With respect to the access to care for heavy-care residents, facilities in those states without CON and/or moratorium policies actually have residents with a lower level of dependency in both the state and facility fixed effects models. Medicaid residents are often believed to be more dependent in their functional abilities than private-pay residents and therefore are not the type of residents that nursing homes want to have fill their empty beds. This result in conjunction with the result of the access model indicates that Medicaid residents are not necessarily more dependent than private-pay residents. Another explanation is that facilities which are in states without these policies are better able to "cream-skim."

6.2 Policy Implications

While the primary goals of the National Health Planning and Resources Development Act (P.L. 93-641) of 1974 were to (1) contain health care costs and (2) increase the accessibility and quality of health services, it is not evident that today those goals are being achieved through the use of certificate of need and construction moratorium policies in the nursing home industry. The results of this research with respect to quality of care and access to care, coupled with recent work on the effect of these policies on the cost of care in nursing homes (Grabowski, et al. 2003; Miller, et al.

2002; Miller, et al. 2001), indicate that perhaps this type of supply regulation is no longer meeting its original purposes.

While it is true that there has been a significant decline in nursing home utilization over the last two decades (Bishop 1999), it is also true that the baby boomer generation is beginning to retire resulting in an aging population that will need long term care. With the risk of becoming a nursing home resident at the age of 65 at 44 percent and at the age of 85 at 53 percent (Spillman and Lubitz 2002) perhaps those states that still have these policies in place should consider the costs and benefits of retaining such regulations. It is also true that quality of care continues to be a major concern with continued reports of nursing homes with serious deficiencies as well as survey and oversight shortcomings (GAO2005). From the results of this research on the effects of CON and/or moratorium policies on quality of care and access to care in the nursing home market, it is no longer clear that the benefits of these policies outweigh the costs.

Substitutes to long term nursing home care exist in the market today that did not exist two decades ago. Medicaid now provides for alternatives such as home health care and assisted living facilities. If it is indeed true that changing market conditions have rendered CON and construction moratorium policies less important in the market for nursing home care, one might then question the relevancy of states maintaining these types of regulation. Perhaps the costs associated with maintaining CON regulation agencies could be better spent on other aspects of ensuring the dignity and quality of care for nursing home residents rather than on the administration of a policy that may no longer be relevant in today's nursing home market.

6.3 Limitations

There are several limitations to this research that should be noted. The first is that while the OSCAR system is one of the most comprehensive, longitudinal information sets available for all Medicare-/Medicaid-certified nursing homes in the United States, it must be recognized that it was created for the purpose of provider certification. However, much research in the nursing home industry has utilized this data since its implementation. Due to the acknowledgment of the usefulness of such data and recognizing the importance of the accuracy and reliability of survey data used in research, emphasis has been placed on state survey procedures to ensure both the accuracy and reliability in the survey and data input processes. However, concerns still remain today with the reliability of the findings of nursing home surveys (GAO2005). Therefore it is important to realize that the results obtained from using data from a system such as OSCAR must be viewed with the acknowledgment of the data limitations.

The second limitation is the use of a binary indicator for the main variable of interest, CON_MORT, which does not capture the complexity or effectiveness of a state's policy. Although these policies theoretically restrict or prohibit growth in the nursing home market it is not always the case in practice. Many states have exceptions for their moratorium policy that allow for additional beds or expansion if it is deemed a critical need. Additionally, my survey of states' regulatory agencies indicated that states vary on the restrictiveness of their CON policies. In some states the CON actually acts as a moratorium while in other states it appears that the CON is simply a formality and most applications for additional or new beds get approved.

The third limitation is the use of only one outcome measure of quality, the proportion of residents with pressure sores. Since the results using this measure of quality are not significant in either the state or facility fixed effects models, without another outcome measure to test it is not readily evident whether or not there is no significant difference between states with and without CON and/or moratorium policies or whether there is a lack of precision in the estimation.

The final limitation to mention concerns the reimbursement rate. While other work accounts for the fact that the rate utilized by some states covers various ancillaries (Harrington, et al. 2000b; Swan, et al. 1993) I did not collect this information when I surveyed each of the states' Medicaid reimbursement agencies.

6.4 Future Research

Future research should address several of the limitations mentioned above. First, in order to eliminate any concern with the use of a single binary indicator for the existence of a CON and/or construction moratorium policy, future work should include a measure of the effectiveness of the policy. Although these policies theoretically restrict or prohibit growth in the nursing home market it is not always the case in practice. Many states have exceptions for their moratorium policy that allows for additional beds or expansion if it is deemed a critical need. My survey of states' regulatory agencies indicates that states vary on the restrictiveness of their CON policies. In some states the CON actually acts as a moratorium while in other states it appears that the CON is simply a formality and most applications for additional or new beds get approved. This

difference in the effectiveness of the regulation should be accounted for in future research to try and eliminate any omitted variable bias that might influence the results.

Second, follow on work from this dissertation should include an attempt to use other outcome-based measures of quality. While it may not be possible to achieve this with OSCAR data that cover the same time period as in this study, it should be possible to construct a panel with data from the mid-1990s through 2005. Since reports of inadequate quality of care continue to be published it is important to look at more outcome-based measures that are more focused directly on residents' "quality of life" (Nyman 1988c) along with their quality of care. Perhaps the use of the Minimum Data Set (MDS) will be an additional source of data to contribute toward this need to provide better outcome-based measures of quality at the resident level.

Third, future work with this data should investigate the relationship of ownership and quality of care as well as access to care. Though not the main variable of interest in this dissertation, the results indicate that nonprofit nursing homes provide higher quality of care (for most of the quality measures) than for-profit homes and that nonprofits have fewer Medicaid residents than for-profit facilities but more heavy-care residents. An interesting model to investigate would be a matching of nonprofit and for-profit nursing homes in states with and without CON and/or moratorium policies to see whether or not any behavioral patterns with respect to quality and access emerge.

While much work has been done on the quality of care in the nursing home industry and some work on the access to care, future work must continue and attempt to clarify for policymakers those policies that are effective in assuring adequate care to our aging population and those that may not be achieving their intended goals.

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Appendix A: Tables

Table A.1

CMS' Deficiency Classification System

CMS deficiency category	Level of severity	Compliance status of home cited for this deficiency
Immediate jeopardy to resident health or safety	Most serious	Noncompliant
Actual harm that does not put resident in immediate jeopardy	Serious	Noncompliant
No actual harm, with potential for more than minimal harm	Less serious	Noncompliant
No actual harm, with potential for minimal harm	Minimal	Substantially compliant

Adapted from the GAO (1998b) report.

Table A.2

Illustrative Measures of Quality of Care in Nursing

Structural Measures	
Staffing levels (nurses, PTs, OTs, etc.)	Governance
Staffing turnover	Age/condition of plant, equipment (include mobility development)
Wages/benefits	Payer mix (percent mix, etc.)
Management/leadership	Case mix
Facility: size, location, ownership	Accreditation
Availability of private rooms	Teaching status
Volunteers	
Process Measures	
Assists with ADL/IADL (includes bathing, skin care)	Bladder training
Injury (staff and patient)	Delivery of "hotel" services (sanitation)
Infection control (includes residents and staff)	Assessment (includes care planning), frequency and completeness
Resident services: special care to prevent problems	Abuse prevention
Overuse of restraints	Quality assurance (RA and MDS)
Use of urinary catheters	Access and use of medical care
	Residents rights
Outcome Measures	
Mortality	Urinary incontinence
Hospitalization	Weight loss
Facility-acquired pressure sore, skin breakdown	Infectious disease
Functional status	Patient satisfaction
Pain control	Family satisfaction
Depression	Thefts/abuse
Injuries	Staff injuries/illness
	Staff satisfaction

Notes: ADL = activities of daily living; IADL = instrumental activities of daily living; OT = occupational therapist; PT = physical therapist; RA = resident assessment; MDS = minimum data set

Table A.3

Certificate of Need and Moratorium Policies for the Years 1991-2003

State	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
AL	1	1	1	3	3	1	1	1	3	1	1	1	3
AK	1	1	1	1	1	3	3	3	1	1	1	1	1
AR*	1	3	3	1	1	1	1	1	1	1	1	1	1
AZ	0	0	0	0	0	0	0	0	0	0	0	0	0
CA	0	0	0	0	0	0	0	0	0	0	0	0	0
CO	2	2	2	2	2	2	2	2	2	2	2	2	0
CT	3	3	3	3	3	3	3	3	3	3	3	3	3
DE	1	1	1	1	1	1	1	1	1	1	1	1	1
FL	1	1	1	1	1	1	1	1	1	1	3	3	3
GA	1	1	1	1	1	1	1	1	1	1	1	1	1
HI	1	1	1	1	1	1	1	1	1	1	1	1	1
IA	1	1	1	1	1	1	1	1	1	1	1	1	1
ID	0	0	0	0	0	0	0	0	0	0	0	0	0
IL	1	1	1	1	1	1	1	1	1	1	1	1	1
IN	1	1	1	1	1	0	1	1	0	0	0	0	0
KS	0	0	0	0	0	0	0	0	0	0	0	0	0
KY	1	3	3	3	1	1	1	1	1	1	3	3	3
LA	1	1	1	1	1	1	3	3	3	3	3	3	3
MA	3	3	3	3	3	3	3	3	3	3	3	3	3
MD	1	1	1	1	1	1	1	1	1	1	1	1	1
ME	3	3	3	3	3	3	3	3	3	3	3	3	3
MI	1	1	1	1	1	3	3	3	3	3	3	3	3
MN	2	2	2	2	2	2	2	2	2	2	2	2	2
MO	3	3	3	3	3	3	3	3	3	3	3	3	1
MS	3	3	3	3	3	3	3	3	3	3	3	3	3
MT	1	1	1	1	1	1	1	1	1	1	1	1	1
NC	1	1	1	1	1	1	1	1	1	1	1	1	1
ND	1	1	1	1	2	2	2	2	2	2	2	2	2
NE	1	1	1	1	1	1	1	1	3	3	3	3	3
NH	1	1	1	1	3	3	3	3	3	3	3	3	3
NJ	3	1	1	1	1	1	1	1	1	1	1	1	1
NM	0	0	0	0	0	0	0	0	0	0	0	0	0
NV[1]	1	1	1	1	1	0	0	0	0	0	0	0	0
NY	1	1	1	1	1	1	1	1	1	1	3	3	3
OH	1	1	3	3	3	3	3	3	3	3	3	3	3
OK	1	1	1	1	1	1	1	1	1	1	1	1	1
OR	1	1	1	1	1	1	1	1	1	1	1	1	1
PA	1	1	1	1	1	1	0	0	0	0	0	0	0
RI	1	1	1	1	1	3	3	3	3	3	3	3	3
SC	1	1	1	1	1	1	1	1	1	1	1	1	1
SD	2	2	2	2	2	2	2	2	2	2	2	2	2
TN	1	1	1	1	1	1	1	1	1	1	1	1	1
TX	2	2	2	2	2	2	2	2	2	2	2	2	2
UT	2	2	2	2	2	2	2	2	2	2	2	2	2

Legend:

0 = no CON and no moratorium
1 = CON but not no moratorium
2 = no CON but moratorium
3 = CON and moratorium
*permit of approval law

[1]Nevada eliminated certificate of need in its two largest counties beginning in 1996 and is thus labeled as 1

Table A.3 (continued)

Certificate of Need and Moratorium Policies for the Years 1991-2003

State	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
VT	1	1	1	1	1	1	1	1	1	1	1	1	1
VA	1	1	1	1	1	1	1	1	1	1	1	1	1
WA	1	1	1	1	1	1	1	1	1	1	1	1	1
WV	3	3	3	3	3	3	3	3	3	3	3	3	3
WI	3	3	3	3	3	3	3	3	3	3	3	3	3
WY*	1	1	1	1	1	1	1	1	1	1	1	1	1

Legend:
0 = no CON and no moratorium
1 = CON but not no moratorium
2 = no CON but moratorium
3 = CON and moratorium
*intent to construct law

Table A.4

Reimbursement Method for the Years 1991-2003

State	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
AL	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs
AK	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
AR[1]	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pfs	pfs	pfs
AZ[2]	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl
CA	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl
CO	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
CT	adj	adj	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs
DE	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs
FL	pfs	pfs	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
GA	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
HI	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
IA	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
ID	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
IL	adj	adj	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs
IN	adj	adj	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs
KS	pfs	pfs	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
KY	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
LA	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pfs
MA	com	com	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs
MD	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
ME	com	com	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
MI	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
MN	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs
MO	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
MS	pfs	pfs	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
MT	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
NC	com	com	com	com	com	com	com	com	com	com	com	com	com
ND	adj	adj	adj	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs
NE	com	ret	ret	ret	ret	ret	ret	ret	ret	ret	pfs	pfs	pfs
NH	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
NJ	adj	adj	adj	adj	adj	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs
NM	adj	adj	adj	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs
NV	adj	adj	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs
NY	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
OH	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
OK	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl	pcl
OR	com	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
PA	ret	ret	ret	ret	ret	com	adj	adj	adj	adj	adj	adj	adj
RI	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs
SC	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
SD	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs
TN	com	com	com	com	com	com	com	pfs	pfs	pfs	pfs	pfs	pfs
TX	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pcl	pcl	pcl	pcl
UT	pcl	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs
VA	com	com	com	com	com	com	com	com	com	com	com	com	pfs
VT	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
WA	adj	adj	adj	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs

Legend: ret = retrospective; pfs = prospective, facility-specific; pcl = prospective, class; com = combination; adj = prospective, adjusted

[1]Harrington, et al. (2000) classifies 1992-1998 as pfs but Medicaid agency contact classified method as pcl.

