**Medicaid Reimbursement and the Quality of Nursing Home Care:
A Case Study of Medi-Cal Long-Term Care Reimbursement Act of 2004 in
California**

**by
Jingping Xing**

**Submitted in Partial Fulfillment of the
Requirements for the Degree
Doctor of Philosophy**

**Supervised by Professor Helena Temkin-Greener
Health Services Research and Policy
School of Medicine and Dentistry**

**University of Rochester
Rochester, New York**

2013

Biographical Sketch

The author was born in Shanghai, China. She attended Shanghai Second Medical University, and graduated with a Doctor of Medicine degree in 2005. She received residency training in Internal Medicine in Shanghai Sixth People's Hospital, China from 2005 to 2006. She was a Research Fellow in Medicine at Rhode Island Hospital, Providence, RI in 2007 and 2008. She began doctoral studies in Health Services Research and Policy at the University of Rochester in the fall of 2008. She was awarded Dean's fellowship from the School of Medicine and Dentistry in 2008-2010 and received the Laurence G. Branch Doctoral Student Research Award from the American Public Health Association in 2011. She worked as a research assistant with Dr. Irena Pesis-Katz in 2010, and with Dr. Helena Temkin-Greener from 2011 to 2013. She pursued her dissertation research in Medicaid reimbursement and the quality of nursing home care under the direction of Dr. Helena Temkin-Greener.

The following publications were a result of work conducted during doctoral study:

1. Xing J, Mukamel DB, Temkin-Greener H. Hospitalizations among Nursing Home Residents in the Last Year of Life: Nursing Home Characteristics and Variation in Potentially Avoidable Hospitalizations. *Journal of the American Geriatrics Society* (In Press).
2. Temkin-Greener H, Zheng NT, Xing J, Mukamel DB. Site of Death Among Nursing Home Residents in the United States: Changing Patterns, 2003-2007. *Journal of the American Medical Directors Association*. Available online 7 May 2013.
3. Rhee H, Pesis-Katz I, Xing J. Cost benefits of a peer-led asthma self-management program for adolescents. *Journal of Asthma*. 2012 Aug; 49(6):606-13.

Acknowledgements

This dissertation would not have been possible without the guidance of the members of my dissertation committee, help from friends, and support from my family.

I would like to express my deepest gratitude to my my advisor, Dr. Helena Temkin-Greener, for her excellent guidance, patience, and encouragement. She devoted enormous amount of time to developing the dissertation framework and gave direction when it was most needed. I really appreciate the opportunity to work with her as a research assistant, which provided me an excellent experience of solving practical issues beyond the textbooks, and her commitment to the highest standards inspired me. I am extremely grateful to Dr. Dana Mukamel, who guided me through every step of building the theoretical model, was always willing to help, and patiently helped me refine the empirical analysis. Discussions with her have always been illuminating. I am deeply indebted to Dr. Laurent Glance, who was incredibly generous in providing constructive comments and suggestions, and whose clinical expertise was an enormous help to me. I would like to show my great appreciation to Dr. Ning Zhang, whose insightful advice, encouragement and friendship have been invaluable to me during my graduate study.

I am appreciative of the helpful suggestions and comments on earlier versions of this work from Dr. Peter Veazie and Dr. Byung-Kwang Yoo. Special thanks goes to Dr. Bruce Friedman, who was always supporting me and encouraging me with his best wishes. I would also like to thank the wonderful faculty, students and staffs at the Department of Public Health Sciences for their support and help, especially Pattie

Kolomic. Thank you to my roommate and friend, Yalan Xing, whose help made my school life easier.

I would also take this opportunity to thank my parents, who have always believed in me. Last, but by no means least, I owe my deepest gratitude to my husband for his love, support and great patience at all times.

Abstract

Inadequate quality of care in the nursing home (NH) has been a matter of great concern and it remains unclear how best to design rate-setting methods to incentivize NH behavior for improving quality of care. In 2005, Medi-Cal Long-Term Care Reimbursement Act (AB1629) was enacted throughout California, changing NH reimbursement methodology from flat-rate to cost-based, facility-specific rate, and encouraging NHs' investment in labor. This dissertation examines the impact of AB1629 on quality of care, and assesses NHs' behavior in response to the changes in reimbursement policy.

I examined changes in time trends for quality indicators before and after AB1629 implementation using longitudinal (2002-2008) logistic regression models. Quality was measured by risk-adjusted physical restraints, pressure ulcers, incontinence, functional decline, and potentially avoidable hospitalizations. To test whether changes in quality of care were related to AB1629, the analyses were stratified by the proportion of Medi-Cal revenues. Changes in staffing levels and wages were examined to decide NHs' investment in direct care labor in response to AB1629. First-difference model was used to analyze whether changes in nurse staffing levels before and after AB1629 were associated with changes in quality.

Following the implementation of AB1629 three of the five quality measures, pressure ulcers, physical restraints, and incontinence, exhibited significant improvement while two (functional decline and potentially avoidable hospitalization) did not change.

The decline in physical restraints was larger among NHs with high Medi-Cal revenues than NHs with low Medi-Cal revenues. NHs had significantly increased licensed nurse hours (registered nurse and licensed practical nurse), but the increase in wages was not persistent or large. Furthermore, the increase in licensed nurse staffing was directly related to the decline in restraint use, but not in pressure ulcers or incontinence.

This dissertation provides evidence that linking Medicaid reimbursement rate to each NH's own expenditures and incentivizing NHs to invest in direct care were effective ways in achieving quality improvement. Refinements of current Medi-Cal reimbursement policy might be needed to encourage NHs to make larger investments. However, maximizing NHs' spending on direct care cannot be relied on as the only policy strategy to improve quality of care.

Contributors and Funding Sources

This work was supervised by a dissertation committee consisting of Professors Helena Temkin-Greener (chair) and Ning Zhang of the Department of Public Health Sciences, Professor Laurent Glance of Department of Anesthesiology, and Professor Dana Mukamel of Health Policy Research Institute, University of California, Irvine. All work for the dissertation was completed independently by the student. Graduate study was supported by a Dean's Fellowship (2008-2010) from the School of Medicine and Dentistry, University of Rochester. University of Rochester Clinical and Translational Science Institute SPICE Training Program provided funds to cover the cost of the data used in this dissertation.

Table of Contents

Biographical Sketch	ii
Acknowledgements	iii
Abstract	v
Contributors and Funding Sources	vii
Table of Contents	viii
List of Tables	xiii
List of Figures	xvi
CHAPTER 1 BACKGROUND AND SIGNIFICANCE	1
1.1 Introduction	1
1.2 Nursing home residents	2
1.3 Payment for nursing home services	3
1.4 Nursing home quality	4
1.4.1 Measuring nursing home quality	4
1.4.2 Evidence of low quality in nursing homes and changes in quality of care overtime	5
1.5 Strategies to improve nursing home care	8
1.5.1 Regulatory approach	9
1.5.1.1 Nursing Home Reform Act	9
1.5.1.2 Other regulatory approaches	10
1.5.2 Market-based approach: quality report cards	11
1.5.3 Medicaid reimbursement policy reform	13

1.5.3.1 Nursing home costs and quality	13
1.5.3.2 Medicaid reimbursement rates and quality of care	14
1.5.3.3 Medicaid reimbursement method and quality of care.....	15
1.5.3.4 Differences of nursing home behavior in response to changes in reimbursement policy.....	19
1.6 Nursing home care in California and Assembly Bill (AB) 1629.....	20
1.6.1 Nursing home care in California.....	20
1.6.2 Assembly Bill (AB) 1629	23
1.6.2.1 Quality assurance fee	24
1.6.2.2 Reimbursement methodology	25
1.6.2.3 Financial incentives in the new payment system	30
1.7 Gaps in knowledge.....	34
1.8 Contribution of this study	35
CHAPTER 2 THEORETICAL FRAMEWORK.....	37
2.1 Introduction.....	37
2.2 Medicaid reimbursement policy change and quality: conceptual model.....	37
2.3 Theoretical framework.....	39
2.3.1 Nursing home market.....	39
2.3.1.1 No binding bed constraint.....	39
2.3.1.2 Uniform quality.....	40
2.3.1.3 Assumptions.....	41
2.3.2 For-profit nursing homes	42

2.3.2.1 Comparison of quality incentives	46
2.3.3 Non-profit nursing homes	48
2.3.3.1 Comparison of quality incentives	51
2.4 Possible differential effects of Medicaid reimbursement change on quality of care ..	52
2.5 Nursing home's investment in labor	52
2.6 Hypotheses	53
CHAPTER 3 DATA AND METHODS	54
3.1 Study population	54
3.2 Data sources	56
3.2.1 Minimum Data Set (MDS)	56
3.2.2 California Medi-Cal cost reports	57
3.2.3 Online Survey, Certification and Reporting (OSCAR) File	57
3.2.4 Medicare Provider Analysis and Review (MedPAR) File.....	57
3.2.5 Medicaid Analytical Extract (MAX) Inpatient File.....	58
3.2.6 Beneficiary Summary File	58
3.2.7 Medicaid Analytical Extract (MAX) Personal Summary File.....	59
3.3 Description of variables	59
3.3.1 Outcome variable: nursing home quality.....	61
3.3.1.1 Pressure ulcers	63
3.3.1.2 Functional decline	66
3.3.1.3 Physical restraints	69
3.3.1.4 Incontinence	72

3.3.1.5 Potentially avoidable hospitalizations.....	74
3.3.2 Outcome variable: nursing home's investment in labor	90
3.3.2.1 Nursing staff levels	90
3.3.2.2 Nursing staff wages.....	91
3.4 Data analysis	91
3.4.1 Examining the changes of quality of nursing home care.....	91
3.4.2 Stratification analyses: quality of care.....	94
3.4.3 Assessing nursing homes' investment in labor in response to AB1629	95
3.4.4 Estimating the relationship between staffing levels and quality of care.....	98
CHAPTER 4 RESULTS	100
4.1 Changes in quality of nursing home care (Hypothesis 1)	100
4.1.1 Descriptive statistics	100
4.1.1.1 Resident characteristics of analytical samples	100
4.1.1.2 Trends in quality of care	109
4.1.2 Hypothesis testing.....	112
4.2 Stratification analyses: quality of care (Hypothesis 2)	114
4.2.1 Descriptive statistics	114
4.2.2 Hypothesis testing.....	117
4.3 Nursing homes' investment in labor in response to AB1629 (Hypothesis 3).....	123
4.3.1 Descriptive statistics	123
4.3.2 Hypothesis testing.....	123
4.4 The relationship between staffing levels and quality of care (Hypothesis 4)	129

4.4.1 Hypothesis testing.....	129
CHAPTER 5 DISCUSSION.....	132
5.1 Discussion.....	132
5.1.1 Changes in quality of nursing home care.....	132
5.1.2 Differential effects of Medicaid reimbursement change on quality of care	134
5.1.3 Nursing homes' investment in labor in response to AB1629	136
5.1.3.1 Nursing homes' investment in staffing levels.....	136
5.1.3.2 Nursing homes' investment in wages	139
5.1.4 The relationship between staffing levels and quality of care.....	141
5.2 Limitations	143
5.3 Implications for policy	145
References.....	149
Appendix 1.....	166
Appendix 2.....	183

List of Tables

<u>Table</u>	<u>Title</u>	<u>Page</u>
Table 1-1	Quality measures published on the Nursing Home Compare	12
Table 1-2	Cost components used to calculate Medi-Cal payment rates	28
Table 1-3	Medi-Cal reimbursement rates in 2004/05	32
Table 3-1	Number of nursing homes in California	55
Table 3-2	Summary of outcome variables used in the analyses	60
Table 3-3	Staging of pressure ulcers	64
Table 3-4	Individual risk factors for developing pressure ulcers	65
Table 3-5	Individual risk factors that may affect functional status	68
Table 3-6	Individual risk factors predicting physical restraints use	71
Table 3-7	Individual risk factors for incontinence	73
Table 3-8	Potentially avoidable hospitalization conditions and ICD-9 codes	76
Table 3-9	Individual risk factors for potentially avoidable hospitalizations	88
Table 3-10	Distribution of nursing homes by the average proportion of Medi-Cal revenues during 2002-2004	95
Table 4-1	Descriptive statistics of resident characteristics for functional decline, 2002-2008	101
Table 4-2	Descriptive statistics of resident characteristics for pressure ulcers, 2002-2008	103
Table 4-3	Descriptive statistics of resident characteristics for physical restraints, 2002-2008	105

Table 4-4	Descriptive statistics of resident characteristics for incontinence, 2002-2008	106
Table 4-5	Descriptive statistics of resident characteristics for potentially avoidable hospitalizations, 2002-2008	108
Table 4-6	Changes in quality of care after AB1629 was implemented in 2005	113
Table 4-7	Descriptive statistics for quality measures, 2002-2008: by proportion of Medi-Cal revenues	116
Table 4-8	Changes in quality measures, stratified by nursing homes with high Medi-Cal revenues versus low Medi-Cal revenues	121
Table 4-9	Descriptive statistics of staffing levels and nursing staff wages, 2002-2008	125
Table 4-10	Changes in staffing levels after AB1629 was implemented in 2005	128
Table 4-11	Changes in nursing staff wages after AB1629 was implemented in 2005	128
Table 4-12	The relationship between staffing levels and quality of care (physical restraints, pressure ulcers, and incontinence)	131
Table A2-1	Changes in functional decline after AB1629 was implemented in 2005	183
Table A2-2	Changes in pressure ulcers after AB1629 was implemented in 2005	184
Table A2-3	Changes in physical restraints after AB1629 was implemented in 2005	185

Table A2-4	Changes in incontinence after AB1629 was implemented in 2005	186
Table A2-5	Changes in potentially avoidable hospitalizations after AB1629 was implemented in 2005	187
Table A2-6	The relationship between staffing levels and physical restraints	189
Table A2-7	The relationship between staffing levels and pressure ulcers	190
Table A2-8	The relationship between staffing levels and incontinence	191
Table A2-9	Changes in antipsychotic use after AB1629 was implemented in 2005	193

List of Figures

<u>Figure</u>	<u>Title</u>	<u>Page</u>
Figure 1-1	Changes in percent of certified nursing homes with deficiencies in physical restraints	7
Figure 1-2	Variation in percentage of long-term care residents with activities of daily living (ADL) decline across states	8
Figure 1-3	Percent of facilities with deficiencies for physical restraints, 1998-2004	21
Figure 1-4	Percent of facilities with deficiencies for pressure ulcers, 1998-2004	22
Figure 1-5	Violations of federal regulations, 2002	23
Figure 2-1	Conceptual model for changes in quality of care in nursing homes	39
Figure 2-2	The relationship between price and quality	47
Figure 3-1	Covariance structure of spatial power	97
Figure 4-1	Unadjusted trends in quality of care pre- and post-AB1629	110
Figure 4-2	Unadjusted trends in quality of care pre- and post-AB1629: by proportion of Medi-Cal revenues	119
Figure 4-3	Unadjusted trends in staffing levels and nursing staff wages pre- and post-AB1629	126
Figure A2-1	Unadjusted trends in antipsychotic use pre- and post-AB1629	192

CHAPTER 1 BACKGROUND AND SIGNIFICANCE

1.1 Introduction

The quality of care provided in nursing homes has been a matter of great concern to consumers, professionals, and policy-makers. Although both regulatory and market-based approaches have been used to improve quality during the past 25 years [1-3], substandard quality of care in nursing homes persists and there are substantial inter- and intra- state variation in quality of care [4-5]. California, where the second largest number of nursing home residents live, has long had serious quality of care problems in nursing homes, demonstrated by higher than average level of deficiency citations for physical restraints and pressure ulcers [6]. To deal with the poor quality in nursing homes, Medi-Cal Long-Term Care Reimbursement Act of 2004 (AB1629) was enacted, which changed California's nursing home reimbursement methodology from flat-rate to cost-based facility-specific rate. The new reimbursement system was offered as a policy solution to encourage nursing home investment in staffing levels, wages and benefits, and to improve quality of patient care. Under AB1629, annual Medicaid spending on nursing home care has increased by about \$1 billion from 2005 through 2008, however relatively little is known about the impact of AB1629, particularly on quality of care. Previous studies based on early, limited data did not find evidence that the objective of quality improvement has been achieved [7-8].

