Medicaid Expansion and Nursing Home Quality of Care*

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Abstract

In 2014, thirty-seven states opted to expand Medicaid coverage under the provisions of the Affordable Care Act (ACA). Using detailed administrative data from the years surrounding the implementation of Medicaid expansion, this paper uses a regression discontinuity design to test the impact of Medicaid expansion on the quality of care provided in Skilled Nursing Facilities (SNFs). While there is no consensus on how best to measure quality of care, I use three measures: overall rating, weighted deficiency scores, and resident complaints, as proxies for total quality. There are small, but statistically significant, effects from Medicaid expansion on each of these dependent variables. This suggests that quality of care is sensitive to policy changes and lays the groundwork for further examination of the interaction between policy and patient outcomes.

1. Introduction

The United States, along with many similarly developed economies, is facing an aging population. The post-WW2 baby boom generation, low birth rates in the past several decades, and advances in medical technology have skewed the distribution of the US population older. Among the challenges introduced by an aging population is the availability and quality of long-term skilled nursing care for elderly and disabled individuals.

Currently, fifteen percent of the US population is age 65 or older. By 2060, the share of aged adults (age 65 or older) is expected to rise to nearly a quarter of the total population – nearly 100 million (US Census Bureau, 2018). Perhaps even more critically, the number of individuals in the US above the age of 85 is expected to triple over the next four decades. The increase in the elderly population affects the demand for skilled nursing facilities (SNFs), as the use rate of nursing facility services of individuals above the age of 85 is three times that of individuals above the age of 65 (24 per 1,000 compared to 85 per 1,000) (Lendon et al., 2018). This shift in the demographic composition of the US population underscores the importance of examining the drivers of quality in long-term care, particularly for those individuals most reliant on the services of skilled nursing facilities which provide high levels of patient observation, proximity to medical services and professionals, and a cost that is generally substantially lower than in-home care.

Roughly 1.4 million Americans resided in nursing homes in 2017 (KFF, 2017). The cost of such care is borne by a combination of private individuals, insurance, and publicly financed healthcare programs. The Medicaid program currently accounts for roughly a third of total US health expenditures on nursing homes (CMS, 2018). However, the growing number of older adults, low participation in private long-term care insurance programs, and declining levels of personal saving suggest an increasing role for Medicaid as a source of financing in the future. Recent significant changes to the structure of the US healthcare system, including the enactment of the Patient Protection and Affordable Care Act (ACA) in 2010 and state level adoptions of Medicaid expansion in 2014, provide a unique environment in which to examine the causal effects of increased spending on the quality of care provided in SNFs. The increase in Medicaid-eligible individuals means that demand for care in SNFs will increase. In the presence of a static supply of qualified facilities, this further suggests that the overall quality of care will decrease. Using detailed administrative data from the years surrounding the implementation of state Medicaid expansion this paper uses a regression discontinuity design to test the impact of Medicaid expansion on the quality of care provided in SNFs. While there is no consensus on how best to measure quality of care, I use three measures: overall rating, weighted deficiency scores, and resident complaints, as proxies for total quality.

Section 2 provides additional background and context for this paper. Section 3 describes the various sources of data compiled for the analysis. Section

4 presents the primary model, alternative model specifications, results, and discussion. Section 5 concludes.

2. Background

Medicaid: A Brief History

Medicaid was one of the many programs that emerged from President Lyndon B. Johnson's Great Society plan in the mid-1960s. Established by Title XIX of the Social Security Act of 1965, the program created a state/federal partnership to:

> "furnish (1) medical assistance on behalf of families with dependent children and of aged, blind, or permanently and totally disabled individuals, whose income and resources are insufficient to meet the costs of necessary medical services, and (2) rehabilitation and other services to help such families and individuals attain or retain capability for independence or self-care."

State participation in the Medicaid program is not mandatory. However, since 1982, when Arizona established the Arizona Health Care Cost Containment System, all states and the District of Columbia have had a Medicaid system. There is no single Medicaid framework, but the Centers for Medicare and Medicaid Services (CMS) provides federal oversight and ensures that the state-run programs comply with minimum federal standards

for service quality.

The Medicaid program operates as a partnership between the federal and state governments. State governments bear a percentage of the costs incurred through administration and provision of the program and the federal government provides matching funds. The level of federal funding varies by state and is determined annually using the Federal Medical Assistance Percentage (FMAP). The FMAP of each state is a function of per capita income in the state and is no less than 50 percent and no greater than 83 percent of total program costs. (DHS, 2015).

Medicaid provides coverage to over 7 million individuals over the age of 65. Table 1 shows the percentage of state populations over the age of 65 covered by Medicaid in 2013, pre-expansion.

As of 2016, 9 percent of Medicaid enrollees were classified as aged. Aged enrollees represent the most rapidly growing group of Medicaid patients, expected to grow by more than 3 percent annually over the next decade. For comparison, every other group (disabled, child, low-income adult) is anticipated to grow by just 1 percent annually over the same time period. (CMS, 2018).

The 9 percent share of Medicaid enrollees that are aged does not represent the full magnitude of the financial burden on the program. The average Medicaid expenditure per aged enrollee in 2016 was $14,700. Only disabled enrollees accounted for higher per-enrollee expenditure ($19,754) and children and low-income adults, collectively 70 percent of Medicaid enrollees, had

Table 1: Medicaid Enrollment by Age

State	Enrollees 65+	State	Enrollees 65+	State	Enrollees 65+
Alabama	11%	Kentucky	11%	North Dakota	11%
Alaska	7%	Louisiana	9%	Ohio	7%
Arizona	7%	Maine	17%	Oklahoma	7%
Arkansas	10%	Maryland	7%	Oregon	9%
California	9%	Massachusetts	12%	Pennsylvania	10%
Colorado	7%	Michigan	7%	Rhode Island	13%
Connecticut	14%	Minnesota	9%	South Carolina	8%
Delaware	6%	Mississippi	12%	South Dakota	9%
District of Columbia	9%	Missouri	8%	Tennessee	10%
Florida	13%	Montana	9%	Texas	9%
Georgia	10%	Nebraska	9%	Utah	5%
Hawaii	9%	Nevada	8%	Vermont	11%
Idaho	7%	New Hampshire	10%	Virginia	10%
Illinois	8%	New Jersey	13%	Washington	8%
Indiana	8%	New Mexico	7%	West Virginia	10%
Iowa	7%	New York	11%	Wisconsin	11%
Kansas	9%	North Carolina	10%	Wyoming	7%

average annual expenditures of just $3,555 and $5,159, respectively. Enrollee heterogeneity and the resulting differences in healthcare requirements cannot be forgotten when considering the effect of policy changes and long-term program costs (CMS, 2018).

The Affordable Care Act and Medicaid Expansion

The Affordable Care Act (ACA), enacted in 2010, included provisions for the expansion of Medicaid benefits to previously ineligible low-income individuals. The Medicaid expansion established a new, higher baseline of income to determine eligibility and expanded coverage to childless adults previously ineligible for Medicaid coverage.

However, the 2012 Supreme Court decision in the 2012 case *National Federation of Independent Business v. Sebelius* found that requiring state-level expansion was an unconstitutionally coercive use of the Spending Clause and, therefore, only be adopted voluntarily. To encourage states to adopt Medicaid expansion, the federal government agreed to pay 100 percent of the costs incurred by individuals newly eligible under state expansion of Medicaid for the first 3 years (2014, 2015, 2016), 95 percent in 2017, 94 percent in 2018, 93 percent in 2019, and 90 percent from 2020 onward.

Thirty-seven states opted into the Medicaid expansion and expanded coverage took effect January 1, 2014 (KFF, 2019).[1] In states that adopted the expansion, childless, non-pregnant adults earning up to 133 percent of the

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[1]Michigan, New Hampshire, Pennsylvania, Indiana, Alaska, Montana, Louisiana, Virginia, Idaho, Maine, Nebraska, and Utah enacted the expansion after the initial (January 2014) eligibility date.

federal poverty limit (FPL) became eligible for coverage. The District of Columbia, Minnesota, and New York opted to expand coverage to adults earning up to 200 percent of the FPL. In the states that did not opt into the expansion, adults who are not pregnant or parents of young children remain ineligible for coverage (CMS, 2018).

Enrollment data show that of the 75 million individuals enrolled in Medicaid in the 32 states that adopted the expansion prior to September 2017, 17 million were new enrollees including 12 million who had not qualified for Medicaid prior to the expansion (KFF, 2019b). Determining what, if any, effect the expansion of Medicaid to previously ineligible patients has on the quality of care is important for assessing the effectiveness of policy changes on individual outcomes. Given the scope of Medicaid's reach and cost and its importance as a social institution, these questions are not trivial.