[2]Harrington, et al. (2000) classifies as pfs but Medicaid agency contact classified method as pcl.

Table A.4 (continued)

Reimbursement Method for the Years 1991-2003

State	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
WI	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs	pfs
WV	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj
WY	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj	adj

Legend: ret = retrospective; pfs = prospective, facility-specific; pcl = prospective, class; com = combination; adj = prospective, adjusted

Table A.5

Case-mix Reimbursement for the Years 1991-2003

State	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
AL	No	No	No	No	No	No	No	No	No	No	No	No	No
AK	No	No	No	No	No	No	No	No	No	No	No	No	No
AR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AZ	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CA	No	No	No	No	No	No	No	No	No	No	No	No	No
CO	No	No	No	No	No	No	No	No	No	No	No	No	No
CT	No	No	No	No	No	No	No	No	No	No	No	No	No
DE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FL	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
GA	No	No	No	No	No	No	No	No	No	No	No	No	Yes
HI	No	No	No	No	No	No	No	No	No	No	No	No	No
IA	Yes	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
ID	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes
IL	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IN	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
KS	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
KY	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LA	No	No	No	No	No	No	No	No	No	No	No	No	Yes
MA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MD	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ME	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MI	No	No	No	No	No	No	No	No	No	No	No	No	No
MN	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MO	No	No	No	No	No	No	No	No	No	No	No	No	No
MS	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MT	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NC	No	No	No	No	No	No	No	No	No	No	No	No	Yes
ND	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NH	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
NJ	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NM	No	No	No	No	No	No	No	No	No	No	No	No	No
NV	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NY	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OH	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OK	No	No	No	No	No	No	No	No	No	No	No	No	No
OR	No	No	No	No	No	No	No	No	No	No	No	No	No
PA	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RI	No	No	No	No	No	No	No	No	No	No	No	No	No
SC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SD	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TN	No	No	No	No	No	No	No	No	No	No	No	No	No
TX	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
UT	No	No	No	No	No	No	No	No	No	No	No	No	Yes
VA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
VT	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WA	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
WI[1]	No	No	No	No	No	No	No	No	No	No	No	No	No
WV	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WY	No	No	No	No	No	No	No	No	No	No	No	No	No

[1]Harrington, et al. (2000) classifies 1993-1998 as having casemix reimbursement but Medicaid agency contact classified as not having case-mix.

Table A.6

Average Per Diem Medicaid Reimbursement Rates for the Years 1991-2003

State	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
AL	52.58	62.48	68.75	75.37	82.76	85.57	94.73	98.69	103.54	107.18	112.54	119.61	126.98
AK	205.04	217.19	221.27	211.21	214.77	225.38	237.47	261.67	265.23	275.00	303.71	320.95	329.21
AR	42.22	49.05	54.86	58.02	60.28	61.98	61.98	61.98	64.51	69.01	76.92	94.73	102.51
AZ	69.24	72.30	71.93	77.80	82.36	88.23	88.23	91.88	95.53	100.30	105.83	108.17	117.16
CA	65.32	70.60	72.28	76.27	79.71	79.77	81.54	88.78	91.32	110.19	113.13	113.60	118.05
CO	64.46	72.55	71.28	73.59	75.93	90.31	90.31	101.55	105.88	111.15	114.68	123.37	130.98
CT	112.38	116.57	118.00	120.27	125.06	129.62	133.82	137.06	147.97	154.37	158.51	161.25	167.95
DE	77.53	81.80	86.16	90.10	93.78	99.14	104.15	102.09	105.22	117.66	133.46	157.91	171.62
FL	71.80	76.71	80.48	86.45	87.95	90.62	95.95	97.99	101.74	110.37	119.54	129.36	142.90
GA	61.03	63.49	67.02	68.85	72.99	77.15	72.60	76.30	86.56	88.50	95.10	105.24	117.59
HI	95.03	100.54	105.76	119.39	124.05	129.65	132.59	127.12	131.06	134.86	140.05	146.85	154.04
IA	50.32	53.10	56.27	57.72	58.87	64.62	68.11	72.78	78.61	85.15	85.90	91.96	95.38
ID	62.28	65.47	74.67	75.45	81.28	88.03	86.29	98.42	104.65	112.65	123.90	130.63	137.66
IL	52.26	62.23	70.08	70.08	70.08	70.22	70.28	77.62	81.44	86.05	90.06	94.86	89.92
IN	60.43	64.02	66.56	71.28	78.48	81.75	80.32	80.32	92.16	94.58	100.39	104.25	101.66
KS	47.72	50.55	51.24	56.14	60.08	63.68	67.11	72.71	76.72	84.12	91.65	97.38	101.04
KY	55.21	59.50	64.03	69.32	73.44	76.00	83.00	80.62	86.34	89.26	100.35	101.76	107.76
LA	50.48	63.82	65.26	60.60	63.78	63.52	61.12	62.48	61.51	71.99	76.67	79.28	80.24
MA	94.77	96.07	96.04	98.84	100.73	103.35	111.92	114.68	119.24	124.47	132.60	140.04	154.26
MD	73.07	77.52	79.33	81.35	89.16	94.19	98.88	106.62	111.93	122.15	134.42	150.64	162.49
ME	84.94	87.25	87.00	101.40	105.85	114.09	113.41	115.77	113.83	116.20	130.32	130.37	158.10
MI	58.21	64.88	67.12	71.01	74.25	79.46	84.17	91.49	101.43	107.10	117.44	125.08	134.43
MN	78.32	82.06	81.91	88.21	92.24	95.61	101.79	106.47	111.03	117.31	123.04	129.62	138.34
MO	42.65	52.89	57.93	58.15	70.39	73.18	83.35	87.81	89.60	92.32	96.42	96.84	97.01
MS	52.20	55.44	58.07	58.08	68.00	72.89	76.77	83.02	86.40	90.22	97.38	104.46	115.63

Table A.6 (continued)

Average Per Diem Medicaid Reimbursement Rates for the Years 1991-2003

State	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
MT	56.39	63.22	69.69	74.62	80.15	83.09	85.89	87.55	90.39	93.39	96.97	102.13	106.29
NC	78.66	86.75	76.68	79.20	83.53	86.87	92.82	93.12	111.94	116.27	122.14	126.36	126.36
ND	66.51	71.98	74.29	75.92	80.86	85.77	90.86	94.13	97.68	104.94	115.03	127.05	129.71
NE	56.82	60.37	60.07	62.03	66.17	70.99	76.70	84.19	90.67	97.97	107.02	113.83	118.94
NH	92.66	95.58	98.94	105.36	105.34	104.00	108.47	109.22	114.58	116.94	119.24	121.99	126.42
NJ	88.86	88.86	91.61	100.35	102.35	102.35	112.01	115.76	119.39	123.93	130.03	137.57	145.29
NM[1]	68.03	73.84	64.72	75.79	77.69	86.80	111.31	129.04	.	.	.	.	.
NV	65.83	68.58	75.85	76.35	79.33	82.51	85.71	86.17	92.16	97.20	110.04	102.88	126.59
NY	117.01	122.90	128.10	134.48	138.94	150.15	148.91	156.83	162.76	160.66	166.57	172.05	177.33
OH	79.29	84.63	88.81	93.74	99.54	106.14	112.00	120.52	126.63	134.97	145.15	153.01	152.72
OK	43.90	46.40	48.90	49.70	52.50	54.94	56.77	64.20	66.38	66.57	84.46	93.58	94.61
OR	58.81	67.37	69.55	75.36	76.54	76.54	81.88	88.21	93.52	97.60	108.09	111.35	111.35
PA	63.46	68.04	78.82	88.07	96.19	102.13	109.13	114.23	119.54	126.14	132.86	140.65	145.57
RI	105.09	110.88	85.76	103.78	98.00	101.50	101.50	109.75	109.25	113.44	119.43	129.97	135.71
SC	58.20	65.24	64.99	67.57	71.22	74.69	78.08	84.85	88.38	94.80	96.07	103.11	107.57
SD	46.85	54.32	60.00	64.37	68.89	77.91	74.26	75.88	77.43	79.60	83.57	86.62	91.61
TN	55.29	62.32	68.99	56.18	62.75	77.91	87.74	86.02	89.58	95.69	98.80	102.70	111.21
TX	51.62	54.51	56.17	60.55	63.34	66.52	71.12	75.15	78.62	83.53	88.50	96.10	95.80
UT	59.68	67.18	67.53	70.38	74.24	76.76	78.53	83.11	85.67	89.11	90.05	94.19	105.55
VA	60.47	63.57	65.50	71.01	72.97	75.07	77.37	79.48	82.60	89.10	99.12	106.33	112.06
VT	76.91	76.19	84.90	89.78	94.24	97.20	100.46	104.10	105.51	113.19	118.20	132.93	139.75
WA	78.74	86.53	85.60	92.74	98.91	104.96	109.03	112.90	116.89	119.55	123.64	127.64	129.23
WI	66.93	71.93	73.41	76.32	80.05	85.85	85.85	95.47	97.68	100.76	105.11	112.09	119.15
WV	68.83	72.28	78.13	80.86	77.27	89.93	101.04	106.57	110.02	117.86	125.34	134.94	141.50
WY	65.77	70.66	70.06	73.06	75.84	90.09	92.41	93.72	95.15	97.89	105.13	117.11	119.43

[1]New Mexico has missing values for 1999-2003.