The objective of this study is to answer two important research questions: (1) What has been the impact of AB1629 on quality of care? Specifically, whether changing payment incentives to encourage and reward nursing homes to invest more in direct care

labor leads to quality improvement? (2) If quality improvement has been achieved, what investment have nursing homes made in order to improve quality of care?

Understanding the impact of AB1629 has important policy implications for future state reimbursement changes and efforts to improve quality of care, especially how the state should design and implement rate-setting methods that incentivize nursing home behavior so as to improve quality of care. If the goal of improving quality has not been achieved, significant changes of current Medicaid reimbursement policy might be needed. It will also help us understand nursing homes' behavior in responding to the new payment incentives and provide insights into their resource allocation decisions that may affect quality of care.

This chapter outlines some of the important features of the relationship between Medicaid reimbursement and the quality of nursing home care. Sections 1.2-1.4 give a general overview of nursing home residents, payment for nursing home services, and nursing home quality. Section 1.5 provides a review of the strategies to improve nursing home care with emphasis on Medicaid reimbursement policy reform. Section 1.6 discusses nursing home care in California and Assembly Bill (AB) 1629. Section 1.7 addresses the gaps in knowledge. And finally, section 1.8 summarizes the contribution of this study.

1.2 Nursing home residents

Currently, approximately 1.4 million people live in 16,500 Medicare and/or Medicaid certified nursing homes nationwide [9]. The vast majority of nursing home residents are elderly. 88.3% of them are aged 65 years and older and 45.2% are aged 85

years and older [10]. Nursing home residents can be classified into 2 types: (1) Those who receive post-acute care. They typically enter a nursing home following a hospital stay and need short term skilled nursing care or rehabilitation before being able to return to the community. (2) Persons receiving custodial care. Custodial care is the care that helps residents with activities of daily living (ADLs) (i.e., bathing, dressing, toileting, transferring, or eating) and is designed to maintain rather than restore functioning. Residents receiving custodial care typically do not return to the community and are often called long-term care residents. Although over one-fourth of Medicare patients who were discharged from acute care hospitals receive post-acute care in the nursing homes [11], 86% of nursing home residents receive custodial care [12].

Nursing home residents have multiple chronic conditions and cognitive and functional impairments. Only 1.6% of all nursing home residents receive no assistance in any ADL, whereas 51.1% receive assistance in all five ADLs. 60.8% long-stay residents have one or more mental or cognitive diagnoses, while 23.4% have dementia [10, 13].

1.3 Payment for nursing home services

In 2010, nursing home expenditures were \$143 billion. Payment sources to nursing homes include Medicare (22.6%), private pay (28%), private insurance (8.6%), and Medicaid and other government programs (40.9%) [14]. Medicare pays for post-acute care but not custodial care. Medicare payment is governed by federal rules and is adjusted for resident case-mix and a local wage index. In 2010, Medicare payment per day for post-acute care was \$398 [15]. Residents receiving custodial care are either paid privately or by Medicaid. Nearly three-quarters of nursing home residents rely on

Medicaid to pay for all or part of their care [16]. In 2011, Medicaid payment per day for nursing home care was \$178 [15]. The Medicaid rate is about 70 percent of the private-pay price [17]. Private-pay residents are usually charged the prevailing market rate, however, Minnesota and North Dakota prohibit nursing homes from charging private-pay residents more than the Medicaid reimbursement rate [18].

1.4 Nursing home quality

1.4.1 Measuring nursing home quality

The Institute of Medicine (IOM) has defined high-quality care as care that is safe, effective, patient-centered, timely, efficient, and equitable (with no disparities between racial or ethnic groups) [19]. In the nursing home area, Donabedian's framework (structure, process-of-care, and outcome measures) has been widely applied to assess quality. Structure measures refer to the resource inputs. Nursing home staffing or staff qualifications are examples of structural measures of quality. Process measures refer to the specific way in which care is provided. Examples of process are restraint use, bladder training, use of urinary catheters, and infection control. Outcome measures are the effects or results obtained from utilizing the structure and processes of health care delivery. Pressure ulcers, incontinence, and hospitalizations are examples of outcome measures. In addition, quality of life is also considered as an important indicator of nursing home quality due to the fact that residents often spend quite a long time in nursing homes.

Because nursing home residents are heterogeneous, quality must be measured differently for residents with different care needs. For residents requiring rehabilitative care, we expect to see improvement in functional status and discharge to the community.

For residents receiving custodial care, quality might be measured by the maintenance of a certain level of functional status or by the non-development of problems associated with long stays (e.g. pressure ulcers).

1.4.2 Evidence of low quality in nursing homes and changes in quality of care overtime

Inadequate quality of care in the nursing home has been discussed in the media and literature for decades [20-21]. In the past two decades, there has been some evidence of improvements in various aspects of nursing home quality. As shown in Figure 1-1, the percentage of facilities cited for physical restraint use declined significantly in the 1990s and then leveled off after 2000. Despite the quality improvement, substantial problems remain with the quality of care in nursing homes [4, 22]. The literature documented quality problems ranging from malnutrition [23-24], and dehydration [25], to medication errors [26], pressure ulcers [27], and pain [28]. Hospitalizations of nursing home residents are common. Research has suggested that 31-45% of these hospitalizations may be avoidable or manageable within the nursing facility with appropriate care [29-32]. In 2010, more than 90% of all certified facilities were cited for one or more deficiencies and nearly one-fourth of all certified facilities were cited for deficiencies that caused actual harm or immediate jeopardy to residents [9]. Federal deficiencies are violations of federal minimum standards for care discovered by investigators during regular inspections. Furthermore, the Administration on Aging's national ombudsman reporting system received more than 136,717 complaints in 2010 concerning nursing facility residents' quality of care, quality-of-life problems, or residents' rights [33]. These complaints

represent judgments about quality of care and life from the perspective of nursing home residents and their families.

There is substantial interstate variation in quality of care. As an example, Figure 1-2 shows the variation in percentage of long-term care residents with ADL decline across states. Within the state, there is wide variation in quality of care across facilities. Controlling for residents' health status, nursing home organizational characteristics affect quality of care, some of which include ownership, Medicaid census, racial composition of residents, and rural location. Driven by profit maximizing, for-profit nursing homes have been shown to provide poorer quality compared to non-profit nursing homes [34-37]. Studies have found that nursing homes with a high Medicaid census have lower quality of care as high Medicaid dependence may limit resources available to improve resident care. Facilities with higher percentages of Medicaid residents have been found to be associated with more deficiencies [38-39], higher odds of hospitalization [40-41], more complaints [42], higher likelihood of voluntary or involuntary terminations [39, 43], higher rates of antipsychotic medication prescription [39, 44], and higher rates of physical restraint use and pressure ulcers [39]. Nursing homes with higher proportions of black residents and rural nursing homes also exhibited worse processes and outcomes [45-47].

Figure 1-1: Changes in percent of certified nursing homes with deficiencies in physical restraints

Source: Harrington et al., 2001-2007, based on data from the Online Survey, Certification, and Reporting System.

1.5.1 Regulatory approach

1.5.1.1 Nursing Home Reform Act

In the 1970s and 1980s, there were widespread concerns about poor quality of care and ineffective regulations of nursing homes. Following the issuance of the report by the Institute of Medicine in 1986, the Nursing Home Reform Act as part of the Omnibus Budget Reconciliation Act of 1987 (OBRA 87) was enacted to regulate nursing home quality [1]. OBRA 87 established new, higher standards that were much more resident focused than previous standards. The law revised the staffing requirements for nursing homes. All nursing facilities were required to have a registered nurse as director of nursing, with licensed nurses on duty 24 hours a day, 7 days a week. Moreover, nursing homes must use the services of a registered nurse for at least 8 consecutive hours a day, 7 days a week. A minimum of 75 hours of training and a competency test were required for certified nursing aides. Physical restraints were specifically prohibited for discipline or convenience and were allowed under only very narrow circumstances. Strict requirements were established limiting the amount of time that residents could be restrained. The law also established a number of quality-of-life rights including freedom from abuse, mistreatment, and neglect. Another major component of the OBRA 87 was establishing an enforcement system for noncompliant nursing homes that incorporated a range of enforcement sanctions. States were required to conduct unannounced surveys, including resident interviews and direct observation of residents and their care, at irregular intervals at least once every 15 months, with the statewide average interval not to exceed 1 year. Noncompliant nursing homes were subject to enforcement sanctions

designed to match the severity of the nursing homes' deficiencies [4]. One of the biggest improvements in nursing home care since the passage of OBRA 87 was the reduction in the use of physical restraints in nursing homes [48]. Research has also shown a significant increase in nursing home staffing levels after the implementation of OBRA 87 [4, 49].

1.5.1.2 Other regulatory approaches

Empirical evidence suggests that higher nursing staff levels (hours per resident day) and higher skilled nursing staff mix (proportion of professional nursing staff such as registered nurses) were associated with better quality of care as measured by processes of care and patient outcomes [38, 40, 50-53]. Although the Nursing Home Reform Act required that a nursing facility certified for Medicare and Medicaid had sufficient nursing staff to provide nursing care to all residents in accordance with resident care plans, it did not specify the nurse-to-resident staffing ratios and the adequacy of the federal regulations with regard to nurse staffing has long been criticized [54-56]. As a result, some policy initiatives have been directed specifically at increasing staffing levels. 40 states have established additional staffing requirements beyond the federal requirements [57]. Research has found that higher state minimum nurse staffing requirements were associated with higher nurse staffing levels [57-59] and were generally associated with improved resident outcomes [58, 60]. State governments have also sought to improve staffing levels through wage pass-through policy, which required that a portion of Medicaid reimbursement or its increase be directed toward staffing improvements, either through enhanced wages or benefits or increasing the number of

staff. The empirical evidence regarding the impact of pass-through has been mixed [61-64], so the data currently do not support the efficacy of such programs.

1.5.2 Market-based approach: quality report cards

Another key strategy for improving nursing home care is to provide more information to consumers. The Centers for Medicare and Medicaid Services (CMS) launched the Nursing Home Quality Initiative in November 2002. Information about quality measures, deficiency citations, and staffing has been published on the Nursing Home Compare website (<http://www.medicare.gov/nursinghomecompare/search.html>) as a market-based strategy to improve quality [3]. Table 1-1 listed the 18 quality measures currently published on Nursing Home Compare website. The quality measures on this website were adjusted using exclusions criteria, which created a relatively homogenous resident group to calculate the quality measure. Some of the quality measures also had additional limited resident-level adjustment. Studies have suggested that more extensive risk adjustment should be considered as it changes quality ranking of nursing homes [65-67].

Werner concluded that public reporting was designed to improve health care quality in two ways. First, market competition for market share may motivate improvements in the quality of individual providers, increasing provider-specific quality of care. Second, public reporting may increase the likelihood that patients select high-quality providers when quality information is easily accessible and understood, thus increasing the number of patients receiving high-quality care [68]. It is reported that publication of the Nursing Home Compare report card was associated with improvement

in some but not all reported dimensions of quality. Mukamel et al found post-publication improvements in physical restraints for long-term residents and pain for short-term residents, but not in pressure ulcers, functional decline, or infections. In another study, Werner et al found that after the initiation of public reporting measures of pain and walking among post-acute residents improved, while there were no significant changes in the rates of delirium [68-69].

Table 1-1: Quality measures published on the Nursing Home Compare

Short-Stay Residents
1. Percent of short-stay residents who self-report moderate to severe pain.
2. Percent of short-stay residents with pressure ulcers that are new or worsened.
3. Percent of short-stay residents assessed and given, appropriately, the seasonal influenza vaccine.
4. Percent of short-stay residents assessed and given, appropriately, the pneumococcal vaccine.
5. Percent of short-stay residents who newly received an antipsychotic medication.
Long-Stay Residents
1. Percent of long-stay residents experiencing one or more falls with major injury.
2. Percent of long-stay residents with a urinary tract infection.
3. Percent of long-stay residents who self-report moderate to severe pain.
4. Percent of long-stay high-risk residents with pressure ulcers.
5. Percent of long-stay low-risk residents who lose control of their bowels or bladder.
6. Percent of long-stay residents who have/had a catheter inserted and left in their bladder.
7. Percent of long-stay residents who were physically restrained.
8. Percent of long-stay residents whose need for help with daily activities has increased.
9. Percent of long-stay residents who lose too much weight.
10. Percent of long-stay residents who have depressive symptoms.
11. Percent of long-stay residents assessed and given, appropriately, the seasonal influenza vaccine.
12. Percent of long-stay residents assessed and given, appropriately, the pneumococcal vaccine.
13. Percent of long-stay residents who received an antipsychotic medication.

1.5.3 Medicaid reimbursement policy reform

Since both regulatory and market-based approaches did not fully promote nursing home quality, efforts have turned toward structuring the Medicaid programs to incentivize nursing homes to improve quality of care. Institute of Medicine argued that payment incentives should be aligned with quality improvement [19]. One approach to linking reimbursement and quality is reforming reimbursement methodologies and/or rates, so as to provide incentives for higher quality. States have considerable flexibility in setting Medicaid payment methods and rates [70], which are critical to the level of resources available to nursing home providers. Another approach is pay-for-performance, in which providers are financially rewarded for specific and targeted improvement in quality or high quality. Between 2002 and 2009, eight states adopted nursing home pay-for-performance programs and most states based the financial reward in part on rates of regulatory deficiencies and staffing ratios. Four of the eight states also tied incentive payments to performance on clinical quality measures. However, the effectiveness of large state-run Medicaid pay-for-performance program is not clear [71-72]. The dissertation focuses on the strategy of changing reimbursement methodologies and/or rates for improving nursing home care.

1.5.3.1 Nursing home costs and quality

Understanding the relationship between costs and quality is important to the development of policies and incentives aiming to encourage the provision of high-quality care in nursing homes. Previous studies have suggested that costs and quality were positively and significantly related to each other [73-75]. One major limitation of these

studies is that the level of staffing was used to measure nursing home quality. Because costs were calculated from information on inputs such as staffing levels, nursing homes with higher staffing, which were characterized as higher quality nursing homes, must have greater costs, regardless of the true relationship between costs and quality. Recent studies using process/outcome measures of quality have suggested a nonmonotonic relationship between costs and quality [76-79]. Mukamel and colleagues found that there was an inverted U-shaped relationship between costs and quality (functional status, pressure ulcers, and mortality). At the lower range of quality, costs increase. However, after some threshold costs decrease with higher quality, which implies that nursing homes that produce better quality are able to achieve lower patient care costs. Because the relationship between costs and quality may depend on the level of quality, for nursing homes with lower quality such as nursing homes in California, it is possible that the opportunities for quality improvement may involve strategies that are cost increasing.

1.5.3.2 Medicaid reimbursement rates and quality of care

Medicaid reimbursement rate is how much nursing home providers are paid for a day of care. Medicaid reimbursement rates vary widely across states. According to the most recent and complete data on state Medicaid policies for nursing home care, in 2004 the average Medicaid payment rate was highest in Delaware (\$188.62) and lowest in Illinois (\$90.97) [80]. Higher Medicaid payment rates are intended to assure that sufficient financial resources are available for nursing homes to produce adequate quality care. Recent studies have in general found a positive relationship between state Medicaid payment rates and nursing home quality. Higher payment rates have been found to be

associated with fewer pressure ulcers [17], more staffing [50, 81], fewer hospitalizations [82-83], fewer physical restraints and feeding tubes [84-85], and fewer government-cited deficiencies [84].