Aging and Medicaid Utilization Among Skilled Nursing Facility Residents

The graying of the American population is not confined to any isolated geographic regions. Figure 1 shows the percentage of the population in each state that is over the age of 65 every five years from 2005 to 2030 (projected). By 2030, only five states are expected to have a population that is less than 15 percent aged. Increases in longevity and medical technology as well as demographic trends and the aging of the boomer generation explain most of this shift (CDC, 2019).

In addition to greater longevity and a need for care, the rate of poverty

Figure 1: Share of population 65+
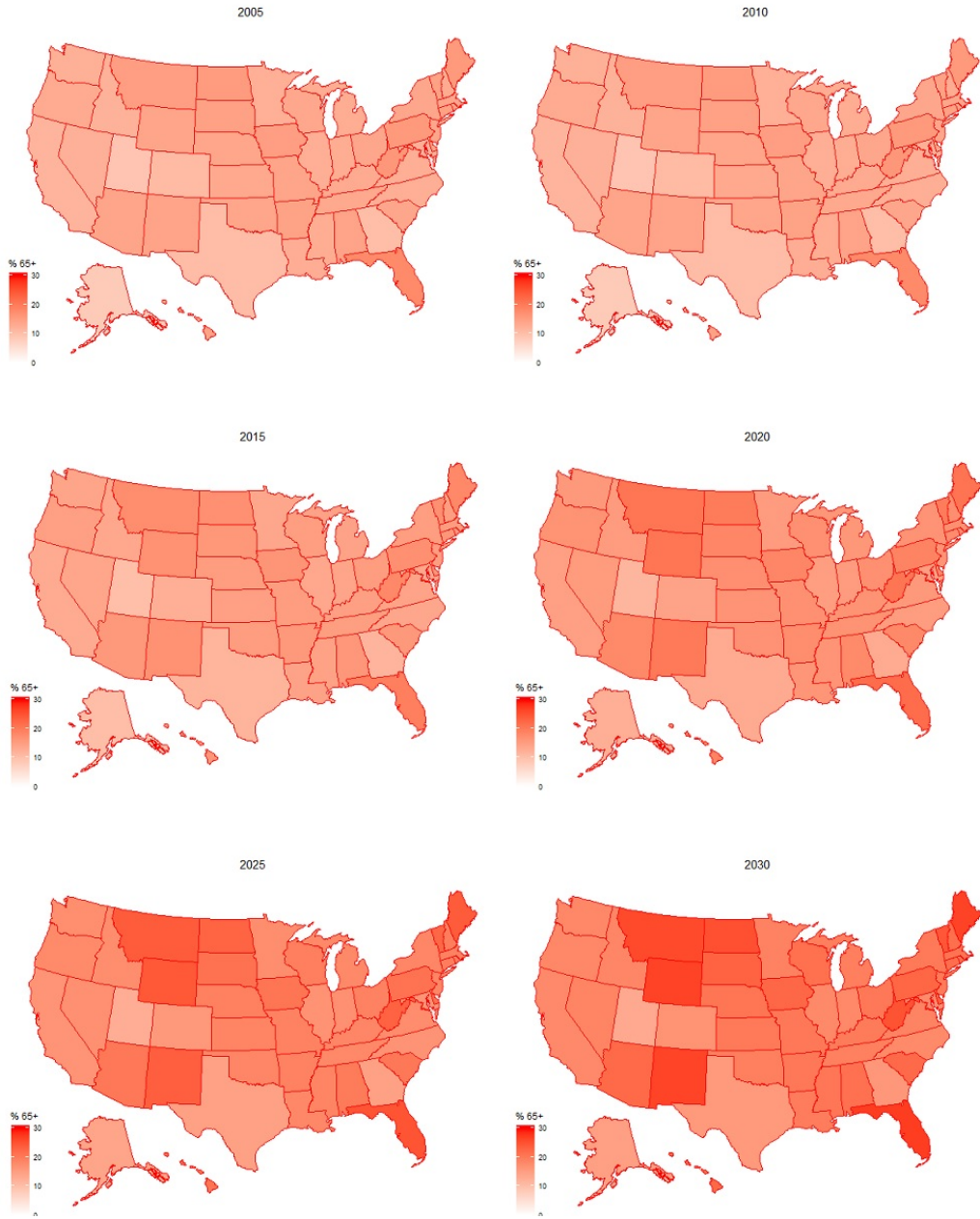
among older Americans is also increasing. In fact, nearly one in ten elderly individuals (over age 65) experience poverty (US Census Bureau, 2017). As the proportion of the impoverished elderly increases and states expand Medicaid coverage, one might expect to see substantially greater numbers of aged individuals receiving coverage and benefits, including coverage of long-term care in an SNF. Figure 2 shows the rate of poverty among the elderly by state as well as the share of aged individuals in each state covered by Medicaid in 2014 (ACL, 2018; MACPAC, 2018).

Medicare and Medicaid both provide coverage for long-term care. But the structure of Medicare is such that custodial care – non-medical nursing home care – is not covered. The limits of Medicare coverage mean that most long-term care patients must either 1) pay costs out-of-pocket, 2) have private long-term care insurance, or 3) receive Medicaid funds.

Between 60 and 65 percent of SNF residents nationwide report Medicaid as the primary payer (KFF, 2019). There is substantial state variation, with the proportion reporting Medicaid as the primary payer ranging from less than half to nearly four fifths. Similarly, there is variation in the percentage with Medicare as the primary payer (from 10 to 20 percent) and with private insurance or other sources as primary payer (10 to 50 percent). These rates are similar in states that adopted and implemented Medicaid expansion and states that did not.

As the use of nursing care outside of the home becomes more widespread, there has been robust discussion surrounding the measuring of and deter-

Figure 2: Poverty rate and Medicaid coverage, 65+
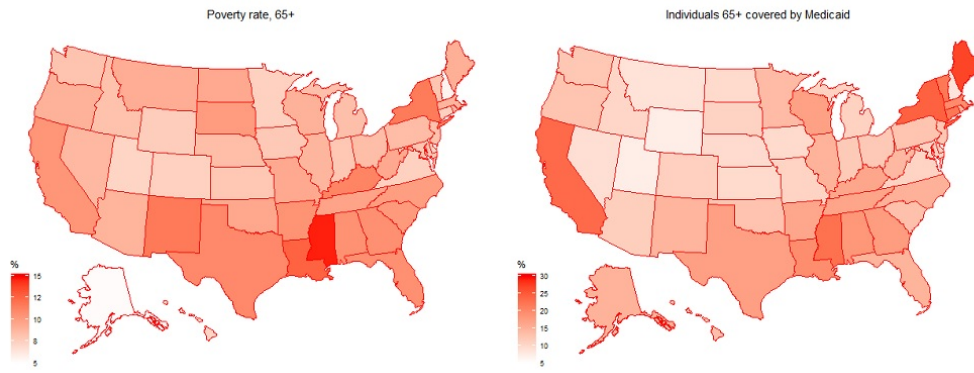
minants of quality of care. Bundorf et al. (2009) and Wedig and Tai-Seale (2002) show that publicly reported quality ratings generate an increase in patient enrollment or participation at medical facilities. Dafny and Dranove (2008) also illustrate an increase in market share of highly rated health plans and providers. Patients value the signals provided by quality rankings and consumption of services is sensitive to changes in the ratings. Consumers benefit from additional quality information on medical services. Reducing the complexity of the quality measure reporting from an assessment of 18 dimensions of clinical care to a single, comprehensive score increased the accessibility of the information to individuals and increased competition between SNFs and overall quality of care (Chernew et al., 2008; Werner et al.; 2012, Zhao, 2016).

While the standard for nursing home quality ratings since 2009 has been the Five-Star Rating System published by CMS, there were a number of precursors, many of which used similar components to measure the quality of care. Typically, the indicators used to determine quality can be divided into three categories: structural, process, and outcome (Donabedian, 1985). Structural quality indicators include elements like staffing levels or records of building renovations. Process indicators frequently rely on tabulation of care-related tasks, such as the administration of medications or vaccines. Finally, outcome indicators may include recovery from an illness, new illness or injury, or changes in weight. Each of these types has advantages and drawbacks, and despite the wide array of quality indicators available there

is still no settled agreement on how best to measure quality (Castle and Ferguson, 2010).