Table A.7

Nursing Home, County, and State-level Characteristics (1991-2003)[a] by CON_MORT

Variable	**Description**	**CON_MORT = 1**				**CON_MORT = 0**			
Access Measure		N	Mean	Overall SD	Within SD	N	Mean	Overall SD	Within SD
PCTMCAID	Percent of Medicaid residents	22,682	65.29	19.98	8.58	128,023	69.59	18.25	8.29
Quality Measures									
PROPPRESSORE	Proportion of residents with decubitus ulcer	22,669	0.07	0.05	0.04	127,902	0.06	0.05	0.04
PROPPARENTERAL	Proportion of residents with feeding tubes	22,669	0.06	0.07	0.03	127,902	0.06	0.06	0.03
PROPCATHETER	Proportion of residents with catheters	22,669	0.07	0.06	0.04	127,902	0.07	0.05	0.04
PROPMOBLREST	Proportion of residents with physical restraints	22,669	0.17	0.16	0.12	127,902	0.16	0.15	0.12
DEFS1TOT	Number of health deficiencies	22,675	9.98	9.46	7.44	127,995	6.25	6.62	5.43
RNS	Registered nurse (RN) hours per resident day	22,682	0.34	0.27	0.17	128,023	0.34	0.32	0.19
LPNS	Licensed practical nurse (LPN) hours per resident day	22,682	0.66	0.37	0.26	128,023	0.68	0.42	0.28
AIDES	Nurses' aides hours per resident day	22,682	2.09	0.85	0.68	128,023	2.15	1.04	0.73
LICNUR	RN and LPN hours per resident day	22,682	0.92	0.43	0.29	128,023	0.94	0.43	0.29
NURSTAFF	RN, LPN, and aide hours per resident day	22,682	2.86	0.96	0.74	128,023	2.92	1.10	0.77
Facility Characteristics									
TOTRES	Number of residents	22,682	86.88	44.77	9.82	128,023	95.47	50.40	11.51
CENMCAID	Number of Medicaid residents	22,682	57.32	36.42	9.84	128,023	66.95	41.78	11.24
CENMCARE	Number of Medicare residents	22,682	5.95	6.68	3.92	128,023	6.58	7.98	4.82
CENOTHER	Number of private-pay residents	22,682	23.61	19.63	8.00	128,023	21.94	19.45	8.57
TOTBEDS	Total number of beds	22,682	101.88	53.12	9.96	128,023	110.95	55.97	8.94
CONTROL1	=1 if for-profit facility (base)	22,682	0.75	0.43	0.12	128,023	0.74	0.44	0.12
CONTROL2	=1 if nonprofit facility	22,682	0.22	0.42	0.12	128,023	0.21	0.41	0.12
CONTROL3	=1 if government facility	22,682	0.02	0.15	0.05	128,023	0.04	0.21	0.05
MULTI	=1 if chain facility	22,682	0.61	0.49	0.23	128,023	0.56	0.50	0.23
ADLINDEX	ADL index	22,669	10.05	1.70	0.88	127,902	9.75	1.48	0.88
OCCUPANCY	Number of residents/total number of beds	22,682	86.27	12.29	7.83	128,023	86.61	14.48	8.35

[a]The data are from the Online, Survey, Certification, and Reporting (OSCAR) system unless otherwise noted.

Table A.7 (continued)

Nursing Home, County, and State-level Characteristics (1991-2003)[a] by CON_MORT

Variable	Description	CON_MORT = 1				CON_MORT = 0			
Market (County) Characteristics									
POP65UP	Elderly population (aged 65+)[b]	22,682	215,562	329,335	13,286	128,023	53,346	94,543	3,022
EMPTYELDERLY	Number of empty beds per 1000 noninstitutionalized elderly[d]	22,682	7.17	8.85	4.23	128,023	8.61	10.17	4.51
INCOME	Per capita personal income (2003 $)[c]	22,682	28,284	6,518	1,774	128,023	27,102	7,200	2,220
HHI	Herfindahl-Hirschman index	22,682	0.18	0.23	0.06	128,023	0.26	0.27	0.08
State-level Characteristics									
RATE	Average, annual Medicaid per diem reimbursement rate (2003 $)[e]	22,682	101.68	21.58	12.73	128,023	104.41	26.34	10.55
RATEMISSING	=1 when New Mexico's rate is missing	22,682	0.01	0.10	0.08	128,023	0.00	0.00	0.00
METHOD0	=1 if state uses retrospective reimbursement[e]	22,682	0.00	0.00	0.00	128,023	0.32	0.18	0.08
METHOD1	=1 if state uses prospective, facility-specific reimbursement[e]	22,682	0.17	0.37	0.17	128,023	0.37	0.48	0.25
METHOD2	=1 if state uses prospective, class reimbursement[e]	22,682	0.50	0.50	0.00	128,023	0.08	0.27	0.14
METHOD3	=1 if state uses prospective, adjusted reimbursement[e] (base)	22,682	0.34	0.47	0.17	128,023	0.44	0.50	0.17
METHOD4	=1 if states combines retrospective and prospective reimbursement[e]	22,682	0.00	0.00	0.00	128,023	0.08	0.26	0.13
CASEMIX	=1 if state uses case-mix Medicaid reimbursement[e]	22,682	0.42	0.49	0.23	128,023	0.55	0.50	0.22

[a]The data are from the Online, Survey, Certification, and Reporting (OSCAR) system unless otherwise noted.
[b]This variable is from the Area Resource File (ARF).
[c]This variable is from the Bureau of Economic Analysis' (BEA) Regional Economic Information System (REIS).
[d]This variable is constructed using OSCAR and ARF files.
[e]These variables are from the *1998 State Data Book on Long-Term Care Program and Market Characteristics* (Harrington, et al. 2000b) and the author's state surveys.

Table A.8

Regression Results for Process-Based Quality Models

State Fixed Effects						
Dependent Variable	PROPCATHETER		PROPPARENTERAL		PROPMOBLREST	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	-0.00957	0.00132***	-0.00096	0.00111	-0.05028	0.00321***
RATE	-0.00002	0.00003	-0.00004	0.00003	-0.00061	0.00008***
RATEMISSING	0.00336	0.00512	-0.00902	0.00461**	-0.07038	0.01653***
CONTROL2	-0.01008	0.00072***	-0.01040	0.00093***	0.00309	0.00151*
CONTROL3	-0.00772	0.00141***	-0.00241	0.00252	0.01414	0.00339***
TOTBEDS	0.00007	5.74e-06***	0.00008	8.03e-06***	0.00001	0.00001
EMPTYELDERLY	0.00005	0.00003	-0.00019	0.00004***	0.00018	0.00007***
MULTI	0.00423	0.00056***	0.00306	0.00067***	-0.01193	0.00118***
ADLINDEX	0.01005	0.00027***	0.01606	0.00068***	0.02203	0.00050***
HHI	-0.00442	0.00119***	-0.02634	0.00160***	0.01163	0.00258***
INCOME	-2.47e-07	4.98e-08***	9.48e-08	7.54e-08	-8.80e-08	1.06e-07
METHOD0	-0.00122	0.00172	-0.00119	0.00149	0.01015	0.00451**
METHOD1	0.00154	0.00080*	-0.00275	0.00067***	0.01518	0.00183***
METHOD2	-0.00370	0.00158**	0.00236	0.00135*	0.04824	0.00357***
METHOD4	-0.00177	0.00132	0.00114	0.00120	0.00679	0.00337**
CASEMIX	0.00195	0.00064***	-0.00380	0.00059***	0.01002	0.00166***
CONSTANT	-0.00209	0.00386	-0.09614	0.00677***	0.06852	0.00866*
N	150,571		150,571		150,571	
R^2	0.1449		0.2941		0.2351	
Prob > F	0.0000		0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.

*p < .10

**p < .05

***p < .01

All models include state and year fixed effects.

Table A.9

Regression Results for Process-Based Quality Models

Facility Fixed Effects						
Dependent Variable	PROPCATHETER		PROPPARENTERAL		PROPMOBLREST	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	-0.01037	0.00133***	-0.00194	0.00099**	-0.04827	0.00325***
RATE	-0.00002	0.00003	-0.00004	0.00002*	-0.00063	0.00008***
RATEMISSING	0.00589	0.00493	-0.01060	0.00414***	-0.08244	0.01552***
CONTROL2	-0.00278	0.00111**	-0.00091	0.00093	0.01006	0.00324***
CONTROL3	-0.00069	0.00282	-0.00098	0.00165	0.01138	0.00791
TOTBEDS	0.00002	0.00002	-5.90e-06	0.00001	0.00005	0.00004
EMPTYELDERLY	0.00016	0.00004***	0.00003	0.00002	0.00047	0.00008***
MULTI	-0.00121	0.00060**	0.00056	0.00051	-0.00460	0.00163***
ADLINDEX	0.00564	0.00016***	0.00668	0.00016***	0.01409	0.00046***
HHI	0.00570	0.00160***	0.00153	0.00130	0.02149	0.00444***
INCOME	5.17e-07	1.31e-07***	-5.82e-07	1.66e-07***	-3.08e-06	5.44e-07***
METHOD0	-0.00133	0.00171	-0.00034	0.00127	0.01356	0.00457***
METHOD1	0.00094	0.00077	-0.00274	0.00057***	0.01701	0.00183***
METHOD2	-0.00567	0.00154***	0.00121	0.00126	0.04961	0.00360***
METHOD4	-0.00214	0.00129*	0.00079	0.00105	0.00772	0.00339**
CASEMIX	0.00252	0.00061***	-0.00181	0.00049***	0.01198	0.00168***
CONSTANT	0.01455	0.00484***	-0.00014	0.00525	0.19108	0.01719***
N	150,571		150,571		150,571	
R^2	0.0535[b]		0.0785[b]		0.1571[b]	
Prob > F	0.0000		0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.

*p < .10

**p < .05

***p < .01

[b]This value is the R^2 within.

All models include year fixed effects.

Table A.10

Regression Results for Outcome and Composite-Based Quality Models

State Fixed Effects				
Dependent Variable	Outcome-Based PROPPRESSORE		Composite-Based DEFS1TOT	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.00081	0.00109	0.11049	0.15330
RATE	-0.00018	0.00002***	-0.00801	0.00370**
RATEMISSING	-0.02305	0.00464***	-0.66741	0.62357
CONTROL2	-0.00752	0.00048***	-1.33765	0.06161***
CONTROL3	-0.00701	0.00102***	-1.46497	0.11455***
TOTBEDS	0.00005	3.76e-06***	0.01388	0.00054***
EMPTYELDERLY	-0.00007	0.00002***	-0.00015	0.00285
MULTI	0.00512	0.00039***	0.13362	0.05319**
ADLINDEX	0.00735	0.00017***	0.03289	0.01819*
HHI	-0.00910	0.00082***	-0.71961	0.11509***
INC03	1.29e-07	3.47e-08***	7.14e-06	4.47e-06
METHOD0	-0.00213	0.00144	-0.34340	0.19223*
METHOD1	9.75e-06	0.00073	1.04717	0.11105***
METHOD2	-0.00112	0.00123	1.11955	0.17030***
METHOD4	-0.00085	0.00110	-0.01786	0.16576
CASEMIX	0.00008	0.00058	0.46302	0.08352***
CONSTANT	0.00340	0.00279	7.20068	0.38482***
N	150,571		150,537	
R^2	0.1209		0.1830	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.

*p < .10

**p < .05

***p < .01

Both models include state and year fixed effects.

Table A.11

Regression Results for Outcome and Composite-Based Quality Models

Facility Fixed Effects				
Dependent Variable	Outcome-Based PROPPRESSORE		Composite-Based DEFS1TOT	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.00032	0.00104	0.34217	0.14785**
RATE	-0.00018	0.00002***	-0.11655	0.00366*
RATEMISSING	-0.02165	0.00465***	-0.57068	0.63383
CONTROL2	0.00036	0.00106	0.10461	0.16863
CONTROL3	0.00244	0.00201	-0.74093	0.44590*
TOTBEDS	0.00004	0.00001***	0.02200	0.00198***
EMPTYELDERLY	0.00008	0.00003***	-0.00677	0.00362*
MULTI	0.00137	0.00057**	-0.20407	0.08834**
ADLINDEX	0.00448	0.00015***	0.10078	0.02063***
HHI	0.00203	0.00157	0.55473	0.21274***
INCOME	4.98e-08	9.26e-08	0.00010	0.00002***
METHOD0	-0.00191	0.00143	-0.09740	0.19073
METHOD1	0.00015	0.00072	1.18294	0.11003***
METHOD2	-0.00165	0.00123	1.32699	0.17023***
METHOD4	-0.00094	0.00111	0.01779	0.16702
CASEMIX	0.00090	0.00057	0.49594	0.08272***
CONSTANT	0.03044	0.00387***	2.98307	0.77156***
N	150,571		150,537	
R^2	0.0142[b]		0.0441[b]	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.

*p < .10

**p < .05

***p < .01

[b]This value is the R^2 within.

Both models include year fixed effects.