Although increasing Medicaid reimbursement rates could be a potential policy tool to improve quality of care in nursing homes, the effect size has been relatively modest. Relatively large increases in reimbursement rates are needed to achieve relatively modest improvements in quality of care. For example, a 10 percent increase in Medicaid payment was associated with a 1.5 percent decrease in the incidence of risk-adjusted pressure ulcers [17]. Hyer et al found in Florida despite a \$40 million incentive package allocated for direct-care staffing, which on average increased the daily Medicaid payment rate by 1.8%, per-resident-day staffing did not change. Per-resident-day staffing increased only after legislative requirements mandated minimum nursing hours per resident day and average Medicaid reimbursement rate was increased by 10.7% [86]. It also is unclear whether nursing homes would direct additional dollars to produce desirable outcomes. Therefore, simply raising reimbursement rates may not have a large impact on quality of care in nursing homes.

1.5.3.3 Medicaid reimbursement method and quality of care

Reimbursement method refers to ways in which state Medicaid programs pay for care. Retrospective payment has been the traditional manner of reimbursing care, but starting in the 1980s it has been replaced by a prospective reimbursement system [87]. Currently, there are four broad Medicaid payment methodologies for nursing home care:

(1) Flat-rate (prospective class); (2) Prospective facility-specific; (3) Prospective adjusted; and (4) Combination of prospective and retrospective.

Prospective methods set rates in advance of care using cost reports from earlier rate periods, regardless of actual costs the facility incurs during the rate year, and therefore are generally found to constrain costs. Flat-rate method sets rates based on groups of facilities in a state (e.g. facilities within the same geographical regions have identical rates). Prospective facility-specific and prospective adjusted methods set rates for each facility. Prospective facility-specific method does not allow upward adjustments in rates during or after the rate-setting period. Adjusted method sets rates prospectively but frequently or routinely allows upward adjustments in the rates when cost reports from current rate period become available. Thus, the lines are often quite narrow between adjusted system and retrospective system [87]. Combination method sets rates prospectively for some cost components and retrospectively for others (e.g. capital cost).

The incentives to provide quality may depend on the general reimbursement method. Different reimbursement method has different cost-containment incentives, and it is believed that efforts to control costs may have unintended side-effects on quality. Under the prospective payment systems, nursing home usually keep the difference between the payment rate and the costs of providing services, therefore it may provide incentives for nursing homes to reduce costs related to patient care, which may adversely affect quality. Because the flat-rate system does not set rates based on the historical costs of each individual facility, it is considered as having the strongest cost-containment incentives, and thus the lowest quality incentives [16]. Under a retrospective system,

Medicaid payment is determined after the provision of care and is based completely on the costs incurred by the facility. As a result, it is thought that facilities have a strong incentive to drive up costs to increase reimbursement and provide the highest quality. Prospective methods have been shown to be associated with lower increases in per diem rates and costs compared with retrospective methods. Flat-rate method was the most stringent in terms of restricting increases in per diem rates and costs [87-88]. Moreover, some mechanisms built into the rate-setting system can also affect nursing homes' incentives to provide quality. For example, some states have been adjusting their rates based upon the characteristics of residents (case-mix reimbursement). Because case-mix reimbursement accounts for differences in costs of providing for patient care needs, it may improve access for heavy-care patients and enhance quality of care [87]. Some states established higher ceilings for the direct care components of the rates than for non-care components in order to promote quality care [16].

Previous studies provide evidence that reimbursement methods may affect both the quality of care and nursing home's decisions about whom to admit. Schlenker found that states with case-mix payment system had greater case-mix intensity than states with flat-rate system, while the results were mixed for the case-mix compared with the facility-specific states. However, few differences in quality of care among the three payment systems have been demonstrated [89]. Schlenker found that in the flat-rate system, case-mix and profits were negatively associated, while case-mix and profits were not associated in the case-mix or facility-specific system [90]. Cohen and Spector have shown that in states with a flat-rate approach, nursing homes used more lower skilled

(licensed practical nurse, LPN) but fewer higher skilled (registered nurse, RN) professional nursing staff than homes in states with a cost-based approach, however reimbursement method did not have a significant impact on resident outcomes (mortality, bedsores, and functional status) [50]. Grabowski found that compared to states with prospective facility-specific system, states with retrospective system were associated with higher RN staffing and fewer risk-adjusted pressure ulcers [17, 81], while states with flat-rate system had more risk-adjusted pressure ulcers [17]. Medicaid payment method may also affect the delivery of care in the nursing homes. Wodchis et al found that compared with prospective facility-specific system, retrospective payment for Medicaid resident care was associated with greater use of rehabilitation therapy for Medicaid residents. In states that changed payment from prospective facility-specific to prospective case-mix adjusted payment methods, Medicaid residents received more rehabilitation therapy after the change [91].

As of 2007, 38 state Medicaid programs had implemented case-mix reimbursement [92]. Feng et al showed that the adoption of case-mix payment increased access to care for higher acuity Medicaid residents. Following the introduction of case-mix payment, the facility average case-mix index for long-stay residents increased by 1.3 to 1.4 percent [93]. However there are conflicting results regarding the effect of case-mix reimbursement on quality of care. Using 1991-1998 panel data for all certified U.S. nursing homes, Grabowski demonstrated that case-mix reimbursement had no significant effect on process and outcome measures of quality (bedsores, catheters, feeding tubes) [94]. However, in a study of nursing homes in 10 states in 1993, Intrator and Mor found

that residents in facilities in states with a case-mix reimbursement system were 30% less likely to be hospitalized than residents in facilities in states without a case-mix reimbursement system [82].

In summary, only a handful of articles investigated the impact of reimbursement methods on quality of care and these studies indicate that the relationship between Medicaid payment methodology and quality is complex. It remains unclear how best to design rate-setting methods to incentivize nursing home behavior for improving quality of care. Further study is needed before recommendations could be made to reform the Medicaid reimbursement system.

1.5.3.4 Differences of nursing home behavior in response to changes in reimbursement policy

There has been some research examining how nursing home providers behave in response to changes in Medicare/Medicaid reimbursement policy. Until 1997, Medicare payments to skilled nursing facilities (SNFs) were determined by a cost-based reimbursement method. In 1998, Balanced Budget Act of 1997 changed the way that Medicare pays SNFs (nursing homes are paid per resident day). The implementation of Medicare prospective payment system (PPS) in nursing homes was associated with a decrease in nurse staffing. Among for-profit nursing homes, the elimination of cost reimbursement was associated with a larger drop in nurse staffing [95]. Konetzka et al found that professional staffing decreased and regulatory deficiencies increased with PPS, and the effects increased with the percent of Medicare residents in the facility, except in facilities with the highest proportions of Medicare residents [96]. In addition,

after the implementation of Medicare PPS, compared with non-profit SNFs, for-profit SNFs dramatically altered the services they provided in response to new financial incentives by decreasing the percentage of residents receiving extremely high levels of rehabilitation therapy [97]. In the 1990s, Florida limited the per diem reimbursement growth of Medicaid payment [98]. The Florida Medicaid program also absorbed more than \$1 billion in budget cuts, with a substantial share occurring in institutional provider payments [99]. Street et al found that Florida SNFs responded differently to the growing gap in reimbursement between Medicaid and other payers, depending on their profit status. As the reimbursement gap grew, for-profit SNFs maximized their revenues by admitting fewer Medicaid paying residents, whereas nonprofit facilities increased their percentage of Medicaid admissions [100]. In summary, the literature shows that nursing homes may respond differently to, or be affected differently by, the changes in Medicare/Medicaid reimbursement policy. Nursing home's response to changes in reimbursement policy might depend on the ownership and the proportion of public patients.

1.6 Nursing home care in California and Assembly Bill (AB) 1629

1.6.1 Nursing home care in California

California is the third largest state in the U.S. It has the largest number of nursing homes (1,229) and second largest number of nursing home residents (101,854) in the country. Medicaid pays for the care of 66% of California's nursing home residents [9]. California has long had serious quality of care problems in nursing homes. Compared with national average, nursing homes in California had higher than average level of

deficiency citations for physical restraints and pressure ulcers (Figure 1-3 and 1-4). In 2001, 98.2% of all certified facilities in California were cited for one or more deficiencies, compared to a national average of 86.3%. 18.6% of nursing homes received deficiency citations for physical restraints and 23.2% for pressure ulcers, compared to national averages of 11% and 17.2%, respectively [6]. In 2002, 78% of nursing homes did not comply with federal care and safety regulations (serious noncompliance) and 11% of nursing homes were cited for very serious noncompliance [101] (Figure 1-5). In 2000, California legislation increased the minimum nurse staffing standard from 3.0 to 3.2 hours per resident day (HPRD) [102]. However, 36% nursing facilities in California did not meet this standard in 2003 [8].

Figure 1-3: Percent of facilities with deficiencies for physical restraints, 1998-2004

Source: Harrington, C., H. Carrillo, and C. Mercado-Scott, Nursing facilities, staffing, residents and facility deficiencies, 1998-2004. 2005, San Francisco: University of California, Department of social and behavioral sciences.

Figure 1-4: Percent of facilities with deficiencies for pressure ulcers, 1998-2004

Source: Harrington, C., H. Carrillo, and C. Mercado-Scott, Nursing facilities, staffing, residents and facility deficiencies, 1998-2004. 2005, San Francisco: University of California, Department of social and behavioral sciences.

Figure 1-5: Violations of federal regulations, 2002

Source: Nursing Homes: A System in Crisis. 2004, California Healthcare Foundation.

1.6.2 Assembly Bill (AB) 1629

To deal with the poor quality in nursing homes, Assembly Bill (AB) 1629 (Appendix 1) was approved in California. The bill enacted the Medi-Cal Long-Term Care Reimbursement Act and imposed a nursing facility quality assurance fee (QAF). Medi-Cal is California's Medicaid program. The purpose of the quality assurance fee program was to enhance federal financial participation in the Medi-Cal program, to provide additional reimbursement to nursing facilities, and to support facility quality improvement efforts in nursing facilities. Because both the federal government and the state share in Medi-Cal program financing, after the state collects quality assurance fee

from nursing homes, the state could get federal matching fund [103] and then make an increased Medi-Cal payment back to the nursing homes. The Medi-Cal Long-Term Care Reimbursement Act implemented a cost-based facility-specific rate-setting system for free standing nursing facilities, effective on August 1, 2005. Nursing facilities that are a distinct part of a facility that is licensed as a general acute care hospital were excluded, and were reimbursed under a different facility-specific system. The new payment methodology only applied to Medi-Cal residents. This bill also added requirement to the Health and Safety Code for discharge plan and assistance when resident has potential and desire to return to the community. It was the intent of the legislature to devise a Medi-Cal long-term care reimbursement methodology that more effectively ensures individual access to appropriate long-term care services, promotes quality resident care, advances decent wages and benefits for nursing home workers, supports provider compliance with all applicable state and federal requirements, and encourages administrative efficiency [104]. The original sunset date for AB1629 was July 31, 2008 and was later extended to July 31, 2013 [104-105].

1.6.2.1 Quality assurance fee

Nursing homes, except a skilled nursing facility that is part of a continuing care retirement community, a skilled nursing facility operated by the state or another public entity, or a skilled nursing facility that is a distinct part of a facility that is licensed as a general acute care hospital, were imposed a uniform quality assurance fee per resident day. For the 2005/06 fiscal year, the quality assurance fee was \$7.31 per resident day. The quality assurance fee was based on the revenue of all nursing facilities subject to the

fee, less Medicare revenue. The quality assurance fee was calculated based on total resident days (private-pay and Medi-Cal residents) and the fee amount was updated annually. The quality assurance fee was considered as an allowable cost under Medicaid, which implies Medicaid covers the part of the quality assurance fee that is attributable to revenues from Medicaid residents. Under AB1629, annual Medi-Cal spending on nursing home care has increased by about \$1 billion from 2005 to 2008. Of that \$1 billion in new spending, only \$282 million came from the quality assurance fee [106]. The quality assurance fee enabled the state to tap an estimated \$250 million a year in federal Medicaid dollars for nursing home care to support the new funding system [107].

1.6.2.2 Reimbursement methodology

The cost-based facility-specific reimbursement rate methodology is intended to reflect the costs of each individual nursing facility. Reimbursement to nursing homes is for routine per diem services. The routine service per diem payment includes all equipment, supplies and services necessary to provide appropriate nursing care to long-term care residents, except those items listed as separately payable, as described in the California Code of Regulations, title 22, section 51511 (c), or personal items such as cosmetics, tobacco products and accessories, dry cleaning, beauty shop services (other than shaves or shampoos performed by the facility and periodic hair cuts performed as part of resident care), and television rental. Nursing homes are required to submit costs reports prepared according to the Office of Statewide Health Planning and Development's (OSHPD) Reporting Requirements and Instructions. The Department conducts financial audits of nursing homes. These audits may be full-scope field audits,

limited scope review, or desk reviews. The per diem payment is calculated prospectively on a facility-specific basis using facility-specific data from the nursing home's most recent cost report period (audited or adjusted), supplemental schedules, and other data determined necessary by the Department. The legislation stated that for the 2005/06 and 2006/07 rate years, facility-specific Medi-Cal reimbursement rate calculated under the facility-specific reimbursement rate methodology would not be less than the Medi-Cal reimbursement rate of July 31, 2005, plus Medi-Cal's projected proportional costs for new state or federal mandates for rate years 2005/06 and 2006/07, respectively.

The per diem payment is comprised of five major cost categories: labor costs, indirect care non-labor costs, administrative costs, capital costs, and direct pass-through costs [108] (Table 1-2). Labor costs, indirect care non-labor costs, and administrative costs are subject to caps. Nursing homes are reimbursed the lower of their actual cost per diem or the ceiling per diem amount. The percentile caps are computed on a geographic peer-grouped basis. Seven peer groups were created based on geographic location.

(1) Labor costs: This category includes: (a) Direct resident care labor costs include all labor costs (salaries, wages, and benefits) related to routine nursing services including all nursing, social services, activities, and other direct care personnel. Direct resident care labor costs include labor expenditures associated with nursing home's permanent direct care employees and expenditures associated with temporary agency staffing. These costs are limited to the 90th percentile of each nursing home's respective peer-group. (b) Indirect care labor costs include all labor costs related to staff supporting the delivery of patient care including, but not limited to, housekeeping, laundry and linen,

dietary, medical records, in-service education, and plant operations and maintenance. These costs are limited to the 90th percentile of each nursing home's respective peer-group. (c) Labor-driven operating allocation (LDOA), which is equal to 8 percent of direct and indirect labor costs, minus expenditures for temporary staffing. The LDOA is capped at 5% of the nursing home's total Medi-Cal reimbursement rate.

(2) Indirect care non-labor costs include the non-labor costs related to services supporting the delivery of resident care, including the non-labor portion of nursing, housekeeping, laundry and linen, dietary, in-service education and plant operations and maintenance costs. These costs are limited to the 75th percentile of each nursing home's respective peer-group.

(3) Administrative costs include allowable administrative and general expenses of operating the facility, including allowable home office costs and property insurance costs. It excludes expenditures associated with caregiver training, liability insurance, facility license fees, and medical records. The category is limited to 50th percentile of the cost distribution of the peer group.

(4) Capital costs are reimbursed based on the Fair Rental Value System (FRVS). Under the FRVS, the Department reimburses a facility based on the estimated current value of its capital assets. The FRVS establishes a facility's value based on the age of the facility and additions and renovations after 2005/06.