While the introduction of a simplified quality ranking measure induces behavioral changes in patients, it also introduces a degree of opacity which hinders more robust analyses of quality. In addition to the broad quality ratings considered by most of the literature, this analysis will incorporate alternative measures of quality in order to determine whether the simplified ratings systems are appropriate for analysis. What this paper will ultimately demonstrate is that the magnitude of the effect of Medicaid expansion depends considerably on the measure selected to represent quality of care.
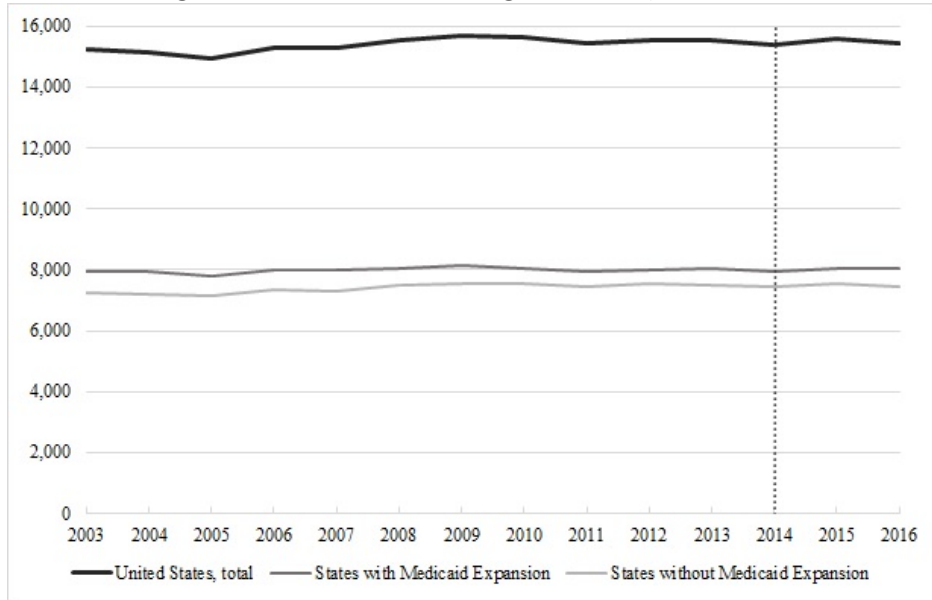
Medicaid Expansion and Quality of Care

The theoretical basis of this analysis rests on the simplest conceptions of supply and demand. Medicaid expansion significantly increased the number of low-income individuals eligible for coverage by increasing the cap on income earned and assets held by Medicaid applicants. The supply of SNFs has remained practically static since the early 2000s and, in the short run, has not increased in response to the larger patient pool. Nationwide, facilities are operating at an average of 80 percent occupancy (KFF, 2018). Figure 3 shows the number of certified nursing facilities in the United States remained practically constant from 2003-2016. In the short-term the current level of supply may be satisfactory. In the longer term, particularly as the population continues to age and the number of individuals requiring custodial care in-

creases, one should expect to see facilities approaching their occupancy caps. Examining the response of nursing home care providers to increased demand over a longer horizon will be a valuable line of inquiry for further analyses.

Since the implementation of Medicaid expansion in 2014, there are 51 more certified facilities nationwide – plus 82 for states with the expansion, minus 31 for states without – a total increase of less than half a percent. Since the passage of the ACA in 2010, there has been a decrease of 170 facilities nationwide – 29 in states that later adopted Medicaid expansion and 141 in states that did not. Again, the change is less than one percent of the total facilities. Growth in the number of nursing facilities has been sluggish over the past decade. Nationally, the growth rate has averaged barely one third of one percent over the past decade. In states that adopted Medicaid expansion, the number of facilities increased at a somewhat slower rate (0.25 percent per year) than in non-expansion states (0.38 percent annually over the same time period).

If nursing care providers are sensitive to patient demand for care, one would expect to see an increase in the number of facilities following the expansion of Medicaid. However, since 2014 the number of facilities in expansion states has grown by only 0.02 percent per year and there has been a decrease of 0.37 percent per year in non-expansion states. Longer-term trends may emerge in future research, but as of now it remains unclear whether Medicaid expansion had an effect on the number of nursing facilities. Additionally, it is highly likely that other barriers exist which limit or slow the increase of

Figure 3: Certified Nursing Facilities, 2003-2016

nursing facilities.

Table 2 shows the average facility capacity, bed count, and number of facilities for expansion and non-expansion states from 2013-2015 – the years straddling the implementation of Medicaid expansion. Appendix tables A1-A3 contain a more detailed breakdown by type of facility.

Facilities in states that adopted Medicaid expansion, on average, both have a larger number of beds and operate at a higher percent of total capacity. Though the number and capacity remain largely stable over the three years being examined, it is important to consider other factors. From 2013 to 2015 there was an increase in facilities in non-expansion states and a decline in the number of certified nursing facilities in states that expanded Medicaid. While this may appear to contradict Figure 2, the sample of facilities in the CMS Nursing Home Compare data from which Table 2 is calculated contains only facilities reporting data for every quarter of the calendar year reported. This excludes facilities that were not operational for the entire year. Thus, facilities that closed and new facilities that began operations after the first quarter of the calendar year are not included in the analysis. More likely, this reflects the definition of long-term care facility captured in the KFF data versus the CMS data, as the latter does not include facilities established primarily for the care and treatment of mental diseases. Further detail on the advantages and limitations of the CMS data will be discussed later in this paper.

The majority of Medicare and Medicaid certified skilled nursing facilities

Table 2: SNF Characteristics by State Expansion Decision

	2013	2014	2015
All states			
Average capacity	0.837	0.831	0.830
Number of beds	108.5	108.3	108.2
Number of facilities	14,251	14,708	14,719
Expansion states			
Average capacity	0.858	0.854	0.852
Number of beds	115.2	115.1	115.0
Number of facilities	7,894	7,855	7,849
Non-expansion states			
Average capacity	0.812	0.805	0.805
Number of beds	100.3	100.6	100.5
Number of facilities	6,357	6,853	6,870

are classified as for-profit (FP). Roughly a quarter are operated as non-profit (NFP) facilities and less than 5 percent are owned and operated by the government. For-profit facilities are driven by the profit motive and expend less on resources that could improve quality of resident care – such as increased nursing staff, facility upgrades, etc. – than their non-profit counterparts (Harrington, 2001; Hilmer et al., 2005). Non-profit facilities, on the other hand, funnel funds towards expanding services and staff or implementing other upgrades to facility quality or capacity (Hilmer et al., 2005).

In addition to the profit motive driving FP facilities, the composition of patients and sources of payments – Medicaid, Medicare, out-of-pocket, or private insurance – may also limit the facilitys' spending on care quality (Decker, 2008). Thus, it will be important to consider facility types and the potential differences in quality determinants when evaluating the effect of state Medicaid expansion.

Determining the effect of Medicaid expansion on quality of care a priori is difficult. While individuals not previously eligible for Medicaid coverage and who had not previously been receiving nursing care will see an increase in total welfare added by nursing care – rising from zero to some positive amount – the increased demand for care coupled with a relatively static supply may reduce the quality of care experienced by individuals participating in the nursing care.

Unless there is a corresponding growth in the supply of skilled nursing

care or a comparatively large increase in nursing care "productivity", we would expect the additional demands on the skilled nursing care system to have a negative effect on the amount of per-patient care as well as the quality. Additionally, one would expect to see an increase in the cost of skilled nursing care, which may have further ramifications for an already stressed public (and private) financing system for long-term care in the United States.

The expansion of state Medicaid programs, though largely affecting individuals under the age of 65, had a demonstrably large impact on the size of the enrolled population in expansion states. Although the expansion was largely telegraphed – care providers and patients were both aware relatively far in advance that the program would be taking effect – the nature of the nursing home industry renders it relatively inflexible with regard to expanding service.

As more patients become eligible for Medicaid subsidized nursing home care, facilities find themselves rapidly approaching capacity. Thus, it is possible that expanding Medicaid coverage could result in more crowded conditions, higher costs (both living and staff) and poorer quality of care in expansion states relative to non-expansion states. This supply constraint, coupled with the dominance of for-profit facilities in the nursing home sector, suggests potential negative effects of Medicaid expansion on the quality of patient care.

3. Data

In order to measure the impact of Medicaid expansion on quality of care, there must be a clear understanding and discussion of what 'quality' is and how it is measured. This necessitates finding a source of data with multiple elements which can be argued to represent a facility's 'quality' of care. Additional information about the facility including patient, staff, facility, and geographic characteristics will serve as control variables.

The most commonly used source of nursing home quality data is the Centers for Medicare and Medicaid Services (CMS) Five-Star Quality Rating System. Implemented in 2009, the Five-Star Quality Rating System was designed with the intention of simplifying the quality measures reported to consumers. There has been substantial review of the effect of simplified healthcare quality rating systems on patient behaviors and outcomes.