Table A.12

Regression Results for Structure-Based Quality Models

State Fixed Effects						
Dependent Variable	RNS		LPNS		AIDES	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.00638	0.00548	0.02957	0.00844***	-0.05294	0.01833***
RATE	0.00028	0.00015*	0.00081	0.00020***	-0.00203	0.00051***
RATEMISSING	0.07977	0.02639***	0.02723	0.03697	-0.23163	0.09461**
CONTROL2	0.05902	0.00472***	0.02486	0.00587***	0.24987	0.01392***
CONTROL3	0.03751	0.00909***	0.02317	0.01017**	0.25495	0.02299***
TOTBEDS	-0.00029	0.00003***	-0.00003	0.00004	-0.00022	0.00010**
EMPTYELDERLY	0.00063	0.00012***	0.00198	0.00021***	0.00209	0.00046***
MULTI	0.01110	0.00311***	0.02901	0.00408***	-0.02409	0.00974**
ADLINDEX	0.02223	0.00162***	0.02508	0.00216***	0.10279	0.00429***
HHI	-0.02315	0.00627***	-0.12060	0.00879***	-0.13185	0.02094***
INCOME	6.40e-06	3.72e-07***	-7.57e-08	4.41e-07	5.66e-06	1.03e-06***
METHOD0	0.00055	0.00915	0.00711	0.01065	-0.21510	0.02744***
METHOD1	0.01893	0.00407***	-0.00109	0.00506	-0.03343	0.01333**
METHOD2	0.02780	0.00548***	0.03998	0.01221***	-0.05716	0.02830**
METHOD4	0.00961	0.00664	-0.00171	0.00865	-0.04944	0.02158***
CASEMIX	0.00019	0.00391	-0.01649	0.00453***	-0.08810	0.01114***
CONSTANT	-0.24675	0.02062***	0.38955	0.02663***	1.06145	0.06128***
N	150,571		150,571		150,571	
R^2	0.1954		0.1266		0.0944	
Prob > F	0.0000		0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.

*p < .10

**p < .05

***p < .01

All models include state and year fixed effects.

Table A.13

Regression Results for Structure-Based Quality Models

Facility Fixed Effects						
Dependent Variable	RNS		LPNS		AIDES	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.00998	0.00489*	0.03114	0.00705***	-0.04119	0.01646**
RATE	0.00050	0.00013***	0.00093	0.00018***	-0.00200	0.00049***
RATEMISSING	0.10221	0.02429***	0.05815	0.03099*	-0.18694	0.08930**
CONTROL2	-0.00428	0.00481	0.00214	0.00703	-0.00376	0.01855
CONTROL3	0.00289	0.00805	-0.00374	0.01696	0.07022	0.04590
TOTBEDS	-0.00062	0.00010***	-0.00037	0.00013***	-0.00095	0.00037***
EMPTYELDERLY	0.00163	0.00014***	0.00307	0.00023***	0.00462	0.00057***
MULTI	0.00068	0.00274	0.00492	0.00397	-0.00912	0.01062
ADLINDEX	0.00571	0.00090***	0.01196	0.00126***	0.04015	0.00330***
HHI	0.04683	0.00677***	0.06716	0.01164***	0.10397	0.02990***
INCOME	-3.20e-06	7.40e-07***	-1.45e-06	7.04e-07**	-6.55e-06	2.23e-06***
METHOD0	0.00417	0.00790	0.00382	0.00952	-0.20872	0.02595***
METHOD1	0.01398	0.00348***	0.00132	0.00457	-0.03751	0.01214***
METHOD2	0.02154	0.00503***	0.01061	0.00933	-0.12369	0.02245***
METHOD4	0.00950	0.00572*	-0.00374	0.00777	-0.05187	0.01879***
CASEMIX	-0.00016	0.00357	-0.01119	0.00427***	-0.07188	0.01076***
CONSTANT	0.35169	0.02612***	0.44031	0.02968***	2.20549	0.08781***
N	150,571		150,571		150,571	
R^2	0.0130[b]		0.0273[b]		0.0105[b]	
Prob > F	0.0000		0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.

*p < .10

**p < .05

***p < .01

[b]This value is the R^2 within.

All models include year fixed effects.

Table A.14

Regression Results for Structure-Based Quality Models

State Fixed Effects				
Dependent Variable	LICNUR		NURSTAFF	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.03481	0.00933***	-0.00769	0.02114
RATE	0.00111	0.00021***	-0.00066	0.00055
RATEMISSING	0.12539	0.04245***	-0.05558	0.10582
CONTROL2	0.08555	0.00639***	0.34693	0.01591***
CONTROL3	0.08903	0.01234***	0.39290	0.02981***
TOTBEDS	-0.00038	0.00005***	-0.00075	0.00011***
EMPTYELDERLY	0.00241	0.00021***	0.00429	0.00052***
MULTI	0.00660	0.00426	-0.07697	0.01060***
ADLINDEX	0.03611	0.00288***	0.11776	0.00571***
HHI	-0.10736	0.00907***	-0.18517	0.02210***
INCOME	4.64e-06	4.89e-07***	7.79e-06	1.10e-06***
METHOD0	-0.00234	0.01300	-0.22118	0.03186***
METHOD1	0.00896	0.00554	-0.03159	0.01429**
METHOD2	0.04853	0.01068***	-0.02749	0.02894
METHOD4	0.00476	0.00962	-0.03836	0.02250*
CASEMIX	-0.01297	0.00288***	-0.08851	0.01241***
CONSTANT	0.28647	0.03166***	1.57380	0.07170***
N	150,571		150,571	
R^2	0.1127		0.1193	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.

*p < .10

**p < .05

***p < .01

Both models include state and year fixed effects.

Table A.15

Regression Results for Structure-Based Quality Models

Facility Fixed Effects				
Dependent Variable	LICNUR		NURSTAFF	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.03915	0.00788***	0.00704	0.01845
RATE	0.00134	0.00019***	-0.00052	0.00052
RATEMISSING	0.15351	0.03558***	-0.01243	0.10158
CONTROL2	0.00402	0.00748	0.00929	0.02027
CONTROL3	0.01347	0.01682	0.10864	0.05227**
TOTBEDS	-0.00103	0.00015***	-0.00213	0.00041***
EMPTYELDERLY	0.00430	0.00026***	0.00833	0.00064***
MULTI	-0.00309	0.00427	-0.02712	0.01138**
ADLINDEX	0.01542	0.00149***	0.05049	0.00379***
HHI	0.10038	0.01351***	0.18436	0.03242***
INCOME	-4.01e-06	9.45e-07***	-9.07e-06	2.52e-06***
METHOD0	0.00311	0.01167	-0.20223	0.02967***
METHOD1	0.00934	0.00506*	-0.03033	0.01311**
METHOD2	0.02981	0.00626***	-0.08105	0.02468***
METHOD4	0.00582	0.00880	-0.03369	0.02013*
CASEMIX	-0.00810	0.00149***	-0.06977	0.01193***
CONSTANT	0.76865	0.03599***	2.89170	0.09794***
N	150,571		150,571	
R^2	0.0174[b]		0.0109[b]	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.

*p < .10

**p < .05

***p < .01

[b]This value is the R^2 within.

Both models include year fixed effects.

Table A.16

Regression Results for Access Model

Dependent Variable				
PCTMCAID	State Fixed Effects		Facility Fixed Effects	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.95788	0.34786***	1.55143	0.29731***
RATE	-0.00507	0.00777	0.00302	0.00616
RATEMISSING	-0.42287	1.64902	1.78212	1.27866
CONTROL2	-9.38626	0.34208***	-0.91782	0.27432***
CONTROL3	0.79328	0.60256	0.92467	0.65133
TOTBEDS	0.01952	0.00235***	-0.01413	0.00460***
EMPTYELDERLY	-0.04217	0.01136***	0.02472	0.00735***
MULTI	-0.96125	0.22794***	-0.17373	0.14230
ADLINDEX	-1.10705	0.09050***	0.15339	0.03652***
HHI	0.70194	0.46441	0.39247	0.35295
INCOME	-0.00038	0.00003***	0.00012	0.00003***
METHOD0	-1.91870	0.48414***	-1.97860	0.40190***
METHOD1	-0.22563	0.23044	-0.40020	0.18285**
METHOD2	-1.40048	0.37974***	-0.78225	0.31524**
METHOD4	0.21310	0.36760	0.62293	0.29102**
CASEMIX	-0.08600	0.17625	-0.09821	0.14293
CONSTANT	96.13814	1.30675***	64.50688	1.19857***
N	150,571		150,571	
R^2	0.2016		0.0060[b]	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.

*p < .10

**p < .05

***p < .01

[b]This value is the R^2 within.

The state fixed effects model includes state and year fixed effects.

The facility fixed effects model includes year fixed effects.

Table A.17

Regression Results for Heavy-Care Access Model

Dependent Variable				
ADLINDEX	State Fixed Effects		Facility Fixed Effects	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	-0.12390	0.02821***	-0.10086	0.02636***
RATE	0.00109	0.00069	0.00081	0.00064
RATEMISSING	-0.06513	0.13310	-0.06249	0.13122
CONTROL2	0.06312	0.02116***	0.02638	0.02532
CONTROL3	0.32173	0.04918***	0.08470	0.06216
TOTBEDS	0.00210	0.00017***	-0.00069	0.00036*
EMPTYELDERLY	-0.00769	0.00085***	0.00070	0.00070
MULTI	0.06928	0.01599***	-0.03014	0.01354**
HHI	-0.11673	0.03379***	0.05923	0.03650
INCOME	-1.24e-07	1.70e-06	-1.12e-06	2.52e-06
METHOD0	0.04236	0.04044	0.02111	0.03785
METHOD1	0.06795	0.01859***	0.03508	0.01670**
METHOD2	-0.04475	0.03208	-0.05763	0.03013*
METHOD4	-0.11659	0.03047***	-0.09409	0.02806***
CASEMIX	0.20506	0.01521***	0.20339	0.01400***
CONSTANT	9.24604	0.07997***	9.34348	0.09638***
N	150,571		150,571	
R^2	0.2424		0.0556[b]	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.

*p < .10

**p < .05

***p < .01

[b]This value is the R^2 within.

The state fixed effects model includes state and year fixed effects.

The facility fixed effects model includes year fixed effects.

Table A.18

Regression Results for Process-Based Quality Models without Method

State-Fixed Effects						
Dependent Variable	PROPCATHETER		PROPPARENTERAL		PROPMOBLREST	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	-0.00869	0.00119***	-0.00116	0.00113	-0.05192	0.00314***
RATE	-0.00002	0.00003	-0.00003	0.00003	-0.00072	0.00007***
RATEMISSING	0.00451	0.00508	-0.00905	0.00455**	-0.08074	0.01637***
CONTROL2	-0.01008	0.00072***	-0.01040	0.00093***	0.00309	0.00151**
CONTROL3	-0.00773	0.00141***	-0.00241	0.00252	0.01420	0.00339***
TOTBEDS	0.00007	5.74e-06***	0.00008	8.03e-06***	0.00001	0.00001
EMPTYELDERLY	0.00005	0.00003	-0.00019	0.00004***	0.00015	0.00007**
MULTI	0.00425	0.00056***	0.00304	0.00067***	-0.01205	0.00118***
ADLINDEX	0.01006	0.00027***	0.01605	0.00068***	0.02202	0.00050***
HHI	-0.00443	0.00119***	-0.02633	0.00160***	0.01191	0.00258***
INCOME	-2.45e-07	4.98e-08***	9.25e-08	7.53e-08	-8.94e-08	1.06e-07
CASEMIX	0.00203	0.00063***	-0.00361	0.00058***	0.00571	0.00164***
CONSTANT	-0.00267	0.00365	-0.09779	0.00680***	0.10298	0.00798**
N	150,571		150,571		150,571	
R^2	0.1446		0.2939		0.2339	
Prob > F	0.0000		0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.

*p < .10

**p < .05

***p < .01

All models include state and year fixed effects.

Table A.19

Regression Results for Process-Based Quality Models without Method

Facility-Fixed Effects						
Dependent Variable	PROPCATHETER		PROPPARENTERAL		PROPMOBLREST	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	-0.00948	0.00118***	-0.00239	0.00092***	-0.05112	0.00316***
RATE	-0.00001	0.00003	-0.00003	0.00002	-0.00076	0.00008***
RATEMISSING	0.00737	0.00490	-0.01109	0.00409***	-0.09399	0.01537***
CONTROL2	-0.00287	0.00112**	-0.00083	0.00093	0.01021	0.00325***
CONTROL3	-0.00088	0.00282	-0.00088	0.00163	0.01249	0.00793
TOTBEDS	0.00002	0.00002	-54.51e-06	0.00001	0.00005	0.00004
EMPTYELDERLY	0.00017	0.00004***	0.00003	0.00002	0.00040	0.00008***
MULTI	-0.00113	0.00061*	0.00051	0.00051	-0.00500	0.00164***
ADLINDEX	0.00566	0.00016***	0.00666	0.00016***	0.01406	0.00046***
HHI	0.00551	0.00160***	0.00162	0.00130	0.02269	0.00446***
INCOME	5.55e-07	1.36e-07***	-6.20e-07	1.70e-07***	-3.10e-06	5.41e-07***
CASEMIX	0.00274	0.00060***	-0.00161	0.00049***	0.00742	0.00167***
CONSTANT	0.01175	0.00490**	-0.00020	0.00534	0.21883	0.01670***
N	150,571		150,571		150,571	
R^2	0.0529[b]		0.0779[b]		0.1553[b]	
Prob > F	0.0000		0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.