(5) Direct pass-through costs are comprised of proportional Medi-Cal costs for property taxes, facility license fees, caregiver training costs, liability insurance costs, the

Medi-Cal portion of the skilled nursing facility quality assurance fee, and new state and federal mandates for the applicable rate year.

Table 1-2: Cost components used to calculate Medi-Cal payment rates

Cost component	Description	Cost limit
(1) Labor costs		
(a) Direct care labor costs	All labor costs (salaries, wages, and benefits) related to routine nursing services including all nursing, social services, activities, and other direct care personnel.	90 th percentile
(b) Indirect care labor costs	All labor costs related to staff supporting the delivery of patient care including, but not limited to, housekeeping, laundry and linen, dietary, medical records, in-service education, and plant operations and maintenance.	90 th percentile
(c) Labor-driven operating allocation (LDOA)	8 percent of direct and indirect labor costs, minus expenditures for temporary staffing.	5% of the nursing home's total Medi-Cal reimbursement rate
(2) Indirect care non-labor costs	Non-labor costs related to services supporting the delivery of resident care, including the non-labor portion of nursing, housekeeping, laundry and linen, dietary, in-service education and plant operations and maintenance costs.	75 th percentile
(3) Administrative costs	Allowable administrative and general expenses of operating the facility,	50 th percentile

	including allowable home office costs and property insurance costs.
(4) Capital costs	Under the FRVS, the Department reimburses a facility based on the estimated current value of its capital assets.
(5) Direct pass-through costs	Proportional Medi-Cal costs for property taxes, facility license fees, caregiver training costs, liability insurance costs, the Medi-Cal portion of the skilled nursing facility quality assurance fee, and new state and federal mandates for the applicable rate year.

In addition to the caps for labor costs, indirect care non-labor costs, and administrative costs, the aggregate facility-specific Medi-Cal payments also subject to caps.

(1) For the 2005/06 rate year, the maximum annual increase in the weighted average Medi-Cal reimbursement rate should not exceed eight percent of the weighted average reimbursement rate for the 2004/05 rate year, as adjusted for the change in the cost to the nursing facility to comply with the skilled nursing facility quality assurance fee for the 2005/06 rate year, plus the total projected nursing facility Medi-Cal cost of complying with new state or federal mandates.

(2) For the 2006/07 rate year, the maximum annual increase in the weighted average Medi-Cal reimbursement rate should not exceed five percent of the weighted

average Medi-Cal rate for the 2005/06 rate year, as adjusted for the projected nursing facility Medi-Cal cost of complying with new state or federal mandates.

(3) For the 2007/08 rate year, the maximum annual increase in the weighted average Medi-Cal reimbursement rate should not exceed 5.5 percent of the weighted average Medi-Cal rate for the 2006/07 rate year, as adjusted for the projected nursing facility Medi-Cal cost of complying with new state or federal mandates.

Because the facility-specific reimbursement rates are developed based on audited or reviewed cost data, the actual past costs need to be inflated forward to account for changes in market conditions. The labor costs are inflated using an inflation index, based on the Department's labor study, developed from the most recently available industry-specific historical wage data as reported to OSHPD by providers. The California Consumer Price Index for All-Urban Consumers, as determined by the State Department of Finance, is used to inflate indirect care non-labor costs, administrative costs, caregiver training costs and liability insurance pass-through costs. Property tax pass-through costs are updated at a rate of 2% annually. Facility-license fee pass-through costs and the Medi-Cal portion of the skilled nursing facility quality assurance fee are applied on a prospective basis and do not require an inflation adjustment.

1.6.2.3 Financial incentives in the new payment system

Before AB1629 was implemented, California had a flat-rate nursing home reimbursement methodology. This methodology was first adopted in 1972 with some subsequent minor changes [109]. Nursing homes were paid a fixed amount per resident day based on such nursing home characteristics as size and geographic location (Table 1-

3), which was set at the median costs of all facilities within specified geographic areas and licensed bed-size. All facilities in the same class received the same rate, regardless of their own expenses. The Medicaid payment rate was lowest for nursing homes in Los Angeles area (<60 beds) and highest for nursing homes in Bay area (≥ 60 beds).

California had a relatively low reimbursement rate compared with other states. In 2004, nursing homes in California received an average of \$124 a day statewide for care of each resident, which ranked 30th among the 48 states in average Medicaid per diem rate. The flat-rate system does not base rates on the historical costs of each individual nursing home, so it is generally considered cost containing. If the costs are below the rate, the nursing home keeps the difference as profit. If the nursing home improves quality of care and raises the costs above the flat-rate, the difference represents a loss. Under the flat-rate system, increasing costs will result in reduction in profits, so nursing homes have strong incentives to reduce the costs below the flat-rate. Efforts to control costs may have unintended side-effects on the quality of care. For example, the Balanced Budget Act of 1997 (BBA) changed the way Medicare pays for residents receiving skilled nursing care, from retrospective cost-based system to prospective payment system, and substantially reduced the payment. As a result, professional staffing levels decreased and regulatory deficiencies increased [96]. Therefore, the flat-rate payment system may provide undesirable incentives for cost minimizing, possibly negatively affecting quality.

Table 1-3: Medi-Cal reimbursement rates in 2004/05

Nursing home class	Rates with the QAF \$3.66	Rates without QAF
1-59 All others	\$ 126.56	\$ 122.90
1-59 Los Angeles	\$ 116.45	\$ 112.79
1-59 Bay area	\$ 141.61	\$ 137.95
60+ All others	\$ 130.46	\$ 126.80
60+ Los Angeles	\$ 116.58	\$ 112.92
60+ Bay area	\$ 150.47	\$ 146.81

To achieve the desired policy outcome, quality improvement, California restructured its method of reimbursement. AB1629 changed California's nursing home reimbursement methodology from flat-rate to cost-based facility-specific rate. Medicaid reimbursement rate is linked to each nursing home's own expenditures, which is set equal to the average costs of private-pay and Medi-Cal residents. AB1629 changed nursing home's financial incentives in order to influence their behavior and achieve quality improvement. Under cost-based facility-specific reimbursement system, if a nursing home provides higher quality of care and incurs higher costs, the rate will be higher than it would be otherwise. The cost-based facility-specific reimbursement method is intended to support quality improvement efforts because nursing facilities have the opportunity to offset the financial investments associated with providing higher quality care. In addition, the legislation encourages nursing homes' investment in labor (e.g. increase staffing levels, increase staff wages and benefits) relative to other spending in order to improve quality of care. First, nursing homes get extra funding, LDOA, which is equal to 8% of labor cost. The LDOA is meant to encourage nursing homes to spend more on labor, because the return is greater than the investment. Second, different reimbursement caps

are set for different cost components. Labor cost, indirect care non-labor cost, and administrative cost are subject to caps. The cap is set higher for labor costs (90th percentile) and lower for indirect care non-labor costs and administrative costs (75th percentile and 50th percentile, respectively) to encourage nursing homes' investment in labor and labor related resources [104].

Although the legislation encourages nursing homes' investment in labor, it does not differentiate the investment between staffing levels and wages and benefits. Nursing home could have received the same return on investment regardless of how the increase in labor costs was achieved. Furthermore, because the LDOA was calculated based on total labor costs, direct and indirect care labor costs, so the incentives to invest in labor were not limited to the nursing staff, but all other personnel providing direct and indirect resident care, such as social service, activities, housekeeping, laundry and linen, dietary personnel.

The effectiveness of the incentives to promote quality could be weakened by some provisions of the bill. First, relatively low reimbursement caps are set for rate increase. For the 2005/06, 2006/07, 2007/08 rate year, the maximum annual increase in the weighted average Medi-Cal reimbursement rate was capped at 8%, 5% and 5.5% respectively. Second, because the facility-specific reimbursement rates are developed based on audited historical cost report, there would be a 19 to 30 months delay between the investment nursing homes make and reimbursement recognition. The reimbursement is tied less closely to nursing home's current costs. For example, for the 2007/08 fiscal year, the rate was calculated based on the cost report of 2005, so the Medi-Cal payment

rate reflected nursing home's expenditures about two years ago. If the nursing homes made the decision to invest in labor in 2006, immediately after the implementation of AB 1629, the nursing homes would see a rate increase reflecting the increase in labor investment in 2008.

1.7 Gaps in knowledge

Relatively little is known about the impact of AB1629. Previous studies have found that majority of nursing homes (86%) experienced a significant increase in Medi-Cal revenues per day following the implementation of the act [7]. Some facilities (26%) have responded to AB1629 by increasing their expenditures. But staffing levels have not dramatically changed as a result of AB1629. Rather, wage increases were the more common reaction to AB1629 compared to increases in staffing levels. The analysis did not offer a clear indication that quality has either significantly improved or deteriorated following implementation of AB1629 [7-8].

Previous studies have some limitations, which only used data for one year after the implementation of AB1629 (year 2006). Within such a short period of time, it may not yet have been possible to observe the full impact of the policy on quality of care. Moreover, it is unknown whether some subgroups of nursing homes, such as nursing homes with high Medi-Cal revenue, would face stronger incentives to increase investment in inputs that are thought to result in higher quality and what will be the impact on the quality of care. Thus, it is essential to conduct a comprehensive study to accurately measure the effect of AB1629, especially with regard to quality

improvements. Comparing the change in the trends before and after AB1629 would provide a more robust test to determine the impact of AB1629.

1.8 Contribution of this study

The existing literature suggested that: (1) Reforming Medicaid reimbursement might be an important strategy to improve quality of care in the nursing home. However previous research has not produced consistent results. In addition, little prior work has examined the impact of the policies on quality of care as measured by process of care and patient outcomes (2) Although AB1629 has been in place for 8 year, there has been no comprehensive study of the effect of the new payment system. (3) It is uncertain whether change in reimbursement policy may affect nursing home behavior, and if so in what ways and under what conditions.

This study is designed to address these gaps by: (1) examining the impact of AB1629, especially with regard to quality of care, and (2) assessing nursing homes' behavior in response to the changes in reimbursement policy. This study will add evidence about the relationship between Medicaid reimbursement system and quality of nursing home care, especially whether the reimbursement system will determine what kind of care is provided. Understanding the impact of AB1629 has important policy implications for future state reimbursement changes and efforts to improve quality of care, especially how the state should design and implement rate-setting methods that incentivize nursing home behavior so as to improve quality of care. If the goal of improving quality has not been achieved, significant changes of current Medicaid reimbursement policy might be needed. It will also help us understand nursing homes'

behavior in responding to the new payment incentives and provide insights into their resource allocation decisions that may affect quality of care.

CHAPTER 2 THEORETICAL FRAMEWORK

2.1 Introduction

In section 2.2, a conceptual model is proposed for analyzing nursing home's response to Medicaid reimbursement policy change with respect to quality of care. AB1629 changed California's nursing home reimbursement methodology from flat-rate to cost-based facility-specific rate. In order to understand and explain the relationship between AB1629 and quality of care, an economic model is used. Differences in nursing home's incentives with regard to quality of care are examined comparing two types of reimbursement: flat-rate system and cost-based system (section 2.3). Section 2.4 considers the possible differential effects of Medicaid reimbursement change on quality of care. Section 2.5 examines nursing homes' investment in labor in order to improve quality of care. Section 2.6 presents the testable hypotheses derived from the theoretical framework and literature review.

2.2 Medicaid reimbursement policy change and quality: conceptual model

A conceptual model is proposed for analyzing nursing home's response to Medicaid reimbursement policy change with respect to quality of care (Figure 2-1). Medicaid reimbursement policy change will affect nursing home's quality incentive, which might have potential implications for quality of care.

Reforming Medicaid reimbursement is a potential policy tool to change nursing homes' incentives and motivate them to improve quality of care. Under the flat-rate system, nursing homes were paid a fixed amount per resident day. Increasing costs will lead to reduction in profits, so nursing homes have strong incentives to reduce the costs

below the flat-rate, which may adversely affect quality. AB1629 changed California's nursing home reimbursement methodology from flat-rate to cost-based facility-specific rate. Because the Medicaid reimbursement rate is linked to each nursing home's own expenditures, nursing facilities have the opportunity to offset the financial investments associated with providing higher quality care. Economic model was employed to explain the impact of Medicaid reimbursement on nursing home's incentives in providing care (section 2.3). Economic theory has been widely used to understand nursing homes' behavior [50, 110-112]. Moreover, some mechanisms built into the rate-setting system encourage nursing homes' investment in labor (e.g. increase staffing levels, increase staff wages and benefits) relative to other spending in order to improve quality of care. First, nursing homes get more return for the spending in labor. Second, higher ceilings for the direct care components of the rates than for non-care components are established in order to promote quality care. Therefore, changes in nursing homes' quality incentives may lead to increased investment in direct care labor, which is thought to result in higher quality. Furthermore, Nursing homes may respond differently to, or be affected differently by, the changes in Medi-Cal reimbursement policy, depending on the proportion of Medi-Cal revenues. Possible differential effects of AB1629 on quality of care are discussed in section 2.4.

Figure 2-1: Conceptual model for changes in quality of care in nursing homes

2.3 Theoretical framework

2.3.1 Nursing home market

Nursing home behavior might be different under different market structures. For example, research has shown that nursing home's response to the increase in Medicaid reimbursement rates may depend on the bed constraint policy [17, 113]. This dissertation develops a theoretical model of nursing home behavior to understand how Medicaid reimbursement policy affects quality of care under the following market structures.

2.3.1.1 No binding bed constraint

In health economics, the nursing home market was proposed as either free entry or with a binding bed constraint policy such as certificate-of-need (CON) law or construction moratorium. A CON law constrains the growth of beds by employing a need-based evaluation of all applications for any new bed construction. A construction moratorium restricts applications for new facilities and beds [17, 114]. These policies are employed to constrain the growth of the nursing home market and thereby control

nursing home expenditures. In the nursing home market with a binding bed constraint, nursing home first admits private-pay residents whose demand curve lies above the Medicaid price and then fills the remaining beds with Medicaid residents, therefore, some Medicaid residents might not be able to gain access to care. In California, there is no CON law or construction moratorium for nursing homes (i.e. no binding bed constraint) [92, 114-115], so the nursing home market is thought to be in equilibrium where there is a sufficient supply of beds to meet the demand for nursing home care.

2.3.1.2 Uniform quality

The economic analyses of the market for nursing home care are based on the assumption that there is no quality of care discrimination between private and public residents within the same facility. The following arguments support this assumption. First, nursing home cannot discriminate in the provision of services based on source of payment according to Federal Law “Facilities must not distinguish between residents based on their source of payment when providing services that are required to be provided under the law. All nursing services, specialized rehabilitative services, social services, dietary services, pharmaceutical services, or activities that are mandated by the law must be provided to residents according to residents’ individual needs, as determined by assessments and care plans” [116]. Second, most nursing home services such as nursing care, social services, and dietary services are produced jointly for both private and public residents. Third, studies have generally confirmed common quality across Medicaid and private-pay residents within facilities, in which quality was assessed by a variety of process and outcome measures [117-119].

2.3.1.3 Assumptions

Following Scanlon [110], my analysis of nursing home behavior is based on the dual-market model. Nursing homes are assumed to provide services to both private-pay residents (x_1) and Medicaid residents (x_2). The Medicare post-acute market was excluded in the economic analyses for the following two reasons. First, post-acute care residents typically stay in nursing homes for a short period of time and have different care needs and discharge expectations. Second, for post-acute residents, the definition of quality is quite different from that for residents receiving custodial care.

Private demand for nursing home care depends on both the private-pay price (p) and quality (q). Medicaid demand depends on quality alone because Medicaid residents do not pay the Medicaid rate out-of-pocket. It is assumed that private demand for nursing home care is a negative function of the private price ($\frac{\partial x_1}{\partial p} < 0$) and a positive function of quality ($\frac{\partial x_1}{\partial q} > 0$) and Medicaid demand for nursing home care is a positive function of quality ($\frac{\partial x_2}{\partial q} > 0$). For private-pay residents, at each quantity consumed, the willingness to pay increases with quality ($\frac{\partial P}{\partial q} > 0$) and the marginal price with regard to quality is diminishing.