Nursing care quality data by state and facility type will be constructed by aggregating facility level data from CMS's Medicare Nursing Home Compare data sets from 2013 to 2015. As Medicare expansion went into effect in the beginning of 2014, examining these years of data will allow us to observe the timeframe in which the policy change took place. Quality measures are reported for each facility on a quarterly basis. In order to permit aggregation of scores on an annual basis, only facilities which operated continuously in each year are included. This does not create a sample size limitation, as there remain more than 14,000 facilities reporting scores in each year.

Approximately 12,000 facilities report scores in each quarter of the entire sample.

Each observation reports rating, staffing, geographic, and descriptive facility data. Overall ratings, survey ratings, quality ratings, staffing ratings, and nursing quality ratings are reported on a five-point scale. Year, quarter, state, certification, county, ownership type (non-profit, for-profit, or government), total size, and number of residents are available for use as facility-level controls. In addition, hours per resident per day of specific types of staff members, weighted deficiency scores, incident and complaint counts, and data on fines levied is included.

This analysis will consider three possible quality measures: weighted deficiency score, resident-adjusted complaints, and overall facility score.

The weighted deficiency score is a composite measure that considers staffing levels, violations observed during routine inspections, and patient health outcomes. A higher score indicates the presence of more frequent – or more severe – violations or deficiencies. The scores are updated annually and incorporate information from Medicare/Medicaid inspectors and status reports filed by the facilities themselves. If Medicaid expansion has a positive effect on the quality of care the weighted deficiency score should decrease. The converse holds true as well.

In addition to facility-specific weighted scores, it is possible to construct a measure of formal complaints per resident recorded by each facility. This will, to some degree, normalize the reporting of deficiencies. This reduces

the amount of information available about the magnitude of the violation or concern being reported. However, as formally reporting a complaint is a somewhat costly process, this analysis will assume that minor incidents will generally not be accounted for and only major complaints or deficiencies will be captured.

Finally, the overall rating is derived directly from the CMS Five-Star rating system. Facilities are given one to five stars based on their assessed performance. Most patients see this information before selecting a facility and use it to inform their decision making. However, there are some drawbacks.

First, the Five-Star rating, while simple to understand, is rather opaque. Absent significant research, patients may not be aware of which elements of a facility's performance are considered when rankings are given. Second, the star ratings are relative to other facilities in the state and do not capture facility performance relative to those in other states.

The ratings are based on health inspection outcomes, staffing, and quality measures. Each of the three components receives a rating from one to five stars and the nursing home receives an overall score under the CMS guidelines. The system is designed to give individuals and their families easily digestible information regarding the relative quality of a specific facility, but there are some critical shortcomings with how the rating system is designed which must be addressed to perform the analyses presented in this paper.

Because of state level variations in health inspection, quality measures,

and staffing requirements the CMS rating is based on a facility's performance relative to other facilities only in that state. Using health rating scores, the top decile receives five-star ratings, the bottom quantile receives one-star ratings, and the middle seventy percent receive two, three, or four stars with the equal allocation. The state-specific ratings of different facilities may distort the effectiveness of quality signaling to patients choosing facilities. If there are large differences in the requirements that two neighboring states impose on nursing facilities, one could potentially see patients opting to cross state lines to receive better care. As many state Medicaid programs restrict patients to in-state facilities, it is unlikely that these effects are large for individuals that do not privately finance their long-term care, and thus fall outside the scope of this analysis.

Concerns about the state-level variation in requirements and ratings basis for nursing home facilities are valid. However, the goal of this analysis is to determine what, if any, effect the adoption of state Medicaid expansions had on the quality of nursing home care. To that end, this analysis will rely on weighted health deficiency scores for facilities which will vary across facilities, time, and state. Since there will not be a direct comparison of raw scores between states, this analysis will allow for the consideration of non-predetermined distributions of scores and the measurement of variability as well as level of scores within a state pre- and post-Medicare expansion. Treatment will, in this context, be whether or not the state in which a facility is located chose to participate in the expansion of Medicaid to additional low-

income individuals.

Table 3 shows median weighted deficiency scores, complaints per resident, and overall rating details in 2013-2015.

At a glance, there are no substantial differences in the number of beds, residents, overall rating, or deficiency scores. There is a slight increase in the number of complaints per 100 residents. Appendix tables A4-A6 report the same information by facility type. Similar trends hold, although there are some differences in the median complaints per 100 residents between types of facilities. In for-profit facilities, there is a decline from 2013 to 2015. Complaints in non-profit facilities remain stable, and complaints in government run facilities more than double. While the underlying causes of these trends are not immediately apparent, their presence suggests the importance of considering facility type in any analysis.

Table 3: SNF Characteristics by Year

	Median	Mean	St. Dev.
2013, n=14,261			
Beds	100.0	108.6	62.6
Residents	82.0	90.6	56.2
Facility capacity	0.871	0.837	0.517
Overall rating	3.00	3.26	1.32
Weighted deficiency score	37.33	55.06	64.85
Complaints per 100 residents	1.39	3.80	6.91
2014, n=14,708			
Beds	100.0	108.3	61.4
Residents	82.0	89.8	54.9
Facility capacity	0.867	0.831	0.187
Overall rating	4.00	3.39	1.32
Weighted deficiency score	38.00	55.63	67.85
Complaints per 100 residents	1.60	4.08	7.34
2015, n=14,722			
Beds	100.0	108.2	61.
Residents	82.0	89.6	54.1
Facility capacity	0.867	0.830	0.172
Overall rating	3.00	3.24	1.37
Weighted deficiency score	37.333	56.041	68.804
Complaints per 100 residents	1.70	4.28	7.52

4. Model and Results

This analysis will employ a difference-in-differences approach where the outcome of interest is facility quality. The treatment is whether the state in which the facility is located elected to expand Medicaid coverage. The baseline model will take the form:

$$quality_{ijt} = \alpha + \beta\, expand_{ijt} + \gamma\, time_t + \delta(time_t * expand_{ijt}) + \varepsilon_{ijt} \quad (1)$$

Where $quality_{ijt}$ represents the quality of facility i in state j at time t, $time_t$ contains time-period dependent controls, $expand_{ijt}$ indicates whether state j had expanded Medicaid coverage at time t, $(time_t * expand_{ijt})$ is the interaction of the treatment – Medicaid expansion – and time, and ε captures the unexplained error term. The coefficient α is the constant, β is the specific group treatment effect, γ is the time trend, and δ is the true treatment effect. The parameter of most interest is δ, which will indicate the effect of Medicaid expansion on the various quality of care measures used as dependent variables in different model specifications.

To obtain a useful estimator of the treatment effect, it should be unbiased. That is, $E[\delta]=\delta$. Standard assumptions include:

1. a correctly specified model,

2. an error term that is, on average, zero ($E[\varepsilon]=0$), and

3. parallel trends, meaning the error term is uncorrelated with other vari-

ables in the equation.

Let there be two time periods: 0 (pre-treatment) and 1 (post-treatment). Treatment is indicated by assigning a value of 0 (control) or 1 (treated) to the *expand* term. Let $Y_{time}^{treatment}$ represent each possible case. Applying the assumptions above to equation (1) the expect values of the outcomes (Y) are:

1. $E[Y_0^0] = \alpha$

2. $E[Y_1^0] = \alpha + \gamma$

3. $E[Y_0^1] = \alpha + \beta$

4. $E[Y_1^1] = \alpha + \beta + \gamma + \delta$

The difference in difference estimator, δ, should be understood as the difference in the average pre- and post-treatment outcome of the treatment group minus the difference in the average pre- and post-treatment outcome of the control group:

$$\delta = Y_1^1 - Y_0^1 - (Y_1^0 - Y_0^0) \tag{2}$$

We can show that the estimator δ is unbiased, as the expected value of the right-hand side of equation (2) is:

$$= E[Y_1^1] - E[Y_0^1] - (E[Y_1^0] - E[Y_0^0]) \tag{3}$$

$$= \alpha + \beta + \gamma + \delta - (\alpha + \beta) - (\alpha + \gamma - \gamma) \tag{4}$$

$$= \delta \tag{5}$$

Figure 4 illustrates the difference in difference estimator graphically. The lower solid line represents the control group. The dashed line is the counterfactual for what would have been expected had the treatment group not received the treatment. The upper solid line is the observed set of outcomes for the treatment effect, and δ is the difference attributable to just the treatment.