*p < .10

**p < .05

***p < .01

[b]This value is the R^2 within.

All models include year fixed effects.

Table A.20

Regression Results for Outcome and Composite-Based Quality Models without Method

State-Fixed Effects				
Dependent Variable	Outcome-Based PROPPRESSORE		Composite-Based DEFS1TOT	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.00162	0.00101	0.40607	0.13719***
RATE	-0.00017	0.00002***	-0.00955	0.00360***
RATEMISSING	-0.02197	0.00459***	-0.53315	0.61513
CONTROL2	-0.00751	0.00048***	-1.33853	0.06162***
CONTROL3	-0.00702	0.00102***	-1.46728	0.11458***
TOTBEDS	0.00005	3.76e-06***	0.01389	0.00054***
EMPTYELDERLY	-0.00007	0.00002***	-0.00037	0.00285
MULTI	0.00512	0.00039***	0.13460	0.05320**
ADLINDEX	0.00735	0.00017***	0.03510	0.01817*
HHI	-0.00910	0.00082***	-0.71115	0.11508***
INC03	1.30e-07	3.47e-08***	7.59e-06	4.47e-06*
CASEMIX	0.00021	0.00056	0.33073	0.08227***
CONSTANT	0.00292	0.00259	8.36010	0.35627***
N	150,571		150,537	
R^2	0.1209		0.1821	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.
*p < .10
**p < .05
***p < .01
Both models include state and year fixed effects.

Table A.21

Regression Results for Outcome and Composite-Based Quality Models without Method

Facility-Fixed Effects				
Dependent Variable	Outcome-Based PROPPRESSORE		Composite-Based DEFS1TOT	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.00111	0.00098	0.56605	0.13340***
RATE	-0.00018	0.00002***	-0.00925	0.00356***
RATEMISSING	-0.02056	0.00461***	-0.53416	0.62653
CONTROL2	0.00034	0.00106	0.09161	0.16870
CONTROL3	0.00238	0.00201	-0.73398	0.45020
TOTBEDS	0.00004	0.00001***	0.02153	0.00197***
EMPTYELDERLY	0.00008	0.00003***	-0.00757	0.00362**
MULTI	0.00139	0.00057**	-0.20468	0.08854**
ADLINDEX	0.00449	0.00015***	0.10394	0.02064***
HHI	0.00199	0.00156	0.57849	0.21298***
INCOME	6.00e-08	9.29e-08	0.00011	0.00003***
CASEMIX	0.00104	0.00056*	0.33201	0.08151***
CONSTANT	0.02885	0.00379***	3.56265	0.79317***
N	150,571		150,537	
R^2	0.0142[b]		0.0425[b]	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.

*p < .10

**p < .05

***p < .01

[b]This value is the R^2 within.

Both models include year fixed effects.

Table A.22

Regression Results for Structure-Based Quality Models without Method

State-Fixed Effects						
Dependent Variable	RNS		LPNS		AIDES	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.00832	0.00567	0.02713	0.00750***	0.01921	0.01565
RATE	0.00023	0.00015	0.00073	0.00019***	-0.00109	0.00050**
RATEMISSING	0.08015	0.02618***	0.01457	0.03639	-0.12940	0.092981
CONTROL2	0.05881	0.00472***	0.02487	0.00587***	0.24992	0.01392***
CONTROL3	0.03749	0.00808***	0.02326	0.01017**	0.25434	0.02300***
TOTBEDS	-0.00029	0.00003***	-0.00003	0.00004	-0.00022	0.00010**
EMPTYELDERLY	0.00063	0.00012***	0.00195	0.00021***	0.00215	0.00046***
MULTI	0.01107	0.00311***	0.02886	0.00409***	-0.02387	0.00974**
ADLINDEX	0.02225	0.00162***	0.02503	0.00216***	0.10275	0.00422***
HHI	-0.02297	0.00627***	-0.12038	0.00878***	-0.13214	0.02093***
INCOME	6.41e-06	3.72e-07***	-8.50e-08	4.41e-07	5.67e-06	1.03e-06***
CASEMIX	-0.00246	0.00382	-0.01938	0.00440***	-0.07356	0.01064***
CONSTANT	-0.22148	0.01966***	0.40798	0.02593***	1.06145	0.06128***
N	150,571		150,571		150,571	
R^2	0.1953		0.1264		0.0940	
Prob > F	0.0000		0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.

*p < .10

**p < .05

***p < .01

All models include state and year fixed effects.

Table A.23

Regression Results for Structure-Based Quality Models without Method

Facility-Fixed Effects						
Dependent Variable	RNS		LPNS		AIDES	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.00971	0.00465**	0.03047	0.00636***	0.02952	0.01448**
RATE	0.00046	0.00013***	0.00089	0.00017***	-0.00104	0.00047**
RATEMISSING	0.10148	0.02409***	0.05301	0.03048*	-0.07747	0.08755
CONTROL2	-0.00434	0.00481	0.00220	0.00703	-0.00406	0.01859
CONTROL3	0.00310	0.00805	-0.00337	0.01698	0.06594	0.04602
TOTBEDS	-0.00063	0.00010***	-0.00037	0.00013***	-0.00090	0.00037**
EMPTYELDERLY	0.00161	0.00014***	0.00306	0.00023***	0.00489	0.00058***
MULTI	0.00057	0.00275	0.00482	0.00397	-0.00766	0.01062
ADLINDEX	0.00572	0.00090***	0.01196	0.00126***	0.04024	0.00330***
HHI	0.04725	0.00676***	0.06745	0.01164***	0.10258	0.02989***
INCOME	-3.15e-06	7.33e-07***	-1.47e-06	7.03e-07**	-6.39e-06	2.21e-06***
CASEMIX	-0.00221	0.00338	-0.01234	0.00412***	-0.05326	0.01065***
CONSTANT	0.36358	0.02548***	0.44642	0.02882***	2.04959	0.08531***
N	150,571		150,571		150,571	
R^2	0.0128[b]		0.0272[b]		0.0097[b]	
Prob > F	0.0000		0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.

*p < .10

**p < .05

***p < .01

[b]This value is the R^2 within.

All models include year fixed effects.

Table A.24

Regression Results for Structure-Based Quality Models without Method

State-Fixed Effects				
Dependent Variable	LICNUR		NURSTAFF	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.03653	0.00850***	0.06552	0.01778***
RATE	0.00106	0.00021***	0.00029	0.00053
RATEMISSING	0.11969	0.04206***	0.04740	0.10447
CONTROL2	0.08555	0.00639***	0.34698	0.01591***
CONTROL3	0.08906	0.01234***	0.39228	0.02982***
TOTBEDS	-0.00038	0.00005***	-0.00075	0.00011***
EMPTYELDERLY	0.00238	0.00021***	0.00433	0.00052***
MULTI	0.00646	0.00426	-0.07686	0.01060***
ADLINDEX	0.03608	0.00287***	0.11767	0.00571***
HHI	-0.10708	0.00907***	-0.18531	0.02209***
INCOME	4.64e-06	4.89e-07***	7.79e-06	1.10e-06***
CASEMIX	-0.01629	0.00514***	-0.07500	0.01182***
CONSTANT	0.31231	0.03110***	1.46827	0.06787***
N	150,571		150,571	
R^2	0.1126		0.1190	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.

*p < .10

**p < .05

***p < .01

Both models include state and year fixed effects.

Table A.25

Regression Results for Structure-Based Quality Models without Method

Facility-Fixed Effects				
Dependent Variable	LICNUR		NURSTAFF	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.03885	0.00689***	0.07442	0.01590***
RATE	0.00129	0.00019***	0.00040	0.00050
RATEMISSING	0.14931	0.03518***	0.09160	0.10011
CONTROL2	0.00414	0.00748	0.00934	0.02032
CONTROL3	0.01409	0.01682	0.10533	0.05243**
TOTBEDS	-0.00103	0.00015***	-0.00209	0.00041***
EMPTYELDERLY	0.00425	0.00026***	0.00853	0.00064***
MULTI	-0.00333	0.00427	-0.02611	0.01139**
ADLINDEX	0.01539	0.00149***	0.05048	0.00379***
HHI	0.10117	0.01351***	0.18417	0.03240***
INCOME	-4.03e-06	9.45e-07***	-9.03e-06	2.52e-06***
CASEMIX	-0.01043	0.00476**	-0.05356	0.01128***
CONSTANT	0.78275	0.03519***	2.75653	0.09567***
N	150,571		150,571	
R^2	0.0173[b]		0.0103[b]	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.
*p < .10
**p < .05
***p < .01
[b]This value is the R^2 within.
Both models include year fixed effects.

Table A.26

Regression Results for Access Model without Method

Dependent Variable				
PCTMCAID	State-Fixed Effects		Facility-Fixed Effects	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	1.54133	0.33592***	2.07968	0.28453***
RATE	0.00561	0.00768	0.01424	0.00612**
RATEMISSING	0.88529	1.64061	3.06620	1.27895**
CONTROL2	-9.38668	0.34207***	-0.91092	0.27417***
CONTROL3	0.78491	0.60253	0.88465	0.65033
TOTBEDS	0.01949	0.00235***	-0.01368	0.00459***
EMPTYELDERLY	-0.04113	0.01135***	0.02621	0.00735***
MULTI	-0.95677	0.22788***	-0.16680	0.14229
ADLINDEX	-1.10707	0.09045***	0.15052	0.03656***
HHI	0.69350	0.46433	0.39209	0.35261
INCOME	-0.00038	0.00003***	0.00012	0.00003***
CASEMIX	0.13168	0.17320	0.12142	0.14065
CONSTANT	94.7137	1.27952***	63.19044	1.18258***
N	150,571		150,571	
R^2	0.2015		0.0053[b]	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.
*p < .10
**p < .05
***p < .01
[b]This value is the R^2 within.
The state fixed effects model includes state and year fixed effects.
The facility fixed effects model includes year fixed effects.

Table A.27

Regression Results for Heavy-Care Access Model without Method

Dependent Variable				
ADLINDEX	State-Fixed Effects		Facility-Fixed Effects	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	-0.11325	0.02709***	-0.09062	0.02483***
RATE	0.00060	0.00068	0.00053	0.00063
RATEMISSING	-0.10095	0.13164	-0.08152	0.13003
CONTROL2	0.06315	0.02117***	0.02452	0.02536
CONTROL3	0.32201	0.04919***	0.08328	0.06255
TOTBEDS	0.00210	0.00017***	-0.00071	0.00036**
EMPTYELDERLY	-0.00762	0.00085***	0.00086	0.00070
MULTI	0.06996	0.01599***	-0.02900	0.01356**
HHI	-0.11670	0.03380***	0.05660	0.03657
INCOME	-6.10e-08	1.70e-06	-2.80e-07	2.50e-06
CASEMIX	0.19390	0.01489***	0.19775	0.01369***
CONSTANT	9.31124	0.07808***	9.33862	0.09448***
N	150,571		150,571	
R^2	0.2423		0.0551[b]	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 15892 clusters.
*p < .10
**p < .05
***p < .01
[b]This value is the R^2 within.
The state fixed effects model includes state and year fixed effects.
The facility fixed effects model includes year fixed effects.