Several assumptions are made about the cost function. First, total cost increases directly with quality and depends on the number of total residents, in some unspecified way. Although there is some evidence to suggest an inverted U-shaped relationship

between quality and costs [76-79], I assume that the above assumption is valid considering the low quality of care in California. Second, marginal costs are assumed to be non-negative. Third, marginal cost of private-pay residents is the same as marginal cost of Medicaid residents within a facility ($\frac{\partial C}{\partial x_1} = \frac{\partial C}{\partial x_2}$). Last, the marginal cost of quality is diminishing.

In the US, approximately two-thirds of nursing homes are for-profit nursing homes [111]. 80% of nursing homes in California were for-profit in 2010 [9]. For-profit and non-profit nursing homes have different goals and might have different quality incentives. Typically, for-profit nursing homes are interested in maximizing the profits. However, non-profit organizations usually pursue multiple objectives including quality and quantity, subject to no-loss constraint [110, 120-121]. In contrast to the profit distribution to shareholders in the for-profit organizations, the profit can be used for quality-enhancing investment in the non-profit organizations [110, 122]. Therefore, different models were used for for-profit and non-profit nursing homes.

2.3.2 For-profit nursing homes

The objective function of for-profit nursing homes is to maximize profit with respect to private and public mix of residents and quality. The profit is the sum of the revenues derived from private and Medicaid residents minus cost. Profit maximization means making difference between the nursing home's revenue and its cost as large as possible. The analysis of incentives consists of deriving and then comparing the decision rules for the choice variable, quality, under the alternative reimbursement method.

- Flat-rate system

In the flat-rate system, Medicaid reimbursement rate is exogenously determined by the rate setting authority, which is unrelated to individual facility costs.

Profit function of nursing home [50]:

$$\max_{x_1, x_2, q} \pi = P(x_1, q) * x_1 + M * x_2 - C(x_1 + x_2, q)$$

π : Profit (\$)

x_1 : Number of private-pay residents

P : Private-pay price per day (\$)

q : Quality

M : Medicaid rate per day (\$)

x_2 : Number of Medicaid residents

C : Cost of a nursing home per day (\$)

First order condition (F.O.C):

$$\frac{\partial \pi}{\partial x_1} : P + x_1 * \frac{\partial P}{\partial x_1} - \frac{\partial C}{\partial x_1} = 0 \quad (1)$$

$$\frac{\partial \pi}{\partial x_2} : M - \frac{\partial C}{\partial x_2} = 0 \quad (2)$$

$$\frac{\partial \pi}{\partial q} : x_1 * \frac{\partial P}{\partial q} - \frac{\partial C}{\partial q} = 0 \quad (3)$$

Equation (1): a nursing home sets the private price so that marginal revenue of private-pay residents equals marginal cost of private-pay residents.

Equation (2): Medicaid residents are chosen so that reimbursement rate equals the marginal cost of Medicaid residents.

Equation (3): Nursing homes have an incentive to provide quality until marginal revenue of private-pay residents attracted by an increase in quality is equal to marginal cost of that quality.

- Cost-based system

In the cost-based system, the objective function remains the same except that Medicaid reimbursement rate is set equal to the average cost of care of both private-pay and Medicaid residents ($M = \frac{C}{x_1 + x_2}$).

Profit function of nursing home:

$$\max_{x_1, x_2, q} \pi = P(x_1, q) * x_1 + \frac{C(x_1 + x_2, q)}{x_1 + x_2} * x_2 - C(x_1 + x_2, q)$$

F.O.C

$$\begin{aligned} \frac{\partial \pi}{\partial x_1} : x_1 * \frac{\partial P}{\partial x_1} + P + \frac{\partial C}{\partial x_1} * \frac{x_2}{x_1 + x_2} + C * x_2 * \frac{\partial(1/x_1 + x_2)}{\partial x_1} - \frac{\partial C}{\partial x_1} &= 0 \\ x_1 * \frac{\partial P}{\partial x_1} + P + \frac{\partial C}{\partial x_1} * \frac{x_2}{x_1 + x_2} - C * x_2 * \frac{1}{(x_1 + x_2)^2} - \frac{\partial C}{\partial x_1} &= 0 \\ x_1 * \frac{\partial P}{\partial x_1} + P + \frac{\partial C}{\partial x_1} * \left(\frac{x_2}{x_1 + x_2} - 1\right) - C * x_2 * \frac{1}{(x_1 + x_2)^2} &= 0 \\ x_1 * \frac{\partial P}{\partial x_1} + P - \frac{\partial C}{\partial x_1} * \frac{x_1}{x_1 + x_2} - C * x_2 * \frac{1}{(x_1 + x_2)^2} &= 0 \end{aligned} \quad (4)$$

$$\begin{aligned}
\frac{\partial \pi}{\partial x_2} : \frac{x_2}{x_1 + x_2} * \frac{\partial C}{\partial x_2} + C * \frac{\partial(x_2 / (x_1 + x_2))}{\partial x_2} - \frac{\partial C}{\partial x_2} &= 0 \\
\frac{x_2}{x_1 + x_2} * \frac{\partial C}{\partial x_2} + C * \frac{x_1 + x_2 - x_2}{(x_1 + x_2)^2} - \frac{\partial C}{\partial x_2} &= 0 \\
\frac{x_2}{x_1 + x_2} * \frac{\partial C}{\partial x_2} + C * \frac{x_1}{(x_1 + x_2)^2} - \frac{\partial C}{\partial x_2} &= 0 \\
\frac{\partial C}{\partial x_2} * (\frac{x_2}{x_1 + x_2} - 1) + C * \frac{x_1}{(x_1 + x_2)^2} &= 0 \\
\frac{\partial C}{\partial x_2} * (-\frac{x_1}{x_1 + x_2}) + C * \frac{x_1}{(x_1 + x_2)^2} &= 0 \\
\frac{\partial C}{\partial x_2} * (-\frac{x_1}{x_1 + x_2}) + (-\frac{x_1}{x_1 + x_2}) * (-\frac{C}{x_1 + x_2}) &= 0 \\
(-\frac{x_1}{x_1 + x_2}) * (\frac{\partial C}{\partial x_2} - \frac{C}{x_1 + x_2}) &= 0 \\
\frac{\partial C}{\partial x_2} - \frac{C}{x_1 + x_2} &= 0
\end{aligned} \tag{5}$$

Because $\frac{\partial C}{\partial x_1} = \frac{\partial C}{\partial x_2}$ and equation (5), the equation (4) can be presented as follows:

$$\begin{aligned}
x_1 * \frac{\partial P}{\partial x_1} + P - \frac{\partial C}{\partial x_1} * \frac{x_1}{x_1 + x_2} - C * x_2 * \frac{1}{(x_1 + x_2)^2} &= 0 \\
x_1 * \frac{\partial P}{\partial x_1} + P - \frac{\partial C}{\partial x_1} * \frac{x_1}{x_1 + x_2} - \frac{C}{x_1 + x_2} * \frac{x_2}{x_1 + x_2} &= 0 \\
x_1 * \frac{\partial P}{\partial x_1} + P = \frac{C}{x_1 + x_2} * \frac{x_1}{x_1 + x_2} + \frac{C}{x_1 + x_2} * \frac{x_2}{x_1 + x_2} \\
x_1 * \frac{\partial P}{\partial x_1} + P = \frac{C}{x_1 + x_2} * \frac{x_1 + x_2}{x_1 + x_2}
\end{aligned} \tag{4}$$

$$\frac{\partial P}{\partial x_1} * x_1 + P = \frac{C}{x_1 + x_2} \tag{6}$$

$$\begin{aligned} \frac{\partial \pi}{\partial q} : x_1 * \frac{\partial P}{\partial q} + \frac{x_2}{x_1 + x_2} * \frac{\partial C}{\partial q} - \frac{\partial C}{\partial q} &= 0 \\ x_1 * \frac{\partial P}{\partial q} &= \frac{\partial C}{\partial q} * (1 - \frac{x_2}{x_1 + x_2}) = \frac{\partial C}{\partial q} * \frac{x_1}{x_1 + x_2} \end{aligned} \quad (7)$$

Equation (5): Medicaid residents are admitted up to the point at which the marginal cost is equal to average cost.

Equation (6): Nursing home admits private-pay residents up to the point at which marginal revenue of private-pay residents equals average cost.

Equation (7): Quality is set at the point that marginal revenue of private-pay residents equals the private share of the marginal cost of the quality.

2.3.2.1 Comparison of quality incentives

$$\text{Flat-rate system: } x_1 * \frac{\partial P}{\partial q} = \frac{\partial C}{\partial q} \quad (3)$$

$$\text{Cost-based system: } x_1 * \frac{\partial P}{\partial q} = \frac{\partial C}{\partial q} * \frac{x_1}{x_1 + x_2} \quad (7)$$

Because $0 < \frac{x_1}{x_1 + x_2} < 1$, as long as nursing home provides services to both

private-pay residents and Medicaid residents, private share of the marginal cost of the

quality is less than total marginal cost ($\frac{\partial C}{\partial q} * \frac{x_1}{x_1 + x_2} < \frac{\partial C}{\partial q}$). I assume that $\frac{\partial C}{\partial q}$ is the same

under flat-rate and cost-based system. Although with the increase of the Medicaid

payment rate under the cost-based system, nursing homes may admit more Medicaid

residents, nursing homes will not displace private-pay residents because nursing homes in

California are not operating at capacity (occupancy rate 85%). Thus the number of

private-pay residents (x_1) is the same under both systems. Therefore, $\frac{\partial P}{\partial q}$ in equation (7) is smaller than that in equation (3). Because for private-pay residents, at each quantity consumed, the willingness to pay is assumed to increase with quality ($\frac{\partial P}{\partial q} > 0$) and the marginal price with regard to quality is diminishing ($\frac{\partial^2 P}{\partial^2 q} < 0$), a smaller $\frac{\partial P}{\partial q}$ implies higher quality in the cost-based system (Figure 2-2). Thus the economic model predicts that AB1629 will cause the quality of nursing home care to increase.

Figure 2-2: The relationship between price and quality

2.3.3 Non-profit nursing homes

Non-profit nursing homes are assumed to desire to maximize quantity and quality, subject to a non-loss constraint.

- Flat-rate system

$$\max_{x_1, x_2, q, \lambda} U(x_1 + x_2, q)$$

$$\text{Subject to } P(x_1, q) * x_1 + M * x_2 = C(x_1 + x_2, q)$$

$$\begin{aligned} \text{Assumptions: } U_{x_1} &= \frac{\partial U}{\partial x_1} > 0, \\ U_{x_2} &= \frac{\partial U}{\partial x_2} > 0, \\ U_{x_1} &= U_{x_2}, \\ U_q &= \frac{\partial U}{\partial q} > 0 \end{aligned}$$

U : Utility

x_1 : Number of private-pay residents

x_2 : Number of Medicaid residents

q : Quality

P : Private-pay price per day (\$)

M : Medicaid rate per day (\$)

C : Cost of a nursing home per day (\$)

λ : Marginal utility of constraint

$$L = U(x_1 + x_2, q) + \lambda * [P(x_1, q) * x_1 + M * x_2 - C(x_1 + x_2, q)]$$

F.O.C

$$\frac{\partial L}{\partial x_1} : \frac{\partial U}{\partial x_1} + \lambda * [P + x_1 * \frac{\partial P}{\partial x_1} - \frac{\partial C}{\partial x_1}] = 0 \quad (8)$$

$$\frac{\partial L}{\partial x_2} : \frac{\partial U}{\partial x_2} + \lambda * [M - \frac{\partial C}{\partial x_2}] = 0 \quad (9)$$

$$\frac{\partial L}{\partial q} : \frac{\partial U}{\partial q} + \lambda * [x_1 * \frac{\partial P}{\partial q} - \frac{\partial C}{\partial q}] = 0 \quad (10)$$

$$\frac{\partial L}{\partial \lambda} : P(x_1, q) * x_1 + M * x_2 - C(x_1 + x_2, q) = 0 \quad (11)$$

Since $\frac{\partial U}{\partial x_1} = \frac{\partial U}{\partial x_2}$ by assumption, equation (8) and (9) can be presented as follows:

$$\lambda * [P + x_1 * \frac{\partial P}{\partial x_1} - \frac{\partial C}{\partial x_1}] = \lambda * [M - \frac{\partial C}{\partial x_2}]$$

$$P + x_1 * \frac{\partial P}{\partial x_1} - \frac{\partial C}{\partial x_1} = M - \frac{\partial C}{\partial x_2}$$

Because $\frac{\partial C}{\partial x_1} = \frac{\partial C}{\partial x_2}$, the above equation can be presented as follows:

$$P + x_1 * \frac{\partial P}{\partial x_1} = M \quad (12)$$

Equation (10) indicates that quality is added up to the point that marginal utility of quality plus λ *marginal revenue of private-pay residents equal λ *marginal cost of the quality.

Equation (11) implies that to maximize utility, the non-profit nursing home must set average revenue equal to average cost.

Equation (12) indicates that to maximize utility, the non-profit nursing home must allocate the number of residents between Medicaid and private-pay residents such that the marginal revenue of private-pay residents equals Medicaid payment rate.

- Cost-based system

$$\max_{x_1, x_2, q, \lambda} U(x_1 + x_2, q)$$

$$\text{Subject to } P(x_1, q) * x_1 + \frac{C(x_1 + x_2, q)}{x_1 + x_2} * x_2 = C(x_1 + x_2, q)$$

$$L = U(x_1 + x_2, q) + \lambda * [P(x_1, q) * x_1 + \frac{C(x_1 + x_2, q)}{x_1 + x_2} * x_2 - C(x_1 + x_2, q)]$$

F.O.C

$$\frac{\partial L}{\partial x_1} : \frac{\partial U}{\partial x_1} + \lambda * [P + x_1 * \frac{\partial P}{\partial x_1} - \frac{\partial C}{\partial x_1} * \frac{x_1}{x_1 + x_2} - \frac{C * x_2}{(x_1 + x_2)^2}] = 0 \quad (13)$$

$$\frac{\partial L}{\partial x_2} : \frac{\partial U}{\partial x_2} + \lambda * [-\frac{\partial C}{\partial x_2} * \frac{x_1}{x_1 + x_2} + \frac{C * x_1}{(x_1 + x_2)^2}] = 0 \quad (14)$$

$$\frac{\partial L}{\partial q} : \frac{\partial U}{\partial q} + \lambda * [x_1 * \frac{\partial P}{\partial q} - \frac{x_1}{x_1 + x_2} * \frac{\partial C}{\partial q}] = 0 \quad (15)$$

$$\frac{\partial L}{\partial \lambda} : P(x_1, q) * x_1 + \frac{C(x_1 + x_2, q)}{x_1 + x_2} * x_2 - C(x_1 + x_2, q) = 0 \quad (16)$$

Since $\frac{\partial U}{\partial x_1} = \frac{\partial U}{\partial x_2}$ by assumption, equation (13) and (14) can be presented as follows:

$$P + x_1 * \frac{\partial P}{\partial x_1} - \frac{\partial C}{\partial x_1} * \frac{x_1}{x_1 + x_2} - \frac{C * x_2}{(x_1 + x_2)^2} = -\frac{\partial C}{\partial x_2} * \frac{x_1}{x_1 + x_2} + \frac{C * x_1}{(x_1 + x_2)^2}$$

Because $\frac{\partial C}{\partial x_1} = \frac{\partial C}{\partial x_2}$, the above equation can be presented as follows:

$$\begin{aligned}
P + x_1 * \frac{\partial P}{\partial x_1} - \frac{C * x_2}{(x_1 + x_2)^2} - \frac{C * x_1}{(x_1 + x_2)^2} &= 0 \\
P + x_1 * \frac{\partial P}{\partial x_1} - \frac{C}{(x_1 + x_2)^2} * (x_1 + x_2) &= 0 \\
P + x_1 * \frac{\partial P}{\partial x_1} - \frac{C}{x_1 + x_2} &= 0
\end{aligned} \tag{17}$$

Equation (15) indicates that under the cost-based system, quality is added up to the point that marginal utility of quality plus λ *marginal revenue of private-pay residents equal λ *private share of the marginal cost of quality.