Through using multiple specifications and different dependent variables, this analysis will endeavor to determine (1) whether or not there is an observed causal relationship between state Medicaid expansion and quality of care and (2) what the key drivers of nursing home quality are.

Before moving to the results of the difference-in-differences results, however, Table 4 presents OLS results for the full sample and then broken down by facility type. Standard errors are presented in parentheses below the estimates. The dependent variable is the facility weighted deficiency score. The deficiency scores range from 0 to 1882.83 with a mean of 55.58 and a median of 37.33. Just one in eight facilities receive deficiency scores greater than 100. The wide variation of scores is a result of the deficiency scoring structure.

When a facility is found to have a deficiency during a routine inspection it is assigned between 4 points (for an isolated instance with no harm potential) and 175 points (for a widespread problem posing immediate jeopardy to resident health or safety). If a facility receives 35 points or more or is

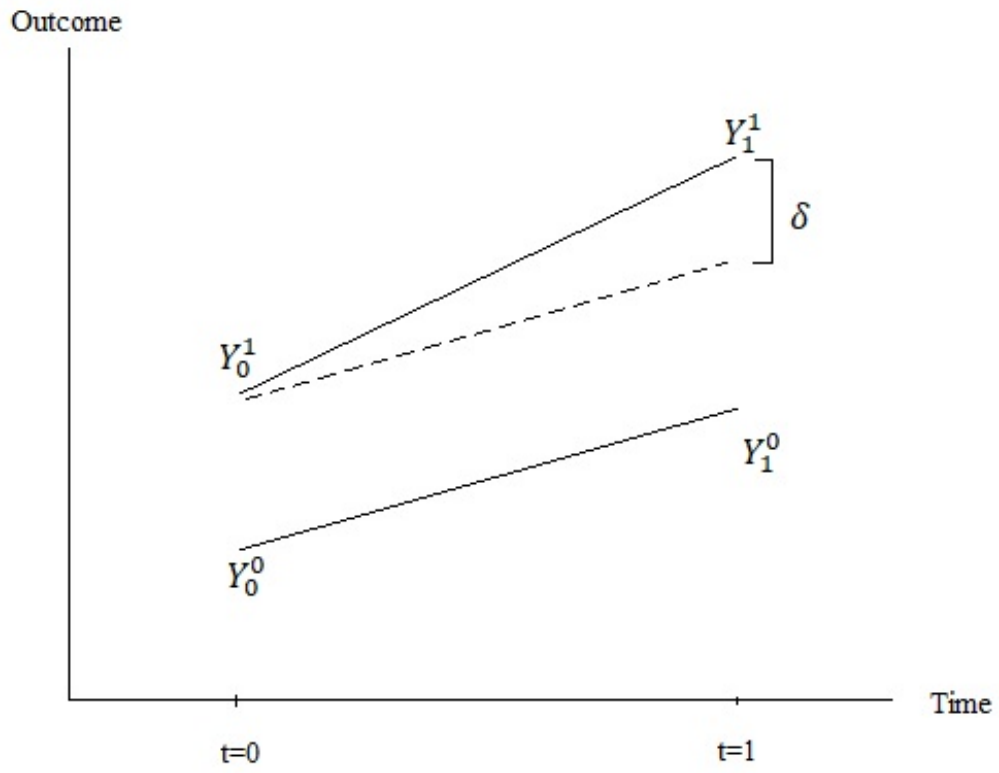Figure 4: Difference-in-difference example

Table 4: OLS Results

	Dependent variable:			
	Weighted deficiency score			
	Full Sample	For-profit	Non-profit	Government
(Intercept)	107.691***	110.279***	97.979***	115.797***
	(0.974)	(1.326)	(1.729)	(4.388)
Expand	−3.681***	−4.082***	−2.238***	−3.927***
	(0.239)	(0.304)	(0.383)	(1.033)
Beds	−0.013***	−0.009***	−0.013***	−0.029***
	(0.002)	(0.003)	(0.003)	(0.005)
Facility capacity	−2.100***	−1.617***	−4.890***	−5.676*
	(0.347)	(0.385)	(1.010)	(3.254)
Overall rating	−4.846***	−2.812***	−7.960***	−9.685***
	(0.248)	(0.317)	(0.393)	(1.042)
Survey rating	−18.411***	−20.872***	−13.407***	−16.883***
	(0.218)	(0.286)	(0.326)	(0.891)
Quality rating	0.483***	−0.154	1.221***	2.262***
	(0.127)	(0.162)	(0.205)	(0.495)
Staffing rating	1.368***	0.169	2.899***	3.500***
	(0.235)	(0.305)	(0.392)	(0.976)
RN rating	−2.958***	−2.814***	−2.653***	0.093
	(0.214)	(0.305)	(0.332)	(0.771)
Aide hours	−6.678***	−22.940***	2.029	4.773
	(1.332)	(2.227)	(1.603)	(4.298)
LPN hours	−8.231***	−21.699***	−1.137	3.343
	(1.090)	(1.813)	(1.303)	(3.640)
RN hours	−11.582***	−36.242***	1.227	6.411
	(2.137)	(3.567)	(2.707)	(5.860)
Total hours	10.593***	28.648***	0.652	−5.240
	(1.382)	(2.315)	(1.666)	(4.364)
Complaints per resident	100.963***	100.045***	109.231***	34.878***
	(1.783)	(2.120)	(4.169)	(7.266)
Total penalties	36.244***	35.954***	34.152***	37.972***
	(0.382)	(0.460)	(0.731)	(1.657)
Incident count	1.217***	1.395***	0.658***	0.454***
	(0.045)	(0.055)	(0.090)	(0.139)
Fine count	−29.419***	−29.037***	−27.401***	−33.363***
	(0.444)	(0.537)	(0.839)	(1.936)
In-hospital facility	4.310***	−1.328	3.156***	10.899***
	(0.571)	(1.717)	(0.604)	(1.207)
R^2	0.504	0.497	0.506	0.542

Note: *p<0.1; **p<0.05; ***p<0.01

found to have low-risk but widespread problems, an automatic reinspection is triggered.

At the first reinspection, points are assigned as in earlier inspections. If problems noted in the initial inspection have been corrected, the process ends. If not, subsequent revisits are scheduled. After the second reinspection facilities are assigned additional non-compliance points – between 50 percent and 85 percent of the points from the previous inspection score are added to the total weighted score. In this manner, a facility that receives an initial score of 175 points and does not take corrective action can have a deficiency score of almost 1000 after three failed reinspections.

There are many similarities between facilities of different types. One key difference is the magnitude and significance of staffing hours of Aides, LPNs, and RNs per patient in for-profit facilities compared to non-profit facilities and government run nursing homes. This suggests that facilities operating under the profit motive may be supplying less staffing per patient relative to non-profit driven facilities and therefore be providing a lower quality level of care.

The OLS results presented in Table 4 are for the model run on the full sample, for-profit facilities only, non-profit facilities only, and government facilities only. The dependent variable is the weighted facility score. Tables A7 and A8 in the Appendix present OLS results using complaints per resident and overall rating as the dependent variables, respectively.

Table 5 presents a simplified table of results for the difference-in-differences

estimations using facility weighted deficiency scores, complaints per 100 residents, and the facility's Five-Star CMS rating as dependent variables. Tables A9-A12 in the Appendix present a full table of results that includes all independent variables.

The key parameter in Table 5 is 'Treated x Time' which is the coefficient of the difference-in-differences estimator. This can be interpreted as the true treatment effect. For all dependent variable specifications, it is significant at the 5 percent level in the full sample, suggesting that states that adopted Medicaid expansion saw lower deficiency scores, improvements in ratings, but an increase in the number of complaints per resident. For non-profit facilities there is nearly no effect, suggesting that they were not substantially affected by the Medicaid expansion.

Figure 5 presents the results in a more visually interpretable way. Panels (I)-(III) illustrate the trends in quality measures pre- and post-treatment for each of the three dependent variables. Period 0 is pre-treatment; period 1 is post-treatment. The red line represents the outcomes of the control facilities in states that did not expand Medicaid. The blue line imposes the same trends on facilities in states that did receive the Medicaid expansion treatment and illustrates the expected constant differences in outcome one would expect to see in a counterfactual universe where treatment did not occur. Finally, the green line shows the actual outcomes of treated facilities.