Table A.28
Regression Results for Process-Based Quality Models
Most Restrictive Sample

State-Fixed Effects						
Dependent Variable	PROPCATHETER		PROPPARENTERAL		PROPMOBLREST	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.00460	0.00219**	0.00157	0.00258	-0.05470	0.00724***
RATE	-0.00013	0.00004***	0.00010	0.00004***	-0.00052	0.00011***
RATEMISSING	-0.00940	0.00636	0.00403	0.00614	-0.05932	0.01840***
CONTROL2	-0.00813	0.00097***	-0.01004	0.00135***	0.00050	0.00219
CONTROL3	-0.00253	0.00214	0.00092	0.00421	0.01412	0.00511***
TOTBEDS	0.00007	7.47e-06***	0.00007	0.00001***	0.00001	0.00002
EMPTYELDERLY	0.00058	0.00012***	0.00051	0.00015***	0.00023	0.00029
MULTI	0.00442	0.00076***	0.00166	0.00106	-0.01235	0.00178***
ADLINDEX	0.00958	0.00038***	0.01805	0.00096***	0.02253	0.00071***
HHI	-0.00436	0.00162***	-0.02604	0.00247***	0.01167	0.00367***
INCOME	-2.11e-07	5.99e-08***	-1.93e-08	9.83e-08	2.29e-07	1.33e-07*
METHOD0	0.01183	0.00249***	0.00455	0.00258*	0.01899	0.00810**
METHOD1	0.00779	0.00116***	-0.00313	0.00116***	0.02467	0.00289***
METHOD2	0.00241	0.00447	0.01799	0.00602***	0.01887	0.01505
METHOD4	0.00761	0.00181***	0.00306	0.00178*	-0.00120	0.00447
CASEMIX	0.00280	0.00097***	-0.00431	0.00101***	0.02536	0.00248***
CONSTANT	0.00028	0.00836	-0.07501	0.01266***	0.10057	0.01931***
N	75,904		75,904		75,904	
R^2	0.1500		0.3093		0.2488	
Prob > F	0.0000		0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 8089 clusters.
*p < .10
**p < .05
***p < .01
All models include state and year fixed effects.

Table A.29

Regression Results for Process-Based Quality Models

Most Restrictive Sample

Facility-Fixed Effects						
Dependent Variable	PROPCATHETER		PROPPARENTERAL		PROPMOBLREST	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.00153	0.00206	-0.00203	0.00224	-0.05707	0.00715***
RATE	-0.00009	0.00004**	0.00008	0.00003**	-0.00566	0.00011***
RATEMISSING	-0.00226	0.00630	0.00077	0.00544	-0.06747	0.01859***
CONTROL2	-0.00250	0.00147*	-0.00231	0.00135*	0.00222	0.00469
CONTROL3	0.00096	0.00443	-0.00008	0.00304	-0.00959	0.01371
TOTBEDS	8.66e-06	0.00003	2.20e-06	0.00003	0.00011	0.00007
EMPTYELDERLY	0.00045	0.00010***	0.00006	0.00009	2.09e-06	0.00031
MULTI	-0.00074	0.00088	0.00097	0.00080	-0.00510	0.00249**
ADLINDEX	0.00447	0.00022***	0.00705	0.00024***	0.01400	0.00065***
HHI	0.00591	0.00210***	0.00030	0.00184	0.00263	0.00647
INCOME	6.32e-07	1.98e-07***	-6.86e-07	2.51e-07***	-2.89e-06	6.93e-07***
METHOD0	0.01147	0.00240***	0.00528	0.00233**	0.01965	0.00805**
METHOD1	0.00701	0.00113***	-0.00395	0.00094***	0.02512	0.00288***
METHOD2	0.00421	0.00439	0.01335	0.00582**	0.02095	0.01515
METHOD4	0.00621	0.00178***	0.00138	0.00156	-0.00115	0.00447
CASEMIX	0.00425	0.00092***	-0.00709	0.00083	0.02815	0.00251***
CONSTANT	0.02018	0.00775***	-0.01031	0.00871	0.20482	0.02576***
N	75,904		75,904		75,904	
R^2	0.0508[b]		0.0910[b]		0.1881[b]	
Prob > F	0.0000		0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 8089 clusters.

*p < .10

**p < .05

***p < .01

[b]This value is the R^2 within.

All models include year fixed effects.

Table A.30

Regression Results for Outcome and Composite-Based Quality Models
Most Restrictive Sample

State-Fixed Effects				
Dependent Variable	Outcome-Based PROPPRESSORE		Composite-Based DEFS1TOT	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.00424	0.00210**	-0.94130	0.34912***
RATE	-0.00015	0.00003***	-0.04641	0.00477***
RATEMISSING	-0.01783	0.00593***	-5.2114	0.73940***
CONTROL2	-0.00746	0.00069***	-1.28071	0.08418***
CONTROL3	-0.00773	0.00156***	-1.33318	0.17198***
TOTBEDS	0.00005	5.28e-06***	0.01491	0.00073***
EMPTYELDERLY	0.00036	0.00010***	0.01668	0.01348
MULTI	0.00520	0.00058***	0.05069	0.07705
ADLINDEX	0.00756	0.00024***	0.07397	0.02582***
HHI	-0.00815	0.00115***	-0.51059	0.15554***
INCOME	2.54e-08	4.25e-08	0.00002	5.31e-06***
METHOD0	0.00167	0.00241	-1.66448	0.37454***
METHOD1	0.00171	0.00113	-0.19344	0.17132
METHOD2	0.00660	0.00387*	1.35087	0.67555**
METHOD4	0.00044	0.00157	-0.87429	0.24996***
CASEMIX	0.00148	0.00091	0.42792	0.13086***
CONSTANT	0.00184	0.00554	9.29651	0.66411***
N	75,904		75,890	
R^2	0.1258		0.2310	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 8089 clusters.

*p < .10

**p < .05

***p < .01

Both models include state and year fixed effects.

Table A.31

Regression Results for Outcome and Composite-Based Quality Models
Most Restrictive Sample

Facility-Fixed Effects				
Dependent Variable	Outcome-Based PROPPRESSORE		Composite-Based DEFS1TOT	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.00152	0.00200	-0.62845	0.35597*
RATE	-0.00015	0.00003***	-0.04333	0.00475***
RATEMISSING	-0.01595	0.00601***	-4.86745	0.75864***
CONTROL2	0.00056	0.00158	0.29073	0.26288
CONTROL3	0.00245	0.00308	0.07535	0.81683
TOTBEDS	0.00005	0.00002**	0.02368	0.00333***
EMPTYELDERLY	0.00322	0.00010***	0.00384	0.01354
MULTI	0.00144	0.00085*	-0.37322	0.13841***
ADLINDEX	0.00405	0.00021***	0.06487	0.03035**
HHI	0.00275	0.00204	0.54486	0.29289*
INCOME	7.46e-08	1.15e-07	0.00009	0.00003***
METHOD0	0.00064	0.00232	-1.33310	0.38046***
METHOD1	0.00144	0.00111	-0.00531	0.17215
METHOD2	0.00605	0.00107	1.68600	0.67179**
METHOD4	-0.00038	0.00158	-0.82442	0.25577***
CASEMIX	0.00249	0.00087***	0.44276	0.13181***
CONSTANT	0.03010	0.00581***	7.00379	1.11310***
N	75,904		75,890	
R^2	0.0128[b]		0.0384[b]	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 8089 clusters.
*p < .10
**p < .05
***p < .01
[b]This value is the R^2 within.
Both models include year fixed effects.

Table A.32
Regression Results for Structure-Based Quality Models
Most Restrictive Sample

State-Fixed Effects						
Dependent Variable	RNS		LPNS		AIDES	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.02150	0.01254*	-0.00421	0.01615	-0.00521	0.03494
RATE	0.00038	0.00020*	0.00126	0.00025***	0.00015	0.00063
RATEMISSING	0.07942	0.03237**	0.09096	0.04279**	0.02671	0.12215
CONTROL2	0.04987	0.00621***	0.01504	0.00711**	0.24503	0.01510***
CONTROL3	0.03924	0.01052***	0.03386	0.01349**	0.30788	0.02922***
TOTBEDS	-0.00042	0.00004***	-0.00015	0.00005***	-0.00052	0.00010***
EMPTYELDERLY	0.00546	0.00077***	0.00868	0.00111***	0.01348	0.00271***
MULTI	0.01280	0.00436***	0.02266	0.00517***	-0.03736	0.01107***
ADLINDEX	0.01839	0.00204***	0.01958	0.00293***	0.08297	0.00475***
HHI	-0.01733	0.00797*	-0.10584	0.01233***	-0.05532	0.02404**
INCOME	5.05e-06	4.07e-07***	-1.10e-06	4.77e-07**	3.33e-06	9.78e-07***
METHOD0	-0.01118	0.01567	-0.02707	0.01798	-0.15958	0.04261***
METHOD1	0.00803	0.00702	-0.00684	0.00795	-0.05563	0.02065***
METHOD2	-0.00216	0.01415	0.00336	0.03250	-0.09861	0.09063
METHOD4	0.00185	0.00955	-0.00537	0.01127	-0.04464	0.02801
CASEMIX	-0.00652	0.00761	-0.03475	0.00819***	-0.09060	0.01702***
CONSTANT	-0.04645	0.03496	0.33916	0.07850***	1.33449	0.17449***
N	75,904		75,904		75,904	
R^2	0.1675		0.1390		0.0922	
Prob > F	0.0000		0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 8089 clusters.
*p < .10
**p < .05
***p < .01
All models include state and year fixed effects.

Table A.33
Regression Results for Structure-Based Quality Models
Most Restrictive Sample

Facility-Fixed Effects						
Dependent Variable	RNS		LPNS		AIDES	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.00468	0.00986	-0.02867	0.01518*	-0.02507	0.03303
RATE	0.00059	0.00017***	0.00161	0.00023***	0.00095	0.00061
RATEMISSING	0.10579	0.03030***	0.14160	0.04085***	0.15987	0.11567
CONTROL2	-0.00755	0.00727	0.00388	0.01000	0.01446	0.02342
CONTROL3	-0.01929	0.01188	-0.00514	0.02073	-0.04004	0.05818
TOTBEDS	-0.00093	0.00020***	-0.00032	0.00022	-0.00169	0.00068**
EMPTYELDERLY	0.00592	0.00066***	0.00789	0.00094***	0.01594	0.00259***
MULTI	-0.00055	0.00398	0.00668	0.00584	-0.01841	0.01456
ADLINDEX	0.00378	0.00119***	0.00861	0.00152***	0.02963	0.00340***
HHI	0.05282	0.01053***	0.06519	0.01819***	0.12331	0.04984**
INCOME	-3.86e-06	1.13e-06***	2.76e-07	9.11e-07	-3.68e-06	2.40e-06
METHOD0	-0.02156	0.01294*	-0.05077	0.01729***	-0.16466	0.04107***
METHOD1	0.00528	0.00637	-0.00892	0.00763	-0.05429	0.02066***
METHOD2	-0.01374	0.01445	0.00056	0.02705	-0.10632	0.08343
METHOD4	0.00845	0.00873	-0.01852	0.01086*	-0.04671	0.02744*
CASEMIX	-0.01382	0.00708*	-0.03321	0.00801***	-0.08781	0.01711***
CONSTANT	0.47167	0.04296***	0.39456	0.04326***	2.13435	0.11889***
N	75,904		75,904		75,904	
R^2	0.0146[b]		0.0318[b]		0.0124[b]	
Prob > F	0.0000		0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 8089 clusters.
*p < .10
**p < .05
***p < .01
[b]This value is the R^2 within.
All models include year fixed effects.

Table A.34
Regression Results for Structure-Based Quality Models
Most Restrictive Sample

State-Fixed Effects				
Dependent Variable	LICNUR		NURSTAFF	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.01867	0.01847	0.02890	0.03945
RATE	0.00161	0.00027***	0.00170	0.00675**
RATEMISSING	0.19055	0.04897***	0.24058	0.13770*
CONTROL2	0.07804	0.00814***	0.33726	0.01819***
CONTROL3	0.10005	0.01446***	0.45467	0.03623***
TOTBEDS	-0.00058	0.00006***	-0.00121	0.00012***
EMPTYELDERLY	0.01186	0.00119***	0.02148	0.00268***
MULTI	0.00162	0.00579	-0.09267	0.01289***
ADLINDEX	0.03048	0.00406***	0.09855	0.00728***
HHI	-0.09248	0.01268***	-0.10792	0.02783***
INCOME	2.83e-06	5.47e-07***	4.55e-06	1.14e-06***
METHOD0	-0.04651	0.02134**	-0.20704	0.04935***
METHOD1	0.00044	0.00936	-0.04879	0.02310**
METHOD2	-0.00148	0.02642	-0.10236	0.09013
METHOD4	-0.00453	0.01351	-0.03657	0.03118
CASEMIX	-0.03662	0.00996***	-0.11244	0.01958***
CONSTANT	0.35313	0.07087***	1.75655	0.17854***
N	75,904		75,904	
R^2	0.0854		0.1063	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 8089 clusters.
*p < .10
**p < .05
***p < .01
Both models include state and year fixed effects.