Equation (16) implies that to maximize utility, the non-profit nursing home must set average revenue equal to average cost.

Equation (17) indicates that with a cost-based system the nursing home admits private-pay residents up to the point at which the marginal revenue equals average cost.

2.3.3.1 Comparison of quality incentives

$$\text{Flat-rate system: } \frac{\partial U}{\partial q} + \lambda * x_1 * \frac{\partial P}{\partial q} - \lambda * \frac{\partial C}{\partial q} = 0 \tag{10}$$

$$\text{Cost-based system: } \frac{\partial U}{\partial q} + \lambda * x_1 * \frac{\partial P}{\partial q} - \lambda * \frac{\partial C}{\partial q} * \frac{x_1}{x_1 + x_2} = 0 \tag{15}$$

The cost-based system provides higher quality incentive, which parallels the for-profit case. The explanation is the same as that of for-profit nursing homes.

Although the goals of for-profit and non-profit nursing homes are different, the economic model predicts that nursing homes will improve quality of care after the Medicaid reimbursement is changed from a flat-rate system to a cost-based system.

2.4 Possible differential effects of Medicaid reimbursement change on quality of care

Nursing homes may respond differently to, or be affected differently by, the changes in Medi-Cal reimbursement policy. In the nursing home industry, the government is a substantial provider of resources to nursing home care. However, facilities differ in the proportion of Medicaid revenues. The percent of revenues from Medi-Cal represents the extent to which a facility is exposed to potential changes in Medi-Cal policy. The larger the proportion of Medi-Cal revenues, the more the facility depends on Medi-Cal reimbursement and is affected by the reimbursement change. Thus, with the implementation of AB1629, nursing homes with higher proportion of Medi-Cal revenues are expected to experience a stronger effect from AB1629 and are more likely to improve quality or have greater quality improvement.

2.5 Nursing home's investment in labor

AB1629 included incentives to encourage nursing homes' investment in labor in order to improve quality of care. Increasing staffing levels is one way for nursing homes to maximize spending on labor. Higher total staffing levels (especially greater RN staffing) have been shown to be associated with improved quality of care [123-124]. Alternatively, nursing homes may choose to improve nursing staff's wages and benefits. Although nursing home care is emotionally and physically demanding work, nursing home care workforce is poorly compensated, especially nurse aides. The wages for nurse aides are barely above the minimum wage and only 44% of them have employer-based health insurance [125]. There is some evidence supporting the potential importance of

compensation for recruiting and retaining a stable workforce. With the low wages and benefits, nursing homes find it difficult to compete with fast-food restaurants and other low-wage service sectors and the turnover rates are high [63, 126], which are associated with poor quality of care [123, 127-129]. Since AB1629 changed payment incentives to encourage and reward nursing homes to invest more in direct care labor, we expect to see nursing homes increasing staffing levels and/or wages.

2.6 Hypotheses

The economic model presented above and a review of previous research on nursing staff suggests 4 main hypotheses to be tested:

Hypothesis 1: The quality of care in nursing homes improved after the implementation of AB1629.

Hypothesis 2: With the implementation of AB1629, nursing homes with higher proportion of Medi-Cal revenues were more likely to improve quality or had greater quality improvement.

Hypothesis 3: After the implementation of AB1629, nursing homes increased staffing levels and/or wages.

Hypothesis 4: The investment in direct care labor was associated with the changes in quality of care during the study period.

CHAPTER 3 DATA AND METHODS

This chapter outlines the data and methods used within this dissertation. This chapter is organized as follows: section 3.1 describes study population. Section 3.2 provides a detailed review of data sources for empirical analyses. Section 3.3 describes the variables. Section 3.4 details the statistical methods.

3.1 Study population

Because AB1629 implemented a Medi-Cal cost-based facility-specific reimbursement rate methodology for freestanding nursing facilities, nursing facilities that are a distinct part of a general acute care hospital were excluded (Table 3-1).

Because Medi-Cal pays for custodial care, I limited the analysis to long-term care nursing home residents. Another reason that post-acute care residents were excluded is that post-acute residents receive a different set of services and quality of care is measured differently for them. Long-term care residents are either paid by Medicaid or privately. Although AB1629 represents a major revision in Medi-Cal reimbursement, I expect that it might affect quality of care for both Medicaid residents and private-pay residents, because quality of care is a common good in the nursing home [117]. Following previous studies [46, 83, 130], long-term care residents were defined as those who had stayed in the nursing home for ≥ 90 days. Residents who remained in the nursing home for at least 90 days generally have a quarterly or annual MDS assessment, because the OBRA regulations have required the assessments to be performed for a nursing facility resident at least quarterly after admission.

Different inclusion and/or exclusion criteria were applied for different outcome variables using the CMS methodology [131] (details in section 3.3.1.1, section 3.3.1.2, and section 3.3.1.4). For potentially avoidable hospitalizations, I removed Medicare managed care beneficiaries and residents who were not a Medicare Part A beneficiary because their hospitalization information was not available in the inpatient claims. Similarly, among Medi-Cal only beneficiaries, residents who enrolled in Medicaid managed care were excluded because hospitalization information was not available in the inpatient claims. The analytic samples were discussed in detail when I introduced outcome variables (sections 3.3.1.1~3.3.1.5).

The study period was 2002-2008, which offered the opportunity to observe the nursing homes 3 years prior to the policy change and 3 years after the policy change. Because AB1629 was implemented on August 1, 2005, 2005 was a mixed a year in terms of Medi-Cal payment and was excluded from the analyses.

Table 3-1: Number of nursing homes in California

Year	Number of nursing homes	Number of free-standing nursing homes	Percent of free-standing nursing homes
2002	1337	1164	87.06
2003	1335	1166	87.34
2004	1314	1141	86.83
2006	1278	1122	87.79
2007	1259	1119	88.88
2008	1258	1118	88.87

Source: Brown University's Long-term Care Facts website (<http://ltcfocus.org/>). Shaping Long Term Care in America Project at Brown University funded in part by the National Institute on Aging (1P01AG027296).

3.2 Data sources

Minimum Data Set (MDS) version 2.0, California Medi-Cal cost reports, the Online Survey, Certification and Reporting (OSCAR) File, Medicare Provider Analysis and Review (MedPAR) File, and Medicaid Analytical Extract (MAX) Inpatient File from 2002 to 2008 were used to test the hypotheses. Medicare Beneficiary Summary File and Medicaid Analytical Extract (MAX) Personal Summary File were used to identify eligible beneficiaries.

3.2.1 Minimum Data Set (MDS)

The Minimum Data Set (MDS) is a standardized, primary screening and assessment tool of health status which forms the foundation of the comprehensive assessment for all residents of long-term care facilities certified to participate in Medicare or Medicaid. The MDS data have been found to be both reliable and valid [132-134] and are used for Medicare and Medicaid reimbursement and for monitoring the quality of care provided to nursing home residents.

The MDS is an individual level dataset with detailed information about resident physical, psychological and psycho-social functioning, which is considered the best available data for measuring nursing home quality. Assessments are performed for a nursing facility resident at admission, quarterly, annually, and whenever the resident

experiences a significant change in status or when the facility identifies a significant error in a prior assessment. The individual-level quality measures and facility case-mix index were derived from the MDS data.

3.2.2 California Medi-Cal cost reports

California Medi-Cal cost reports were obtained from the Office of Statewide Health Planning and Development. These data are submitted by all nursing homes to the state of California and are used by the state to set Medi-Cal payment rates for nursing homes. Data quality is enhanced through an audit process implemented by the state. The data include information about revenues by payer type, expenditures by cost center, staffing levels by type, wages and turnover rates. The cost report and MDS were matched by facility zip code and address, and the match rate was 97% in each year.

3.2.3 Online Survey, Certification and Reporting (OSCAR) File

Nursing home characteristics such as whether the nursing home is hospital-based were obtained from OSCAR data. OSCAR is a compilation of all the data elements collected by surveyors during the inspection survey conducted at nursing facilities for the purpose of certification for participation in the Medicare and Medicaid programs. OSCAR data were obtained from CMS.

3.2.4 Medicare Provider Analysis and Review (MedPAR) File

The Medicare Provider Analysis and Review (MEDPAR) File contains data from claims for services provided to beneficiaries admitted to Medicare certified inpatient hospitals and skilled nursing facilities (SNF). Beneficiary demographic characteristics, diagnosis and surgery information, and use of hospital or SNF resources are included on

the MEDPAR records. The MedPAR data were linked with the MDS discharge records to identify hospital admissions for Medicare beneficiaries and diagnoses associated with each hospitalization. The linkage was done using the Chronic Condition Data Warehouse (CCW) unique identifier (BENE_ID).

3.2.5 Medicaid Analytical Extract (MAX) Inpatient File

The Medicaid Analytical Extract (MAX) Inpatient File contains complete stay records for Medicaid beneficiaries who used inpatient services, including diagnoses, procedures, discharge status, length of stay, and payment amount. MAX Inpatient File was used to supplement hospitalizations for those Medi-Cal only beneficiaries. In California, 13% of elderly Medi-Cal beneficiaries are Medi-Cal only and are not eligible for Medicare because they lack sufficient, countable Social Security work time or immigration requirements necessary for Medicare eligibility [135]. The MAX Inpatient File was linked with the MDS discharge records to identify hospital admissions and diagnoses associated with each hospitalization. The linkage was done by the CCW unique identifier (BENE_ID) or STATE_CD and MSIS_ID.

3.2.6 Beneficiary Summary File

The Beneficiary Summary File contains demographic and enrollment information about each beneficiary enrolled in Medicare during a calendar year. Some of the information contained in this file includes the CCW unique identifier, state and county codes, zipcode, date of birth, date of death, sex, race, age, monthly entitlement indicators (A/B/C/D), reasons for entitlement, state buy-in indicators, and monthly managed care

indicators (yes/no). The Beneficiary Summary File was used to identify Medicare managed care beneficiaries.

3.2.7 Medicaid Analytical Extract (MAX) Personal Summary File

The Medicaid Analytical Extract (MAX) Personal Summary File contains one record for every individual enrolled for at least one day during the year. The file contains demographic data (e.g. date of birth, gender, race), basis of eligibility, maintenance assistance status, monthly enrollment status, and a utilization summary. The MAX Personal Summary File was used to identify Medicaid managed care beneficiaries.

3.3 Description of variables

This section provides a brief description of the outcome variables (Table 3-2). Control variables utilized in the empirical analysis for each outcome variable were also included.

Table 3-2: Summary of outcome variables used in the analyses

Outcome variables	Description	Data source
Nursing home quality		
Pressure ulcers	=1 if high-risk resident had pressure ulcers (stage 2 or higher); =0 otherwise	MDS
Functional decline	=1 if the residents' need for help with daily activities has increased between baseline and target assessments; =0 otherwise	MDS
Physical restraints	=1 if the resident was physically restrained daily; =0 otherwise	MDS
Incontinence	=1 if the low-risk residents lose control of their bowels or bladder; =0 otherwise	MDS
Potentially avoidable hospitalizations	=1 if the resident was admitted to an acute care hospital for a condition for which hospitalization may be potentially avoidable; =0 otherwise	MDS; MEDPAR; MAX Inpatient File
Nursing home's investment in labor		
Nursing staff levels		
• Registered nurse (RN)	Number of staff hours per resident-day (HPRD)	California Medi-Cal cost reports
• Licensed practical nurse (LPN)	Number of staff hours per resident-day (HPRD)	California Medi-Cal cost reports
• Certified nurse aide (CNA)	Number of staff hours per resident-day (HPRD)	California Medi-Cal cost reports
Nursing staff wages		
• Registered nurse (RN)	\$ per hour (in 2008 \$)	California Medi-Cal cost reports
• Licensed practical nurse (LPN)	\$ per hour (in 2008 \$)	California Medi-Cal cost

		reports
• Certified nurse aide (CNA)	\$ per hour (in 2008 \$)	California Medi-Cal cost reports

3.3.1 Outcome variable: nursing home quality

In this dissertation, quality was represented by five separate individual-level measures, which included pressure ulcers, functional decline, physical restraints, incontinence, and potentially avoidable hospitalizations, because quality is a multidimensional construct and there is a lack of correlation across different measures [136]. These quality measures reflect important aspects of care affecting long-term care residents. The quality of care was measured at the resident level rather than aggregated at the facility level because an analysis of outcomes at the resident level is necessary to make solid conclusions about the impact of AB1629 on residents. In addition, it allows extensive controls for changes in resident characteristics. Each outcome was expressed as a binary variable equal to 1 if the resident experienced the event and 0 otherwise.

The quality measures, except potentially avoidable hospitalizations, were derived from the MDS using CMS algorithm [131]. Prevention of these conditions requires labor intensive care. Pressure ulcers and functional status have proven to be sensitive quality indicators linked to staffing levels due to the considerable amount of nursing staff time necessary to improve outcomes [123]. Pressure ulcers and functional status were selected as outcome quality measures, which develop quickly and over a longer period of time, respectively, when care is inadequate. Incontinence was selected as another outcome measure and prevention of incontinence involves regularly scheduled toileting or bladder

rehabilitation. Restraint use, which may be more likely to occur under the conditions of limited staff availability, was used to measure process of care. Therefore, pressure ulcers, functional status, physical restraints, and incontinence are nursing staff dependent quality measures. If AB1629 has motivated nursing homes to spend more on labor, I would expect to see improvement in these quality measures. These four quality measures are among the 19 quality measures for long-stay residents currently published by the Centers for Medicare & Medicaid (CMS) in the Nursing Home Compare report card [65].

Potentially avoidable hospitalizations are another accepted indicator of nursing home quality [137] and reduction of potentially avoidable hospitalizations has the potential to decrease Medicare expenditure [30]. Potentially avoidable hospitalizations have thus far not been publicly reported on the Nursing Home Compare website and thus might not be a priority in quality improvement. However, potentially avoidable hospitalizations do indicate changes in resident outcomes that cannot be gathered from analysis of the above four quality measures. Furthermore, compared to the above four quality measures, potentially avoidable hospitalizations were used as a measure reflecting overall care provided in the nursing home and the decision to hospitalize a resident may involve many factors [138].

Because the likelihood that an individual resident will experience the above outcomes depends on both individual risk factors (e.g. co-morbidity) and nursing home's unique quality of care for all residents, all measures were risk-adjusted by the inclusion of resident characteristics in the regression. The sets of risk factors were identified

according to previous literature and clinical judgment of a geriatrician and were identified separately for each outcome.

3.3.1.1 Pressure ulcers

The outcome variable is whether the high-risk resident had pressure ulcers (stage 2 or higher). Pressure ulcers are lesions caused by unrelieved pressure that results in damage to the underlying tissue. Generally, these are the result of soft tissue compression between a bony prominence and an external surface for a prolonged period of time [139-140]. Pressure ulcers are staged by a 1-4 grading system based on the degree of penetration into underlying structures (Table 3-3). Pressure ulcers are a significant problem in elderly and critically ill patients, causing pain, reducing mobility, and increasing the risk for infection and death in nursing homes [141]. Identifying patients at risk, to target appropriate interventions, is critical to preventing pressure ulcers. Pressure ulcer prevention requires regular follow-up to identify changes in clinical status and daily skin inspections to detect early evidence of pressure-induced skin damage [142]. For high-risk individuals, regular turning and repositioning schedule with particular attention to vulnerable tissue covering bony prominences are recommended [143]. Sufficient staffing levels are necessary for effective pressure ulcer prevention [144]. Other things nursing homes can do that may help to prevent or treat pressure ulcers include proper nutrition, and using soft padding to reduce pressure on the skin.