It is clear that there was indeed an effect from Medicaid expansion on the quality outcome measures. For the weighted deficiency score, the sign

Table 5: Difference-in-Difference Results

	Full Sample	For-Profit	Non-Profit	Government
Weighted deficiency score				
(Intercept)	106.991***	110.181***	97.961***	113.484***
	(1.000)	(1.356)	(1.771)	(4.515)
Treated	−1.412***	−1.504***	−1.114*	1.484
	(0.404)	(0.513)	(0.646)	(1.743)
Time	2.344***	2.668***	1.170*	3.402**
	(0.359)	(0.448)	(0.602)	(1.494)
Treated x Time	−3.669***	−4.163***	−1.687**	−7.892***
	(0.485)	(0.613)	(0.783)	(2.030)
R^2	0.505	0.498	0.507	0.543
Complaints per resident				
(Intercept)	0.043***	0.050***	0.039***	0.071***
	(0.001)	(0.001)	(0.001)	(0.004)
Treated	−0.002***	−0.003***	−0.0003	0.001
	(0.0003)	(0.0004)	(0.0004)	(0.001)
Time	0.001**	0.001*	0.0005	0.001
	(0.0003)	(0.0003)	(0.0004)	(0.001)
Treated x Time	−0.0004	−0.0002	−0.001	−0.0004
	(0.0004)	(0.0005)	(0.001)	(0.002)
R^2	0.765	0.778	0.717	0.733
Overall rating				
(Intercept)	−1.238***	−1.421***	−0.804***	−0.865***
	(0.010)	(0.012)	(0.022)	(0.043)
Treated	−0.008*	−0.001	−0.002	−0.038**
	(0.004)	(0.005)	(0.008)	(0.017)
Time	0.016***	0.011***	0.033***	0.012
	(0.003)	(0.004)	(0.007)	(0.014)
Treated x Time	0.015***	0.020***	−0.003	0.008
	(0.005)	(0.006)	(0.010)	(0.019)
R^2	0.884	0.887	0.858	0.877

Figure 5: Difference-in-difference output graphs
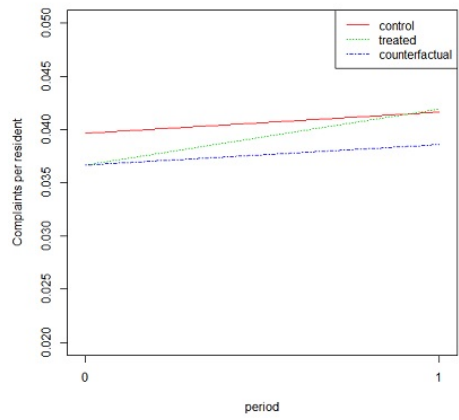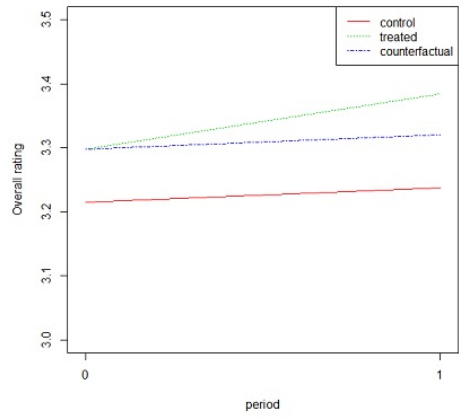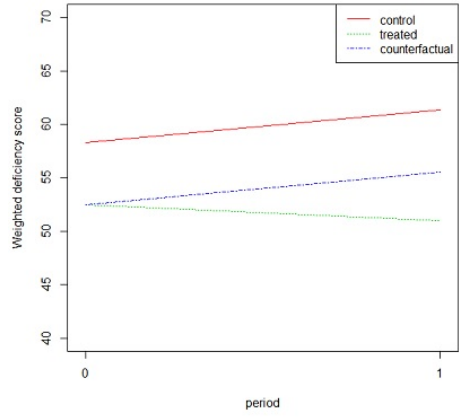
of the change from control to treated groups flips. Rather than the increase predicted, Medicaid expansion results in a small decline which suggests that quality increases in states which adopt Medicaid expansion. This result complements recent findings showing an improvement in the quality of nursing care after increases in Medicaid reimbursement rates (Hackman, 2019). The most substantial effect is seen in government-run SNFs. Non-profit facilities see the smallest change, but initial deficiency scores tended to be lower than for-profit and government facilities even before any intervention. This may point to a convergence in SNF quality following Medicaid expansion.

There is also a positive treatment effect on the overall rating of facilities. The increase, 0.015 points, is small relative to the total rating scores (reported on a one to five-point scale) and may be less valuable than other quality measures due to the nature of the Five-Star rating system discussed above. There is no statistically significant change observed in the ratings of non-profit and government SNFs.

Finally, we examine the complaints per resident. There are no significant effects of Medicaid expansion on the number of complaints in any type of facility. While complaints may serve as a useful proxy for quality due to the non-zero time and energy cost of creating an official record, this analysis may fail to capture some of their usefulness, as it is likely that the process varies substantially across states.

5. Conclusion

The expansion of Medicaid at the state level provides an invaluable pseudo-experiment from which the direct effects of policy changes on patient outcomes can be observed. This paper finds some evidence to conclude that state expansion of Medicaid does, in fact, have a statistically significant, though ultimately small, impact on the quality of care provided in some nursing homes. Contrary to the initial hypothesis, state Medicaid expansion appears to have resulted in small but measurable increase in quality as measured by at least two of the three indicators tested. While overall rating and weighted deficiency scores show unambiguous improvements in states that expanded Medicaid relative to non-expansion states, understanding the increase in complaints filed will require a deeper analysis of the complaint filing systems and how those vary across states and over time.

The ambiguity of the effect of Medicaid expansion on quality of care in skilled nursing facilities is unsurprising given the difficulty of determining how precisely one should be evaluating quality. Adding to an already complex question are the differences in the administration, enforcement, and implementation of program rules across states. Ultimately, it may be difficult to assert any one general effect of Medicaid expansion.

Future extensions of this work that include a wider variety of state and time controls might reduce the uncertainty and ambiguity of the results presented in this paper. Future analyses will also benefit from additional years

of data which may more fully capture the effects of Medicaid expansion on nursing home quality as the aged population continues to increase.

While the results presented in this paper may not indicate a very dramatic effect of state Medicaid expansion on SNF quality, understanding the interactions of the large-scale decisions made by policymakers on individuals provides a useful lens through which to assess program effectiveness and impact.

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Appendix

Table A1: SNF Characteristics: For-Profit Facilities

	2013	2014	2015
All states			
Average capacity	0.827	0.820	0.820
Number of beds	110.8	111.1	111.2
Number of facilities	9,907	10,338	10,342
Distribution of facilities	69.5%	70.3%	70.3%
Expansion states			
Average capacity	0.850	0.846	0.846
Number of beds	116.0	116.6	116.8
Number of facilities	5,349	5,347	5,356
Distribution of facilities	67.8%	68.1%	68.2%
Non-expansion states			
Average capacity	0.800	0.792	0.791
Number of beds	104.8	105.2	105.2
Number of facilities	4,558	4,991	4,986
Distribution of facilities	71.7%	72.8%	72.6%

Table A2: SNF Characteristics: Non-Profit Facilities

	2013	2014	2015
All states			
Average capacity	0.868	0.865	0.862
Number of beds	99.0	97.9	98.0
Number of facilities	3551	3527	3473
Distribution of facilities	24.9%	23.9%	24.9%
Expansion states			
Average capacity	0.882	0.879	0.875
Number of beds	105.9	104.8	105.3
Number of facilities	2113	2052	2008
Distribution of facilities	26.8%	26.1%	24.9%
Non-expansion states			
Average capacity	0.848	0.846	0.846
Number of beds	89.0	88.3	88.1
Number of facilities	1438	1475	1465
Distribution of facilities	22.6%	21.5%	24.9%

Table A3: SNF Characteristics: Government Facilities

	2013	2014	2015
All states			
Average capacity	0.832	0.825	0.823
Number of beds	122.5	118.0	113.0
Number of facilities	793	843	904
Distribution of facilities	5.6%	5.7%	5.6%
Expansion states			
Average capacity	0.845	0.834	0.825
Number of beds	151.6	143.5	135.0
Number of facilities	432	456	485
Distribution of facilities	5.5%	5.8%	5.6%
Non-expansion states			
Average capacity	0.817	0.814	0.820
Number of beds	87.7	87.9	87.5
Number of facilities	361	387	419
Distribution of facilities	5.7%	5.7%	5.6%