Table A.35
Regression Results for Structure-Based Quality Models
Most Restrictive Sample

Facility-Fixed Effects				
Dependent Variable	LICNUR		NURSTAFF	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	-0.01321	0.01605	-0.01135	0.03594
RATE	0.00210	0.00025***	0.00291	0.00065***
RATEMISSING	0.24970	0.04667***	0.40824	0.13043***
CONTROL2	0.00375	0.01064	0.02791	0.02593
CONTROL3	0.00047	0.02033	0.00779	0.05970
TOTBEDS	-0.00119	0.00027***	-0.00290	0.00074***
EMPTYELDERLY	0.01107	0.00105***	0.02226	0.00240***
MULTI	-0.00538	0.00640	-0.03971	0.01600**
ADLINDEX	0.01204	0.00181***	0.03988	0.00446***
HHI	0.09287	0.02183***	0.17693	0.05187***
INCOME	-3.09e-06	1.06e-06***	-5.83e-06	2.71e-06**
METHOD0	-0.06496	0.01991***	-0.21151	0.04662***
METHOD1	-0.00370	0.00910	-0.05162	0.02313**
METHOD2	-0.01073	0.02333	-0.10881	0.08425
METHOD4	-0.01380	0.01280	-0.04150	0.02983
CASEMIX	-0.03627	0.00954***	-0.10217	0.01942***
CONSTANT	0.81163	0.05067***	2.84249	0.13258***
N	75,904		75,904	
R^2	0.0157[b]		0.0121[b]	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 8089 clusters.
*p < .10
**p < .05
***p < .01
[b]This value is the R^2 within.
Both models include year fixed effects.

Table A.36
Regression Results for Access Model
Most Restrictive Sample

Dependent Variable				
PCTMCAID	State-Fixed Effects		Facility-Fixed Effects	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	2.10167	0.71449***	3.68244	0.56805***
RATE	0.01873	0.00995*	0.01122	0.00795
RATEMISSING	3.35836	1.95300*	3.64824	1.51695**
CONTROL2	-8.50022	0.48757***	-1.11712	0.40088***
CONTROL3	4.35162	0.77855***	1.91969	1.08148*
TOTBEDS	0.02720	0.00312***	-0.02642	0.00707***
EMPTYELDERLY	0.09504	0.04670**	0.00670	0.02408
MULTI	-1.76661	0.33569***	-0.59560	0.21049***
ADLINDEX	-0.74316	0.12425***	0.16310	0.05107***
HHI	3.26867	0.65618***	-0.41052	0.49224
INCOME	-0.00041	0.00003***	0.00008	0.00004**
METHOD0	-1.01304	0.77661	-0.75264	0.61478
METHOD1	0.18235	0.38161	-0.07545	0.29549
METHOD2	-1.95926	1.21465	0.31312	1.12446
METHOD4	1.11780	0.53190**	1.45567	0.41672***
CASEMIX	-0.30968	0.28800	-0.22946	0.23233
CONSTANT	88.31466	2.67226***	66.41340	1.63747***
N	75,904		75,904	
R^2	0.1823		0.0099[b]	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 8089 clusters.
*p < .10
**p < .05
***p < .01
[b]This value is the R^2 within.
The state fixed effects model includes state and year fixed effects.
The facility fixed effects model includes year fixed effects.

Table A.37
Regression Results for Heavy-Care Access Model
Most Restrictive Sample

Dependent Variable				
ADLINDEX	State-Fixed Effects		Facility-Fixed Effects	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	-0.26803	0.06390***	-0.27698	0.05058***
RATE	0.00284	0.00093***	0.00298	0.00085***
RATEMISSING	0.27901	0.16209*	0.38902	0.15658**
CONTROL2	-0.03202	0.03121	0.05377	0.03643
CONTROL3	0.37891	0.07373***	0.19462	0.10332*
TOTBEDS	0.00194	0.00024***	-0.00095	0.00060
EMPTYELDERLY	-0.02158	0.00347***	0.00127	0.00254
MULTI	0.05436	0.02401**	-0.03056	0.02029
HHI	-0.13302	0.04773***	0.02480	0.05278
INCOME	-7.02e-07	2.12e-06	2.26e-06	3.13e-06
METHOD0	0.06635	0.07163	0.04578	0.06057
METHOD1	0.01923	0.03098	-0.03994	0.02674
METHOD2	-0.07406	0.10565	-0.05278	0.09838
METHOD4	-0.21592	0.04542***	-0.18824	0.03970***
CASEMIX	0.22287	0.02457***	0.22514	0.02285***
CONSTANT	10.06110	0.18597***	9.45304	0.14257***
N	75,904		75,904	
R^2	0.2087		0.0606[b]	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 8089 clusters.
*p < .10
**p < .05
***p < .01
[b]This value is the R^2 within.
The state fixed effects model includes state and year fixed effects.
The facility fixed effects model includes year fixed effects.

Table A.38

Regression Results for Process-Based Quality Models

Least Restrictive Sample

State-Fixed Effects						
Dependent Variable	PROPCATHETER		PROPPARENTERAL		PROPMOBLREST	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	-0.01149	0.00163***	-0.00202	0.00123*	-0.04263	0.00386***
RATE	0.00009	0.00004**	-0.00018	0.00004***	-0.00072	0.00011***
RATEMISSING	0.01318	0.00883	-0.01973	0.00714***	-0.07095	0.03727*
CONTROL2	-0.12296	0.00106***	-0.01023	0.00126***	0.00616	0.00206***
CONTROL3	-0.01268	0.00183***	-0.00522	0.00276*	0.01455	0.00449***
TOTBEDS	0.00007	8.83e-06***	0.00008	0.00001***	0.00002	0.00002
EMPTYELDERLY	0.00002	0.00004	-0.00015	0.00004***	0.00007	0.00007
MULTI	0.00398	0.00082***	0.00441	0.00079***	-0.01153	0.00155***
ADLINDEX	0.01075	0.00040***	0.01366	0.00095***	0.02130	0.00070***
HHI	-0.00310	0.00187*	-0.02137	0.00185***	0.00882	0.00384**
INCOME	-3.42e-07	9.73e-08***	7.09e-07	1.15e-07***	-9.00e-07	1.85e-07***
METHOD0	-0.00649	0.00247***	-0.00307	0.00162*	-0.01969	0.00633***
METHOD1	-0.00324	0.00113***	-0.00087	0.00077	-0.00174	0.00263
METHOD2	-0.00804	0.00182***	0.00477	0.00142***	0.02468	0.00414***
METHOD4	-0.00942	0.00232***	0.00142	0.00172	0.01808	0.00668***
CASEMIX	0.00156	0.00090*	-0.00180	0.00076**	-0.00319	0.00238
CONSTANT	-0.00917	0.00566	-0.08346	0.01001***	0.12087	0.01181***
N	74,667		74,667		74,667	
R^2	0.1447		0.2648		0.2271	
Prob > F	0.0000		0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 7821 clusters.

*p < .10

**p < .05

***p < .01

All models include state and year fixed effects.

Table A.39

Regression Results for Process-Based Quality Models

Least Restrictive Sample

Facility-Fixed Effects						
Dependent Variable	PROPCATHETER		PROPPARENTERAL		PROPMOBLREST	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	-0.01161	0.00166***	-0.00116	0.00114	-0.03956	0.00388***
RATE	0.00006	0.00004	-0.00015	0.00004***	-0.00071	0.00012***
RATEMISSING	0.011187	0.00789	-0.02018	0.00670***	-0.09721	0.03043***
CONTROL2	-0.00286	0.00166*	0.00028	0.00127	0.01808	0.00437***
CONTROL3	-0.00165	0.00371	-0.00131	0.00190	0.02390	0.00929***
TOTBEDS	0.00003	0.00002*	-0.00003	0.00002**	0.00008	0.00005
EMPTYELDERLY	0.00011	0.00004***	0.00009	0.00003***	0.00033	0.00009***
MULTI	-0.00169	0.00083**	0.00026	0.00064	-0.00396	0.00213*
ADLINDEX	0.00686	0.00023***	0.00623	0.00021***	0.01436	0.00064***
HHI	0.00568	0.00239**	0.00483	0.00184***	0.03207	0.00607***
INC03	1.94e-07	2.13e-07	-5.28e-07	2.12e-07***	-2.72e-06	7.34e-07***
METHOD0	-0.00793	0.00253***	-0.00256	0.00150*	-0.01614	0.00639**
METHOD1	-0.00421	0.00108***	-0.00046	0.00071	0.00125	0.00262
METHOD2	-0.01100	0.00176***	0.00477	0.00133***	0.02808	0.00416***
METHOD4	-0.00942	0.002270***	0.00194	0.00164	0.02057	0.00656***
CASEMIX	0.00152	0.00084*	-0.00062	0.00062	-0.00106	0.00241
CONSTANT	0.00987	0.00680	0.00698	0.00633	0.16933	0.02151***
N	74,667		74,667		74,667	
R^2	0.0598[b]		0.0686[b]		0.1282[b]	
Prob > F	0.0000		0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 7821 clusters.

*p < .10

**p < .05

***p < .01

[b]This value is the R^2 within.

All models have year fixed effects.

Table A.40

Regression Results for Outcome and Composite-Based Quality Models
Least Restrictive Sample

State-Fixed Effects				
Dependent Variable	Outcome-Based PROPPRESSORE		Composite-Based DEFS1TOT	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.00030	0.00138	0.39374	0.18673**
RATE	-0.00023	0.00004***	0.04098	0.00579***
RATEMISSING	-0.03164	0.00743***	5.45617	1.18333***
CONTROL2	-0.00742	0.00066***	-1.37505	0.09018***
CONTROL3	-0.00579	0.00133***	-1.50386	0.15082***
TOTBEDS	0.00005	5.36e-06***	0.01253	0.00078***
EMPTYELDERLY	-0.00008	0.00002***	-0.00303	0.00299
MULTI	0.00511	0.00051***	0.19029	0.07275***
ADLINDEX	0.00716	0.00023***	-0.00824	0.02499
HHI	-0.00652	0.00122***	-0.98078	0.17867***
INCOME	4.48e-07	6.65e-08***	-8.47e-06	9.21e-06
METHOD0	-0.00328	0.00212	0.66507	0.27790**
METHOD1	-0.00777	0.00103*	2.36500	0.16135***
METHOD2	-0.00412	0.00148***	2.64283	0.21232***
METHOD4	-0.00157	0.00203	0.78846	0.37235**
CASEMIX	-0.00136	0.00079*	0.40608	0.11215***
CONSTANT	0.00410	0.00398	4.49264	0.55528***
N	74,667		74,647	
R^2	0.1123		0.1322	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 7821 clusters.
*p < .10
**p < .05
***p < .01
Both models include state and year fixed effects.

Table A.41

Regression Results for Outcome and Composite-Based Quality Models
Least Restrictive Sample

Facility-Fixed Effects				
Dependent Variable	Outcome-Based PROPPRESSORE		Composite-Based DEFS1TOT	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.00053	0.00131	0.57946	0.17650***
RATE	-0.00023	0.00004***	0.04103	0.00579***
RATEMISSING	-0.02894	0.00697***	5.27053	1.24988***
CONTROL2	0.00010	0.00141	0.00142	0.21261
CONTROL3	0.00179	0.00262	-1.2186	0.50713**
TOTBEDS	0.00004	0.00002**	0.01941	0.00241***
EMPTYELDERLY	0.00004	0.00003	-0.00192	0.00383
MULTI	0.00133	0.00075*	-0.07906	0.11193
ADLINDEX	0.00495	0.00021***	0.12874	0.02773***
HHI	0.00096	0.00239	0.78495	0.31125**
INCOME	1.07e-07	1.69e-07	0.00011	0.00003***
METHOD0	-0.00376	0.00214*	0.73696	0.27617***
METHOD1	-0.00168	0.00103	2.42352	0.15862***
METHOD2	-0.00463	0.00149***	2.71901	0.20974***
METHOD4	-0.00205	0.00206	0.62906	0.37838*
CASEMIX	-0.00071	0.00080	0.44168	0.11078***
CONSTANT	0.02692	0.00576***	-0.97425	0.95677
N	74,667		74,647	
R^2	0.0167[b]		0.0594[b]	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 7821 clusters.