Residents with any one of the following inclusion criteria were defined as high-risk residents: (1) Comatose; (2) Suffer malnutrition (International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes 260, 261, 262, 263.0,

263.1, 263.2, 263.8, or 263.9); (3) Impaired in bed mobility or transfer (indicated by G1a(A) = 3, 4, or 8 OR G1b(A) = 3, 4, or 8). Pressure ulcers (stage 1-4) were determined by nurse assessment or physician diagnosis (ICD-9-CM codes 707.21-707.24 for stages 1-4, respectively). Nursing home resident characteristics that were potentially associated with the risk of developing pressure ulcers were listed in Table 3-4.

In the analyses, 319, 491 long-term care residents were identified as at high-risk for pressure ulcers. 2,923(0.91%) residents were excluded because of missing assessment and 31,016(9.71%) residents were excluded because the facilities were hospital-based. Another 461(0.14%) residents were excluded due to the missing values of individual control variables. The final analytic sample after both resident and facility exclusion included 285,091 long-term care residents in 1,170 facilities.

Table 3-3: Staging of pressure ulcers

Stage	Description
1	A persistent area of skin redness (without a break in the skin) that does not disappear when pressure is relieved.
2	A partial thickness loss of skin layers that presents clinically as an abrasion, blister, scab or shallow crater.
3	A full thickness of skin is lost, exposing the subcutaneous tissues. Presents as a deep crater with or without undermining adjacent tissue.
4	A full thickness of skin and subcutaneous tissue is lost, exposing muscle or bone.

Source: CMS's RAI Version 2.0 Manual. Chapter 3: Item-by-item guide to the MDS.

Table 3-4: Individual risk factors for developing pressure ulcers

Risk factors	Description	MDS item
Age (years)	Continuous	AA3_BIRTH_DT
Gender	=1 if gender is female	AA2_GENDER
Functional status (Difficulties in the activities of daily living)	Functional status was measured by the activity of daily living (ADL) score [145]. ADL score ranges from 0 to 28 depending on residents' ability to perform 7 activities (bed mobility, transfer, locomotion on unit, dressing, eating, toilet, and personal hygiene), with a higher score indicating increased dependence.	G1GA_SELF_DRESS G1JA_SELF_HYGIENE G1IA_SELF_TOLIET G1EA_SELF_LOC_UNIT G1BA_SELF_TRANS G1AA_SELF_BED G1HA_SELF_EAT
Cognitive status	Cognitive status was measured by the Cognitive Performance Scale [146], which ranges from 0 to 6, with 0 indicating intact cognition and 6 indicating most severe cognitive impairment.	B1_COMATOSE B2A_ST_MEMORY B4_DAY_DCSN_MAKING C4_IS_UNDERSTOOD G1HA_SELF_EAT
Disease diagnosis		
Dementia	=1 if the resident has Alzheimer disease or other types of dementia	I1Q_ALZHEIMER I1U_DEMENTIA
Stroke	=1 if the resident has stroke	I1T_STROKE
Diabetes	=1 if the resident has diabetes	I1A_DIABETES
Cancer	=1 if the resident has cancer	I1PP_CANCER
Other endocrine disease	=1 if the resident has hyperthyroidism or hypothyroidism	I1B_HYPERTHYRD I1C_HYPOTHYRD
Cardiovascular disease	=1 if the resident has at least one of the following conditions: arteriosclerotic heart disease (ASHD),	I1D_ASHD I1E_CARD_DYSRH I1F_CON_HEART_FAIL I1G_VEIN_THROMB

	cardiac dysrhythmias, congestive heart failure, deep vein thrombosis, hypertension, hypotension, peripheral vascular disease, and other cardiovascular disease	I1H_HYPERTENSION I1I_HYOPTENSION I1J_PERI_VAC_DIS I1K_OTH_CARDIO_DIS
Musculoskeletal disease	=1 if the resident has at least one of the following conditions: arthritis, hip fracture, missing limb, osteoporosis, and pathological bone fracture	I1L_ARTHRITIS I1M_HIP_FRAC I1N_MISS_LIMB I1O_OSTEOPORO I1P_PATH_BONE_FRAC
At end stage of life (expectancy ≤6 mo)	=1 if the resident has end-stage disease (6 or fewer months to live)	J5C_END_STG_DISEAS
Malnutrition	=1 if the resident has malnutrition (I3a through I3e = 260, 261, 262, 263.0, 263.1, 263.2, 263.8, or 263.9)	I3A_OTHR_ICD9_CD I3B_OTHR_ICD9_CD I3C_OTHR_ICD9_CD I3D_OTHR_ICD9_CD I3E_OTHR_ICD9_CD
Incontinence	=1 if the resident has frequent or complete bowel or bladder incontinence	H1A_BOWEL_CONTRL H1B_BLADDER_CONTRL
Antipsychotic drug use	=1 if the resident received antipsychotic medication during the last 7 days	O4A_ANTIPSYCHOTIC
Daily physical restraint use	=1 if trunk restraint, limb restraint, or chair prevents rising was used	P4C_TRUNK_REST P4D_LIMB_REST P4E_CHR_PRVNT_RISE

3.3.1.2 Functional decline

The outcome variable is whether the residents' need for help with daily activities has increased between baseline and target assessments. Most nursing home residents are at risk of physical decline. The resident's ability to perform daily functions is important in maintaining health status and quality of life. Changes in functional status (e.g., not being able to move to/from bed independently) should prompt further diagnostic

evaluation and intervention. Restorative care is needed to prevent the deterioration of residents' abilities in ADLs. Restorative care refers to nursing interventions that promote resident's ability to adapt and adjust to living as independently and safely as is possible (training and skill practice in ADLs).

According to the CMS methodology, functional status was measured by 4 ADLs: bed mobility, transferring, eating, and toilet use. Each ADL component is measured by a 5-point scale (0: independence; 1: supervision; 2: limited assistance; 3: extensive assistance; 4: total dependence or activity did not occur). Residents meeting any of the following conditions were excluded: (1) The resident is comatose or comatose status is unknown on the target assessment; (2) The resident has end-stage disease or end-stage disease status is unknown on the target assessment; (3) The resident is receiving hospice care or hospice status is unknown on the target assessment or the most recent full assessment; (4) None of the four ADL items can show decline because each of the four is total dependence or activity did not occur. A resident's need for help with daily activities has increased (declined function) if the resident had at least 2 ADLs increased by 1 point or at least 1 ADL increased by 2 points between baseline and target assessments. Table 3-5 lists the baseline resident characteristics that may affect subsequent functional decline.

In the analyses, I used the fourth quarter of each year as the target quarter. The baseline assessment is 46 to 165 days before the target assessment. This window insures that the gap between the baseline and target assessments is not small and allows sufficient time to find an OBRA assessment. Originally, 379,556 long-term care residents were

identified during the 6 year study period. When CMS exclusions based on resident characteristics were applied, 78,326 (20.64%) residents were excluded. 24,652(6.50%) residents were further excluded because they were from hospital-based facilities. Finally, 971(0.26%) residents were excluded due to the missing values of individual control variables. The final analytic sample after both resident and facility exclusion included 275,607 long-term care residents in 1,179 facilities.

Table 3-5: Individual risk factors that may affect functional status

Risk factors	Description	MDS item
Length between baseline and target assessment (in weeks)	Continuous	A3A_ASMT_REF_DT
Age (years)	Continuous	AA3_BIRTH_DT
ADL performance		
ADL bed mobility	0: independence;	G1AA_SELF_BED
ADL transfer	1: supervision;	G1BA_SELF_TRANS
ADL eating	2: limited assistance;	G1HA_SELF_EAT
ADL toilet use	3: extensive assistance; 4: total dependence or activity did not occur	G1IA_SELF_TOLIET
Short-term memory problem	=1 if the resident has short-term memory problem	B2A_ST_MEMORY
Cognitive skills for daily decision making moderately/severely impaired	=1 if cognitive skills for daily decision making moderately impaired or severely impaired	B4_DAY_DCSN_MAKING
Having difficulty understanding others	=1 if the resident sometimes/rarely/never understands others	C6_UNDERSTAND_OTH
Having difficulty making self understood	=1 if the resident is sometimes/rarely/never understood	C4_IS_UNDERSTOOD
Depression	=1 if the resident has depression	I1EE_DEPRESSION
Bowel incontinence	=1 if the resident has	H1A_BOWEL_CONTRL

	frequent or complete bowel incontinence	
Urinary incontinence	=1 if the resident has frequent or complete urinary incontinence	H1B_BLADDER_CTRL
Urinary tract infection	=1 if the resident has urinary tract infection	I2J_UTI_THRTY_DAYS
Weight loss	=1 if the resident has weight loss (e.g., 5% or more in last 30 days, or 10% or more in last 180 days)	K3A_WEIGHT_LOSS
Pressure ulcers (stage 2 or higher)	=1 if the resident has pressure ulcer (stage 2 or higher)	M2A_PRES_ULCER
Delirium	=1 if at least one of the following symptoms present, over last seven days and appear different from resident's usual functioning: easily distracted; altered perception; disorganized speech; restlessness; lethargy; or varied mental function	B5A_DISTRACTED B5B_ALTER_PERCEPT B5C_DISORG_SPEECH B5D_RESTLESS B5E_LETHARGY B5F_MENTAL_FUNC
Pain	=1 if the resident has moderate or severe pain	J2A_PAIN_FREQUENCY J2B_PAIN_INTENSITY
Fall	=1 if the resident fell in past 30 days	J4A_FELL_30_DAYS

3.3.1.3 Physical restraints

The outcome variable is whether the resident was physically restrained daily. In nursing home inspections conducted by state licensure and certification agencies, physical restraints were defined as any manual method or physical or mechanical device, material, or equipment attached or adjacent to the resident's body that the individual cannot remove easily which restricts freedom of movement or normal access to one's

body. Restraints should only be used when they are necessary as part of the treatment of a resident's medical condition. Immobility resulting from physical restraints may increase the risk of pressure ulcers, depression, mental and physical deterioration, and mortality [147-148]. Research has found that physical restraints were used more frequently in facilities with lower staffing levels [149-150]. Nursing homes may also use restraints to reduce the burden to nursing staff. Nursing home resident characteristics that were potentially associated with the use of physical restraints were listed in Table 3-6.

In the analyses, 484,404 long-term care residents were identified. 43,183(8.91%) residents were excluded because they belonged to hospital-based nursing homes and 434(0.09%) residents were excluded because of the missing values of individual control variables. The final analytic sample included 440,787 long-term care residents in 1,189 facilities.

Table 3-6: Individual risk factors predicting physical restraints use

Risk factors	Description	MDS item
Age (years)	Continuous	AA3_BIRTH_DT
Gender	=1 if gender is female	AA2_GENDER
Making self understood		
Always or usually (reference)	=1 if the resident is always or usually understood	C4_IS_UNDERSTOOD
Sometimes	=1 if the resident is sometimes understood	
Rarely	=1 if the resident is rarely/never understood	
Behavior problems		
Physically abusive	=1 if physically abusive behavior occurred in the last 7 days	E4CA_PHYS_ABUSIVE
Socially inappropriate	=1 if socially inappropriate behavior occurred in the last 7 days	E4DA_DIS_BEHAVIOR
Resists care	=1 if resisting care occurred in the last 7 days	E4EA_RESIST_CARE
ADL limitation in bed mobility	0: independence; 1: supervision; 2: limited assistance; 3: extensive assistance; 4: total dependence or no activity	G1AA_SELF_BED
Fall in last 180 days	=1 if the resident fell in last 180 days	J4A_FELL_30_DAYS J4B_FELL_OVR_31_DA
Cognitive status	Cognitive status was measured by the Cognitive Performance Scale, which ranges from 0 to 6, with 0 indicating intact cognition and 6 indicating most severe cognitive impairment.	B1_COMATOSE B2A_ST_MEMORY B4_DAY_DCSN_MAKING C4_IS_UNDERSTOOD G1HA_SELF_EAT
Ability to understand others		
Always or usually (reference)	=1 if the resident always or usually understand others	C6_UNDERSTAND_OTH

Sometimes	=1 if the resident sometimes understand others
Rarely	=1 if the resident rarely/never understand others

3.3.1.4 Incontinence

The outcome variable is whether the low-risk residents lost control of their bowels or bladder (frequently incontinent or fully incontinent). Urinary incontinence is associated with increased risk of hospitalization, urinary tract infection, and pressure ulcers, and significantly impairs quality of life [151]. Bowel or bladder incontinence is thought to be preventable and reversible in the nursing home residents [152]. Instituting prompted voiding was found to be effective in reducing daytime incontinence [153-154]. Prompted voiding involves regular monitoring by caregivers and prompting to toilet on a scheduled basis. According to CMS's algorithm for incontinence quality measure, residents who qualified as high risk were excluded. These residents were those: (1) with severe cognitive impairment; (2) totally dependent in mobility ADLs; (3) comatose; (4) with an indwelling catheter. The list of potential risk factors is in Table 3-7.

Originally, 337, 401 low-risk residents were identified. I excluded 25,035(7.42%) residents who belonged to hospital-based nursing homes. 61(0.02%) residents were excluded because of the missing values of individual control variables. The final analytic sample after both resident and facility exclusion included 312,305 long-term care residents in 1,186 facilities.

Table 3-7: Individual risk factors for incontinence

Risk factors	Description	MDS item
Age (years)	Continuous	AA3_BIRTH_DT
Gender	=1 if the gender is female	AA2_GENDER
Cognitive status	Cognitive status was measured by the Cognitive Performance Scale, which ranges from 0 to 6, with 0 indicating intact cognition and 6 indicating most severe cognitive impairment.	B1_COMATOSE B2A_ST_MEMORY B4_DAY_DCSN_MAKING C4_IS_UNDERSTOOD G1HA_SELF_EAT
Delirium	=1 if at least one of the following symptoms present, over last seven days and appear different from resident's usual functioning: easily distracted; altered perception; disorganized speech; restlessness; lethargy; or varied mental function	B5A_DISTRACTED B5B_ALTER_PERCEPT B5C_DISORG_SPEECH B5D_RESTLESS B5E_LETHARGY B5F_MENTAL_FUNC
Make self-understood		
Always or usually (reference)	=1 if the resident is always or usually understood	C4_IS_UNDERSTOOD
Sometimes	=1 if the resident is sometimes understood	
Rarely	=1 if the resident is rarely/never understood	
Behavioral symptoms	=1 if wandering, verbally abusive, or socially inappropriate behavior occurred in the last 7 days	E4AA_WANDERS E4BA_VRBL_ABUSIVE E4DA_DIS_BEHAVIOR
Physically abusive	=1 if physically abusive behavior occurred in the last 7 days	E4CA_PHYS_ABUSIVE
Activities of daily living (ADLs)		
Transfer	0: independence;	G1BA_SELF_TRANS

Locomotion	1: supervision;	G1EA_SELF_LOC_UNIT
Eating	2: limited assistance;	G1HA_SELF_EAT
Personal hygiene	3: extensive assistance;	G1JA_SELF_HYGIENE
Bathing	4: total dependence or no activity	G2A_BATH_SELF

3.3.1.5 Potentially avoidable hospitalizations

The outcome measure is whether the resident was admitted to an acute care hospital for a condition for which hospitalization may be potentially avoidable during the observation period. Hospitalizations of nursing home residents are common, about 20-30% of long-term care residents are hospitalized [30, 83]. A substantial body of research has demonstrated that hospitalizations of nursing homes residents tend to increase the risk of iatrogenic illness, delirium, and functional decline [155-157], and are often inconsistent with residents' preferences [158-159]. Furthermore, research suggests that a significant proportion of hospitalizations may be avoidable or manageable within the nursing facility with appropriate care (31-45%) [29-31, 160]. Nursing staffs play an important role in recognition, assessment, and early management of conditions that may result in hospitalizations. While nurse aides help residents with activities of daily living, registered nurses (RNs) observe, assess, and record resident symptoms and progress. RNs also collaborate with physicians in treatment, administration of medications, and development and implementation of care plans. Research has found that more RNs were associated with fewer hospitalizations [144, 161-162]. In addition to the around-the-clock nursing care, when laboratory tests can often be obtained fast, medications can be

administered promptly, and physicians are available on-call, nursing homes may be able to provide sufficient care to prevent unnecessary hospitalizations.