Table A4: SNF Characteristics by Year: For-Profit

	Median	Mean	St. Dev.
2013, n=9,907			
Beds	103.0	110.8	53.3
Residents	85.0	91.2	48.0
Facility capacity	0.860	0.827	0.602
Overall rating	3.00	3.09	1.32
Weighted deficiency score	40.667	59.626	68.118
Complaints per 100 residents	1.92	4.45	7.51
2014, n=10,338			
Beds	100.0	109.5	59.3
Residents	83.0	90.6	53.1
Facility capacity	0.866	0.829	0.199
Overall rating	3.00	3.24	1.32
Weighted deficiency score	38.667	56.999	66.939
Complaints per 100 residents	1.55	3.90	7.01
2015, n=10,342			
Beds	100.0	109.7	60.7
Residents	83.0	90.9	54.6
Facility capacity	0.900	0.833	0.602
Overall rating	3.00	3.24	1.32
Weighted deficiency score	38.667	56.423	64.896
Complaints per 100 residents	1.50	3.84	6.60

Table A5: SNF Characteristics by Year: Non-Profit

	Median	Mean	St. Dev.
2013, n=3,506			
Beds	85.0	99.0	68.1
Residents	72.0	86.1	62.5
Facility capacity	0.900	0.868	0.240
Overall rating	4.00	3.69	1.22
Weighted deficiency score	28.700	42.058	50.350
Complaints per 100 residents	1.00	2.14	4.53
2014, n=3,527			
Beds	99.0	106.4	65.1
Residents	81.0	90.9	59.8
Facility capacity	0.888	0.860	0.981
Overall rating	4.00	3.35	1.31
Weighted deficiency score	34.000	50.479	62.302
Complaints per 100 residents	1.03	3.36	6.36
2015, n=3,473			
Beds	99.0	106.5	64.8
Residents	80.0	90.4	58.7
Facility capacity	0.883	0.847	0.133
Overall rating	4.00	3.37	1.30
Weighted deficiency score	33.333	50.723	64.075
Complaints per 100 residents	1.04	3.39	6.68

Table A6: SNF Characteristics by Year: Government

	Median	Mean	St. Dev.
2013, n=793			
Beds	96.0	122.5	116.0
Residents	77.0	102.7	101.6
Facility capacity	0.870	0.832	0.151
Overall rating	4.00	3.47	1.25
Weighted deficiency score	38.333	56.254	72.478
Complaints per 100 residents	0.63	3.07	6.47
2014, n=843			
Beds	96.0	106.7	79.0
Residents	74.0	87.6	68.2
Facility capacity	0.856	0.820	0.143
Overall rating	4.00	3.36	1.34
Weighted deficiency score	39.500	55.676	57.082
Complaints per 100 residents	1.47	4.68	7.95
2015, n=904			
Beds	98.0	105.0	65.1
Residents	76.0	86.1	56.7
Facility capacity	0.860	0.823	0.156
Overall rating	3.00	3.28	1.31
Weighted deficiency score	40.700	60.756	74.040
Complaints per 100 residents	1.74	5.18	10.44

Table A7: OLS Results

	Dependent variable:			
	Complaints per resident			
	Full Sample	For-profit	Non-profit	Government
	(1)	(2)	(3)	(4)
(Intercept)	0.093***	0.089***	0.077***	0.173***
	(0.001)	(0.002)	(0.002)	(0.006)
Expand	0.001***	0.001	−0.002***	0.021***
	(0.0003)	(0.0004)	(0.0004)	(0.001)
Weighted deficiency score	0.0002***	0.0002***	0.0001***	0.0001***
	(0.00000)	(0.00000)	(0.00001)	(0.00001)
Beds	−0.0001***	−0.0001***	−0.0001***	−0.0001***
	(0.00000)	(0.00000)	(0.00000)	(0.00001)
Facility capacity	−0.017***	−0.013***	−0.030***	−0.087***
	(0.0005)	(0.001)	(0.001)	(0.004)
Overall rating	−0.002***	−0.001**	−0.001**	−0.005***
	(0.0003)	(0.0004)	(0.0005)	(0.001)
Survey rating	−0.009***	−0.011***	−0.004***	−0.010***
	(0.0003)	(0.0004)	(0.0004)	(0.001)
Quality rating	−0.002***	−0.003***	−0.002***	0.001**
	(0.0002)	(0.0002)	(0.0002)	(0.001)
Staffing rating	−0.002***	−0.002***	−0.001***	−0.011***
	(0.0003)	(0.0004)	(0.0005)	(0.001)
RN rating	0.002***	0.002***	0.001	0.005***
	(0.0003)	(0.0004)	(0.0004)	(0.001)
Aide hours	0.012***	0.022***	0.008***	0.013**
	(0.002)	(0.003)	(0.002)	(0.006)
LPN hours	0.017***	0.026***	0.009***	0.016***
	(0.001)	(0.002)	(0.002)	(0.005)
RN hours	0.031***	0.057***	0.016***	0.026***
	(0.003)	(0.005)	(0.003)	(0.008)
Total hours	−0.018***	−0.028***	−0.011***	−0.017***
	(0.002)	(0.003)	(0.002)	(0.006)
Total penalties	0.035***	0.043***	0.008***	0.009***
	(0.001)	(0.001)	(0.001)	(0.002)
Incident count	0.004***	0.004***	0.002***	−0.0003
	(0.0001)	(0.0001)	(0.0001)	(0.0002)
Fine count	−0.030***	−0.038***	−0.002**	−0.004
	(0.001)	(0.001)	(0.001)	(0.003)
In-hospital facility	−0.021***	−0.024***	−0.011***	−0.016***
	(0.001)	(0.002)	(0.001)	(0.002)
R^2	0.249	0.273	0.167	0.207

Note: *p<0.1; **p<0.05; ***p<0.01

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Table A8: OLS Results

	Dependent variable:			
	Overall rating			
	Full Sample	For-profit	Non-profit	Government
	(1)	(2)	(3)	(4)
(Intercept)	−1.227***	−1.412***	−0.780***	−0.859***
	(0.009)	(0.012)	(0.022)	(0.042)
Expand	0.001	0.011***	−0.004	−0.031***
	(0.002)	(0.003)	(0.005)	(0.010)
Weighted deficiency score	−0.0005***	−0.0002***	−0.001***	−0.001***
	(0.00002)	(0.00003)	(0.0001)	(0.0001)
Beds	0.00003*	0.00005*	0.0001*	−0.0002***
	(0.00002)	(0.00003)	(0.00004)	(0.00004)
Facility capacity	−0.005	−0.003	−0.034***	0.009
	(0.003)	(0.003)	(0.012)	(0.031)
Survey rating	0.767***	0.798***	0.692***	0.730***
	(0.001)	(0.001)	(0.002)	(0.005)
Quality rating	0.321***	0.328***	0.305***	0.301***
	(0.001)	(0.001)	(0.002)	(0.004)
Staffing rating	0.366***	0.367***	0.346***	0.330***
	(0.002)	(0.003)	(0.005)	(0.009)
RN rating	0.048***	0.060***	0.037***	0.027***
	(0.002)	(0.003)	(0.004)	(0.007)
Aide hours	−0.087***	−0.128***	−0.111***	0.043
	(0.013)	(0.020)	(0.020)	(0.041)
LPN hours	−0.091***	−0.122***	−0.108***	−0.007
	(0.011)	(0.016)	(0.016)	(0.035)
RN hours	−0.367***	−0.486***	−0.344***	−0.066
	(0.021)	(0.032)	(0.033)	(0.056)
Total hours	0.089***	0.142***	0.109***	−0.032
	(0.013)	(0.021)	(0.021)	(0.041)
Complaints per resident	−0.086***	−0.040**	−0.122**	−0.222***
	(0.017)	(0.019)	(0.052)	(0.069)
Total penalties	−0.039***	−0.030***	−0.077***	−0.040**
	(0.004)	(0.004)	(0.009)	(0.016)
Incident count	0.001	−0.0001	0.002	−0.0001
	(0.0004)	(0.0005)	(0.001)	(0.001)
Fine count	0.026***	0.021***	0.057***	0.017
	(0.004)	(0.005)	(0.010)	(0.019)
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
In-hospital facility	0.003	−0.032**	−0.001	−0.008
	(0.006)	(0.015)	(0.007)	(0.011)
R²	0.884	0.887	0.858	0.877