*p < .10

**p < .05

***p < .01

[b]This value is the R^2 within.

Both models include year fixed effects.

Table A.42

Regression Results for Structure-Based Quality Models

Least Restrictive Sample

State-Fixed Effects						
Dependent Variable	RNS		LPNS		AIDES	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	-0.01613	0.00622***	0.03371	0.01030***	-0.10149	0.02246***
RATE	-0.00002	0.00023	0.00011	0.00033	-0.00463	0.00084***
RATEMISSING	0.09933	0.04898**	-0.04867	0.06762	-0.49284	0.14188***
CONTROL2	0.05067	0.00701***	0.03390	0.00944***	0.25115	0.02382***
CONTROL3	0.03758	0.01212***	0.01614	0.01531	0.21321	0.03490***
TOTBEDS	-0.00021	0.00006***	0.00003	0.00007	-0.00004	0.00017
EMPTYELDERLY	0.00069	0.00013***	0.00186	0.00022***	0.00239	0.00049***
MULTI	0.01052	0.00436**	0.03598	0.00625***	-0.00926	0.01580
ADLINDEX	0.02704	0.00255***	0.03211	0.00319***	0.12633	0.00734***
HHI	0.00292	0.00982	-0.10605	0.01289***	-0.14898	0.03551***
INCOME	9.92e-06	7.79e-07***	2.54e-06	1.04e-06**	0.00001	2.75e-06***
METHOD0	0.03198	0.01521**	-0.00364	0.01650	-0.09587	0.05340*
METHOD1	0.03232	0.00512***	-0.00100	0.00701	0.01901	0.01928
METHOD2	0.03896	0.00655***	0.04920	0.01350***	0.01122	0.03252
METHOD4	0.01640	0.01490	-0.01700	0.02268	-0.02571	0.05974
CASEMIX	0.00279	0.00430	-0.00201	0.00571	-0.06514	0.01613***
CONSTANT	-0.39987	0.03457***	0.27847	0.04265***	0.78037	0.10672***
N	74,667		74,667		74,667	
R^2	0.2152		0.1239		0.0868	
Prob > F	0.0000		0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 7821 clusters.

*p < .10

**p < .05

***p < .01

All models include state and year fixed effects.

Table A.43

Regression Results for Structure-Based Quality Models

Least Restrictive Sample

Facility-Fixed Effects						
Dependent Variable	RNS		LPNS		AIDES	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	-0.00163	0.00567	0.04317	0.00826***	-0.07180	0.02016***
RATE	0.00260	0.00020	0.00011	0.00028	-0.00526	0.00078***
RATEMISSING	0.10920	0.04122***	-0.03028	0.04021	-0.55575	0.12313***
CONTROL2	-0.00175	0.00636	-0.00092	0.00981	-0.02562	0.02829
CONTROL3	0.01877	0.01057*	-0.000264	0.02461	0.15239	0.06428**
TOTBEDS	-0.00043	0.00011***	-0.00046	0.00016***	-0.00082	0.00041*
EMPTYELDERLY	0.00126	0.00014***	0.00286	0.00024***	0.00461	0.00060***
MULTI	0.00205	0.00378	0.00406	0.00540	0.00122	0.01529
ADLINDEX	0.00793	0.00135***	0.01519	0.00201***	0.04990	0.00523***
HHI	0.05089	0.00900***	0.08529	0.01550***	0.13731	0.03593***
INCOME	-1.56e-06	8.62e-07*	-4.71e-06	1.62e-06***	-0.00001	3.68e-06***
METHOD0	0.02305	0.01378*	-0.00318	0.01558	-0.08624	0.04947*
METHOD1	0.02040	0.00415***	-0.00030	0.00600	0.00722	0.01605
METHOD2	0.03040	0.00584***	0.01798	0.01053*	-0.05596	0.02578**
METHOD4	0.02335	0.01105**	-0.00775	0.01928	0.00952	0.04192
CASEMIX	0.00836	0.00376**	0.00501	0.00513	-0.03480	0.01470**
CONSTANT	0.23228	0.03220***	0.52687	0.05031***	2.3422	0.12998***
N	74,667		74,667		74,667	
R^2	0.0147[b]		0.0262[b]		0.0142[b]	
Prob > F	0.0000		0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 7821 clusters.

*p < .10

**p < .05

***p < .01

[b]This value is the R^2 within.

All models include year fixed effects.

Table A.44
Regression Results for Structure-Based Quality Models
Least Restrictive Sample

State-Fixed Effects				
Dependent Variable	LICNUR		NURSTAFF	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.01996	0.01120*	-0.06266	0.02578**
RATE	0.00022	0.00034	-0.00372	0.00089***
RATEMISSING	0.04489	0.08459	-0.39278	0.15122***
CONTROL2	0.09157	0.00980***	0.35219	0.02631***
CONTROL3	0.08222	0.01979***	0.34392	0.04659***
TOTBEDS	-0.00024	0.00008***	-0.00043	0.00019**
EMPTYELDERLY	0.00234	0.00022***	0.00450	0.00055***
MULTI	0.01314	0.00617**	-0.05823	0.01663***
ADLINDEX	0.04333	0.00405***	0.14083	0.00905***
HHI	-0.07646	0.01296***	-0.18579	0.03471***
INCOME	9.13e-06	1.04e-06***	0.00002	2.67e-06***
METHOD0	0.01423	0.02306	-0.09974	0.06211
METHOD1	0.01211	0.00715*	0.00638	0.01983
METHOD2	0.05533	0.01207***	0.02602	0.03324
METHOD4	-0.00092	0.02199	-0.02582	0.05568
CASEMIX	0.00155	0.00640	-0.05651	0.01754***
CONSTANT	0.11218	0.04982***	1.25096	0.11896***
N	74,667		74,667	
R^2	0.1359		0.1180	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 7821 clusters.
*p < .10
**p < .05
***p < .01
Both models have state and year fixed effects.

Table A.45
Regression Results for Structure-Based Quality Models
Least Restrictive Sample

Facility-Fixed Effects				
Dependent Variable	LICNUR		NURSTAFF	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	0.03729	0.00927***	-0.02571	0.02242
RATE	0.00029	0.00031	-0.00447	0.00084***
RATEMISSING	0.03999	0.04586	-0.49537	0.14552***
CONTROL2	0.00254	0.01049	-0.01420	0.03066
CONTROL3	0.02189	0.02452	0.18073	0.07651**
TOTBEDS	-0.00096	0.00018***	-0.00196	0.00047***
EMPTYELDERLY	0.00383	0.00027***	0.00806	0.00070***
MULTI	-0.00020	0.00570	-0.01345	0.01608
ADLINDEX	0.01890	0.00236***	0.06067	0.00612***
HHI	0.12451	0.01697***	0.24296	0.04002***
INCOME	-5.11e-06	1.69e-06***	-0.00002	4.26e-06***
METHOD0	0.01518	0.02154	-0.07700	0.05775
METHOD1	0.00965	0.00620	0.00536	0.01675
METHOD2	0.03673	0.01044***	-0.02269	0.02817
METHOD4	0.01071	0.02070	0.01221	0.04577
CASEMIX	0.01012	0.00581*	-0.02672	0.01621*
constant	0.75621	0.05415***	3.01955	0.14603***
N	74,667		74,667	
R^2	0.0234[b]		0.0150[b]	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 7821 clusters.
*p < .10
**p < .05
***p < .01
[b]This value is the R^2 within.
Both models include year fixed effects.

Table A.46
Regression Results for Access Model
Least Restrictive Markets

Dependent Variable				
PCTMCAID	State-Fixed Effects		Facility-Fixed Effects	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	-0.62873	0.41804	0.66737	0.36207*
RATE	-0.03963	0.01215***	-0.01374	0.00971
RATEMISSING	-6.97784	2.6512***	-3.31099	2.36212
CONTROL2	-10.13519	0.47517***	-0.73226	0.37400**
CONTROL3	-2.57698	0.86979***	0.12175	0.77340
TOTBEDS	0.00728	0.00346**	-0.00706	-0.00706
EMPTYELDERLY	-0.03419	0.01192***	0.02668	0.00798***
MULTI	-0.20703	0.30485	0.20340	0.19248
ADLINDEX	-1.50868	0.13121***	0.14916	0.05219***
HHI	-1.75475	0.64923***	1.03556	0.50782**
INCOME	-0.00028	0.00004***	0.00019	0.00005***
METHOD0	-1.74078	0.71196**	-0.81800	0.59639
METHOD1	-0.36103	0.29609	-0.27111	0.24335
METHOD2	-1.35941	0.43857***	-0.76737	0.36560**
METHOD4	-0.34194	0.71408	0.17570	0.58264
CASEMIX	0.20832	0.23109	0.01360	0.19147
CONSTANT	101.29370	1.89618***	62.32554	1.41084***
N	74,667		74,667	
R^2	0.2364		0.0047[b]	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 7821 clusters.
*p < .10
**p < .05
***p < .01
[b]This value is the R^2 within.
The state fixed effects model includes state and year fixed effects.
The facility fixed effects model includes year fixed effects.

Table A.47
Regression Results for Heavy-Care Access Model
Least Restrictive Market

Dependent Variable				
ADLINDEX	State-Fixed Effects		Facility-Fixed Effects	
Explanatory Variables	**Coefficient**	**Standard Error[a]**	**Coefficient**	**Standard Error[a]**
CON_MORT	-0.04861	0.03376	-0.00141	0.03263
RATE	-0.00005	0.00104	-0.00061	0.00098
RATEMISSING	-0.56527	0.23961**	-0.69092	0.22297***
CONTROL2	0.16315	0.02835***	-0.00477	0.03503
CONTROL3	0.26759	0.06476***	-0.00948	0.07494
TOTBEDS	0.00223	0.00025***	-0.00057	0.00045
EMPTYELDERLY	-0.00539	0.00090***	0.00160	0.00076**
MULTI	0.08487	0.02107***	-0.03106	0.01809*
HHI	-0.11583	0.04907**	0.10844	0.05091**
INCOME	1.36e-06	2.96e-06	-5.07e-06	4.32e-06
METHOD0	-0.16837	0.06291***	-0.16757	0.06172***
METHOD1	0.07910	0.02506***	0.07337	0.02270***
METHOD2	-0.03807	0.03722	-0.02008	0.03482
METHOD4	-0.03295	0.05968	-0.04687	0.05667
CASEMIX	0.21721	0.02042***	0.20908	0.01879***
CONSTANT	9.17985	0.11400***	9.15576	0.13787***
N	74,667		74,667	
R^2	0.1949		0.0537[b]	
Prob > F	0.0000		0.0000	

[a]The standard errors represent the Huber-White robust standard errors corrected for intra-home correlation using the cluster option in Stata 9 S/E. Each regression contains 7821 clusters.
*p < .10
**p < .05
***p < .01
[b]This value is the R^2 within.
The state fixed effects model includes state and year fixed effects.
The facility fixed effects model includes year fixed effects.

About the Author

Barbara Caldwell obtained her undergraduate degree in Industrial Engineering from Georgia Institute of Technology in 1981. After holding several positions in the manufacturing industry she earned her MBA in 1999 at the University of South Florida. While studying at USF she was inducted into the Phi Kappa Phi and Beta Gamma Sigma Honor Societies.

Upon completion of her MBA, Ms. Caldwell entered the PhD program in the Department of Economics with her main area of research in Health Economics. She received the Howard S. Dye Memorial Scholarship in Economics in the Fall of 2004 and was a 2005 recipient of the National Science Foundation Doctoral Dissertation Research Grant.