Note:	*p<0.1; **p<0.05; ***p<0.01

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	Dependent variable:		
	Weighted deficiency score	Complaints per resident	Overall rating
	(1)	(2)	(3)
(Intercept)	99.966**	0.115*	2.180**
	(48.318)	(0.063)	(1.016)
Treated	−2.184***	−0.001	0.041***
	(0.413)	(0.001)	(0.009)
Time	3.213***	0.001*	0.043***
	(0.367)	(0.0005)	(0.008)
DID	−3.878***	0.004***	0.014
	(0.496)	(0.001)	(0.010)
Weighted deficiency score		0.0002***	−0.008***
		(0.00000)	(0.00004)
Complaints per resident	96.162***		−2.348***
	(1.826)		(0.038)
Overall rating	−5.176***	−0.002***	
	(0.253)	(0.0003)	
Survey rating	−18.552***	−0.008***	
	(0.223)	(0.0003)	
Quality rating	0.478***	−0.002***	
	(0.129)	(0.0002)	
Staffing rating	1.488***	−0.001***	
	(0.240)	(0.0003)	
RN rating	−2.842***	0.002***	
	(0.218)	(0.0003)	
Aide hours	−6.337***	0.010***	0.123***
	(1.360)	(0.002)	(0.028)
LPN hours	−7.097***	0.015***	−0.049**
	(1.113)	(0.001)	(0.023)
RN hours	−10.065***	0.029***	0.772***
	(2.180)	(0.003)	(0.043)
Total hours	10.020***	−0.016***	0.235***
	(1.410)	(0.002)	(0.029)
For-profit	6.343	−0.026	0.132
	(48.308)	(0.063)	(1.016)
Non-profit	3.768	−0.039	0.257
	(48.309)	(0.063)	(1.016)
Government	6.842	−0.030	0.178
	(48.311)	(0.063)	(1.016)
In-hospital facility	4.979***	−0.017***	−0.364***
	(0.602)	(0.001)	(0.013)
Beds	−0.011***	−0.0001***	−0.001***
	(0.002)	(0.00000)	(0.00004)
Facility capacity	−1.453***	−0.016***	0.041***
	(0.354)	(0.0005)	(0.007)
Total Penalties	39.979***	0.035***	0.055***
	(0.387)	(0.001)	(0.008)
Incident count	1.214***	0.003***	−0.004***
	(0.045)	(0.0001)	(0.001)
Fine count	−28.553***	−0.031***	−0.171***
	(0.453)	(0.001)	(0.010)
R²	0.484	0.253	0.424

Note: *p<0.1; **p<0.05; ***p<0.01

Table A10: DID Results: For-profit facilities

	Dependent variable:		
	Weighted deficiency score	Complaints per resident	Overall rating
	(1)	(2)	(3)
(Intercept)	108.988***	0.091***	1.865***
	(1.380)	(0.002)	(0.021)
Treated	−2.416***	−0.002***	−0.001
	(0.523)	(0.001)	(0.011)
Time	3.625***	0.001	0.035***
	(0.457)	(0.001)	(0.009)
DID	−4.411***	0.005***	0.020
	(0.626)	(0.001)	(0.013)
Weighted deficiency score		0.0002***	−0.008***
		(0.00000)	(0.0001)
complaintper	96.127***		−2.455***
	(2.159)		(0.043)
Overall rating	−2.955***	−0.001**	
	(0.323)	(0.0004)	
Survey rating	−21.224***	−0.011***	
	(0.292)	(0.0004)	
Quality rating	−0.259	−0.003***	
	(0.165)	(0.0002)	
Staffing rating	0.083	−0.002***	
	(0.310)	(0.0004)	
RN rating	−2.677***	0.001***	
	(0.310)	(0.0004)	
Aide hours	−21.491***	0.021***	−0.117**
	(2.269)	(0.003)	(0.046)
LPN hours	−19.521***	0.024***	−0.217***
	(1.847)	(0.002)	(0.037)
RN hours	−32.942***	0.055***	0.825***
	(3.633)	(0.005)	(0.068)
Total hours	26.847***	−0.026***	0.539***
	(2.358)	(0.003)	(0.047)
In-hospital facility	−1.298	−0.024***	−0.629***
	(1.748)	(0.002)	(0.035)
Beds	−0.006**	−0.0001***	−0.001***
	(0.003)	(0.00000)	(0.0001)
Facility capacity	−1.089***	−0.013***	0.040***
	(0.392)	(0.001)	(0.008)
Total penalties	39.209***	0.042***	0.069***
	(0.466)	(0.001)	(0.010)
Incident count	1.440***	0.004***	−0.002
	(0.056)	(0.0001)	(0.001)
Fine count	−27.731***	−0.039***	−0.182***
	(0.546)	(0.001)	(0.011)
R^2	0.478	0.272	0.415

Note: *p<0.1; **p<0.05; ***p<0.01

Table A11: DID Results: Non-profit facilities

	Dependent variable:		
	Weighted deficiency score	Complaints per resident	Overall rating
	(1)	(2)	(3)
(Intercept)	98.309***	0.078***	3.048***
	(1.808)	(0.002)	(0.037)
Treated	−1.859***	−0.002**	0.106***
	(0.660)	(0.001)	(0.016)
Time	1.805***	0.001*	0.067***
	(0.615)	(0.001)	(0.015)
DID	−1.944**	0.0002	−0.021
	(0.800)	(0.001)	(0.019)
Weighted deficiency score		0.0001***	−0.011***
		(0.00001)	(0.0001)
complaintper	105.748***		−2.427***
	(4.260)		(0.104)
Overall rating	−8.569***	−0.001**	
	(0.401)	(0.0005)	
Survey rating	−13.375***	−0.004***	
	(0.333)	(0.0004)	
Quality rating	1.352***	−0.002***	
	(0.209)	(0.0002)	
Staffing rating	3.027***	−0.001***	
	(0.400)	(0.0005)	
RN rating	−2.619***	0.0005	
	(0.340)	(0.0004)	
Aide hours	2.434	0.007***	0.353***
	(1.638)	(0.002)	(0.039)
LPN hours	−0.284	0.009***	0.154***
	(1.331)	(0.002)	(0.032)
RN hours	2.456	0.016***	0.813***
	(2.766)	(0.003)	(0.060)
Total hours	0.015	−0.010***	−0.090**
	(1.702)	(0.002)	(0.040)
In-hospital facility	3.627***	−0.011***	−0.212***
	(0.617)	(0.001)	(0.015)
Beds	−0.011***	−0.0001***	−0.001***
	(0.003)	(0.00000)	(0.0001)
Facility capacity	−4.836***	−0.030***	0.039
	(1.032)	(0.001)	(0.025)
Total penalties	38.244***	0.008***	−0.012
	(0.740)	(0.001)	(0.019)
Incident count	0.542***	0.002***	−0.017***
	(0.092)	(0.0001)	(0.002)
Fine count	−27.476***	−0.003***	−0.124***
	(0.857)	(0.001)	(0.021)
R^2	0.484	0.166	0.421

Table A12: DID Results: Non-profit facilities

	Weighted deficiency score	Complaints per resident	Overall rating
	Dependent variable:		
	(1)	(2)	(3)
(Intercept)	116.846***	0.175***	3.121***
	(4.814)	(0.006)	(0.081)
Treated	−0.072	0.014***	0.026
	(1.859)	(0.002)	(0.036)
Time	4.179***	0.0001	0.018
	(1.594)	(0.002)	(0.031)
DID	−6.650***	0.009***	0.043
	(2.166)	(0.003)	(0.042)
Weighted deficiency score		0.00004***	−0.008***
		(0.00001)	(0.0002)
complaintper	26.649***		−3.002***
	(7.757)		(0.148)
Overall rating	−10.300***	−0.005***	
	(1.112)	(0.001)	
Survey rating	−16.982***	−0.010***	
	(0.950)	(0.001)	
Quality rating	2.267***	0.001**	
	(0.528)	(0.001)	
Staffing rating	4.199***	−0.011***	
	(1.042)	(0.001)	
RN rating	−1.071	0.005***	
	(0.823)	(0.001)	
Aide hours	2.602	0.013**	−0.438***
	(4.588)	(0.006)	(0.089)
LPN hours	2.276	0.016***	−0.597***
	(3.886)	(0.005)	(0.075)
RN hours	4.111	0.026***	−0.369***
	(6.257)	(0.008)	(0.121)
Total hours	−3.094	−0.017***	0.684***
	(4.658)	(0.006)	(0.090)
In-hospital facility	10.534***	−0.015***	−0.206***
	(1.287)	(0.002)	(0.025)
Beds	−0.022***	−0.0001***	−0.001***
	(0.005)	(0.00001)	(0.0001)
Facility capacity	−6.147*	−0.086***	0.235***
	(3.472)	(0.004)	(0.068)
Total penalties	51.325***	0.007***	0.108***
	(1.726)	(0.002)	(0.035)
Incident count	0.385***	−0.0003	−0.014***
	(0.148)	(0.0002)	(0.003)
Fine count	−40.509***	−0.004	−0.211***
	(2.056)	(0.003)	(0.041)
R²	0.479	0.207	0.404

Note: *p<0.1; **p<0.05; ***p<0.01