Hospitalizations were deemed as originating from a nursing home if they occurred within 3 days of nursing home discharge. The 3-day gap between nursing home discharge and hospital admission was used to ensure that hospitalizations were related to nursing home stays and to allow for recording inaccuracy [137, 163]. Re-hospitalizations that occur within 24 hours of hospital discharge were excluded because re-hospitalizations which occur shortly after nursing home admission may not be related to the care provided by the nursing home but instead may because the patient was discharged too soon from the hospital. An observation episode is defined as continuous nursing home stay and transfers to and from hospitals that may have occurred during that stay. If a nursing home resident transfers to another nursing home, the episode of care is terminated and a new episode of care is started. A resident may have multiple nursing home episodes during the year. For residents with more than one observation episode, one of the episodes is randomly selected to avoid within-individual correlation. The ICD-9-CM codes used to define potentially avoidable hospitalizations are listed in Table 3-8. These conditions considered as potentially preventable or manageable within the nursing home setting were developed by a technical expert panel in a study funded by CMS [32]. Table 3-9 lists the baseline resident characteristics that may affect subsequent hospitalization risk.

Initially, 544,315 long-term care residents were identified. 26,026(4.78%) residents were excluded because they could not be matched with Medicare Beneficiary

Summary File/MAX Personal Summary File. 145,569(26.74%) residents were excluded because they enrolled in managed care (Medicare/Medicaid) or they were not Medicare Part A beneficiaries during the observation period. 36,338(6.68%) residents were excluded because they belonged to hospital-based nursing homes. Finally, 7,308(1.34%) residents were excluded because they had missing values for some of the explanatory variables. The final analytic sample after both resident and facility exclusion included 329,074 long-term care residents in 1,187 facilities.

Table 3-8: Potentially avoidable hospitalization conditions and ICD-9 codes

Condition	ICD-9 codes
Anemia	'280.0', '280.1', '280.8', '280.9', '281.0', '281.1', '281.2', '281.3', '281.4', '281.8', '281.9', '285.21', '285.22', '285.29', '285.9'
Congestive heart failure (CHF)	'398.91', '402.11', '402.91', '404.11', '404.13', '404.91', '404.93', '428.0', '428.1', '428.20', '428.21', '428.22', '428.23', '428.30', '428.31', '428.32', '428.33', '428.40', '428.41', '428.42', '428.43', '428.9', '518.4'
Hypertension; hypotension	'401.9', '402.10', '402.90', '403.10', '403.90', '404.10', '404.90', '458.0', '458.1', '458.21', '458.29', '458.8', '458.9'
Poor glycemic control (hyperglycemia; hypoglycemia; diabetes with ketoacidosis; hyperosmolar coma)	'250.02', '250.03', '250.10', '250.11', '250.12', '250.13', '250.20', '250.21', '250.22', '250.23', '250.30', '250.31', '250.32', '250.33', '251.0', '251.2', '790.29'
Dehydration; acute renal failure; hypokalemia; hyponatremia	'276.5', '276.50', '276.51', '276.52', '584.5', '584.6', '584.7', '584.8', '584.9', '588.81', '588.89', '588.9', '276.1', '276.8'

Constipation/fecal impaction/obstipation	'560.39', '564.00', '564.01', '564.09'
Diarrhea; gastroenteritis; C.Difficile	'003.0', '004.0', '004.1', '004.2', '004.3', '004.8', '004.9', '005.0', '005.1', '005.2', '005.3', '005.4', '005.81', '005.89', '005.9', '006.0', '007.0', '007.1', '007.2', '007.3', '007.4', '007.5', '007.8', '007.9', '008.00', '008.01', '008.02', '008.03', '008.04', '008.09', '008.1', '008.2', '008.3', '008.41', '008.42', '008.43', '008.44', '008.46', '008.47', '008.49', '008.5', '008.61', '008.62', '008.63', '008.64', '008.65', '008.66', '008.67', '008.69', '008.8', '009.0', '009.1', '009.2', '009.3', '558.9', '787.91', '008.45'
Skin ulcers; cellulitis	'681.00', '681.01', '681.02', '681.10', '681.11', '681.9', '682.0', '682.1', '682.2', '682.3', '682.4', '682.5', '682.6', '682.7', '682.8', '682.9', '683.', '686.00', '686.01', '686.09', '686.1', '686.8', '686.9', '707.00', '707.01', '707.02', '707.03', '707.04', '707.05', '707.06', '707.07', '707.09', '707.10', '707.11', '707.12', '707.13', '707.14', '707.15', '707.19', '707.8', '707.9'
Pneumonia	'480.0', '480.1', '480.2', '480.3', '480.8', '480.9', '481.', '482.0', '482.1', '482.2', '482.30', '482.31', '482.32', '482.39', '482.40', '482.41', '482.49', '482.81', '482.82', '482.83', '482.84', '482.89', '482.9', '483.0', '483.1', '483.8', '485.', '486.', '507.0'
Urinary tract infection	'590.10', '590.11', '590.80', '590.81', '590.9', '595.0', '595.1', '595.2', '595.4', '595.89', '595.9', '597.0', '598.00', '598.01', '599.0', '601.0', '601.1', '601.2', '601.3', '601.4', '601.8', '601.9'
Falls/trauma	'800.00', '800.01', '800.02', '800.03', '800.04', '800.05', '800.06', '800.09',

'800.10', '800.11', '800.12', '800.13',
'800.14', '800.15', '800.16', '800.19',
'800.20', '800.21', '800.22', '800.23',
'800.24', '800.25', '800.26', '800.29',
'800.30', '800.31', '800.32', '800.33',
'800.34', '800.35', '800.36', '800.39',
'800.40', '800.41', '800.42', '800.43',
'800.44', '800.45', '800.46', '800.49',
'800.50', '800.51', '800.52', '800.53',
'800.54', '800.55', '800.56', '800.59',
'800.60', '800.61', '800.62', '800.63',
'800.64', '800.65', '800.66', '800.69',
'800.70', '800.71', '800.72', '800.73',
'800.74', '800.75', '800.76', '800.79',
'800.80', '800.81', '800.82', '800.83',
'800.84', '800.85', '800.86', '800.89',
'800.90', '800.91', '800.92', '800.93',
'800.94', '800.95', '800.96', '800.99',
'801.00', '801.01', '801.02', '801.03',
'801.04', '801.05', '801.06', '801.09',
'801.10', '801.11', '801.12', '801.13',
'801.14', '801.15', '801.16', '801.19',
'801.20', '801.21', '801.22', '801.23',
'801.24', '801.25', '801.26', '801.29',
'801.30', '801.31', '801.32', '801.33',
'801.34', '801.35', '801.36', '801.39',
'801.40', '801.41', '801.42', '801.43',
'801.44', '801.45', '801.46', '801.49',
'801.50', '801.51', '801.52', '801.53',
'801.54', '801.55', '801.56', '801.59',
'801.60', '801.61', '801.62', '801.63',
'801.64', '801.65', '801.66', '801.69',
'801.70', '801.71', '801.72', '801.73',
'801.74', '801.75', '801.76', '801.79',
'801.80', '801.81', '801.82', '801.83',
'801.84', '801.85', '801.86', '801.89',
'801.90', '801.91', '801.92', '801.93',
'801.94', '801.95', '801.96', '801.99',

'802.0', '802.1', '802.20', '802.21', '802.22',
'802.23', '802.24', '802.25', '802.26',
'802.27', '802.28', '802.29', '802.30',
'802.31', '802.32', '802.33', '802.34',
'802.35', '802.36', '802.37', '802.38',
'802.39', '802.4', '802.5', '802.6', '802.7',
'802.8',
'802.9', '803.00', '803.01', '803.02',
'803.03', '803.04', '803.05', '803.06',
'803.09', '803.10', '803.11', '803.12',
'803.13', '803.14', '803.15', '803.16',
'803.19', '803.20', '803.21', '803.22',
'803.23', '803.24', '803.25', '803.26',
'803.29', '803.30', '803.31', '803.32',
'803.33', '803.34', '803.35', '803.36',
'803.39', '803.40', '803.41', '803.42',
'803.43', '803.44', '803.45', '803.46',
'803.49', '803.50', '803.51', '803.52',
'803.53', '803.54', '803.55', '803.56',
'803.59', '803.60', '803.61', '803.62',
'803.63', '803.64', '803.65', '803.66',
'803.69', '803.70', '803.71', '803.72',
'803.73', '803.74', '803.75', '803.76',
'803.79', '803.80', '803.81', '803.82',
'803.83', '803.84',
'803.85', '803.86', '803.89', '803.90',
'803.91', '803.92', '803.93', '803.94',
'803.95', '803.96',
'803.99', '804.00', '804.01', '804.02',
'804.03', '804.04', '804.05', '804.06',
'804.09', '804.10',
'804.11', '804.12', '804.13', '804.14',
'804.15', '804.16', '804.19', '804.20',
'804.21', '804.22',
'804.23', '804.24', '804.25', '804.26',
'804.29', '804.30', '804.31', '804.32',
'804.33', '804.34',
'804.35', '804.36', '804.39', '804.40',

'804.41', '804.42', '804.43', '804.44',
'804.45', '804.46',
'804.49', '804.50', '804.51', '804.52',
'804.53', '804.54', '804.55', '804.56',
'804.59', '804.60',
'804.61', '804.62', '804.63', '804.64',
'804.65', '804.66', '804.69', '804.70',
'804.71', '804.72',
'804.73', '804.74', '804.75', '804.76',
'804.79', '804.80', '804.81', '804.82',
'804.83', '804.84',
'804.85', '804.86', '804.89', '804.90',
'804.91', '804.92', '804.93', '804.94',
'804.95', '804.96',
'804.99', '805.00', '805.01', '805.02',
'805.03', '805.04', '805.05', '805.06',
'805.07', '805.08',
'805.10', '805.11', '805.12', '805.13',
'805.14', '805.15', '805.16', '805.17',
'805.18', '805.3',
'805.5', '805.6', '805.7', '805.9', '806.00',
'806.01', '806.02', '806.03', '806.04',
'806.05', '806.06', '806.07', '806.08',
'806.09', '806.10', '806.11', '806.12',
'806.13', '806.14', '806.15', '806.16',
'806.17', '806.18', '806.19', '806.20',
'806.21', '806.22', '806.23', '806.24',
'806.25', '806.26', '806.27', '806.28',
'806.29', '806.30', '806.31', '806.32',
'806.33', '806.34', '806.35', '806.36',
'806.37', '806.38', '806.39', '806.4', '806.5',
'806.60', '806.61', '806.62', '806.69',
'806.70', '806.71', '806.72', '806.79',
'806.8', '806.9', '807.00', '807.01', '807.02',
'807.03', '807.04', '807.05', '807.06',
'807.07', '807.08', '807.09', '807.10',
'807.11', '807.12', '807.13', '807.14',
'807.15', '807.16', '807.17', '807.18',

'807.19', '807.2', '807.3', '807.4', '807.5',
'807.6', '808.0', '808.1', '808.2', '808.3',
'808.41', '808.42', '808.43', '808.51',
'808.52', '808.53', '808.59', '808.8', '808.9',
'809.0', '809.1', '810.00', '810.01', '810.02',
'810.03', '810.10', '810.11', '810.12',
'810.13', '811.00', '811.01', '811.02',
'811.03', '811.09', '811.10', '811.11',
'811.12', '811.13', '811.19', '812.00',
'812.02', '812.03', '812.09', '812.10',
'812.11', '812.12', '812.13', '812.19',
'812.20', '812.21', '812.30', '812.31',
'812.40', '812.41', '812.42', '812.43',
'812.44', '812.49', '812.50', '812.51',
'812.52', '812.53', '812.54', '812.59',
'813.00', '813.01', '813.02', '813.03',
'813.04', '813.05', '813.06', '813.07',
'813.08', '813.10', '813.11', '813.12',
'813.13', '813.14', '813.15', '813.16',
'813.17', '813.18', '813.20', '813.21',
'813.22', '813.23', '813.30', '813.31',
'813.32', '813.33', '813.40', '813.41',
'813.42', '813.43', '813.44', '813.45',
'813.50', '813.51', '813.52', '813.53',
'813.54', '813.80', '813.81', '813.82',
'813.83', '813.90', '813.91', '813.92',
'813.93', '814.00', '814.01', '814.02',
'814.03', '814.04', '814.05', '814.06',
'814.07', '814.08', '814.09', '814.10',
'814.11', '814.12', '814.13', '814.14',
'814.15', '814.16', '814.17', '814.18',
'814.19', '815.00', '815.01', '815.02',
'815.03', '815.04', '815.09', '815.10',
'815.11', '815.12', '815.13', '815.14',
'815.19', '816.00', '816.01', '816.02',
'816.03', '816.10', '816.11', '816.12',
'816.13', '817.0', '817.1', '818.0', '818.1',
'819.0', '819.1', '820.00', '820.01', '820.02',

'820.03', '820.09', '820.10', '820.11',
'820.12', '820.13', '820.19', '820.20',
'820.21', '820.22', '820.30', '820.31',
'820.32', '820.8', '820.9', '821.00', '821.01',
'821.10', '821.11', '821.20', '821.21',
'821.22', '821.23', '821.29', '821.30',
'821.31', '821.32', '821.33', '821.39',
'822.0', '822.1', '823.00', '823.01', '823.02',
'823.10', '823.11', '823.12', '823.20',
'823.21', '823.22', '823.30', '823.31',
'823.32', '823.40', '823.41', '823.42',
'823.80', '823.81', '823.82', '823.90',
'823.91', '823.92', '824.0', '824.1', '824.2',
'824.3', '824.4', '824.5', '824.6', '824.7',
'824.8', '824.9', '825.0', '825.1', '825.20',
'825.21', '825.22', '825.23', '825.24',
'825.25', '825.29', '825.30', '825.31',
'825.32', '825.33', '825.34', '825.35',
'825.39', '826.0',
'826.1', '827.0', '827.1', '828.0', '828.1',
'829.0', '829.1', '830.0', '830.1', '831.00',
'831.01',
'831.02', '831.03', '831.04', '831.09',
'831.10', '831.11', '831.12', '831.13',
'831.14', '831.19',
'832.00', '832.01', '832.02', '832.03',
'832.04', '832.09', '832.10', '832.11',
'832.12', '832.13',
'832.14', '832.19', '833.00', '833.01',
'833.02', '833.03', '833.04', '833.05',
'833.09', '833.10',
'833.11', '833.12', '833.13', '833.14',
'833.15', '833.19', '834.00', '834.01',
'834.02', '834.10',
'834.11', '834.12', '835.00', '835.01',
'835.02', '835.03', '835.10', '835.11',
'835.12', '835.13',
'836.0', '836.1', '836.2', '836.3', '836.4',

'836.50', '836.51', '836.52', '836.53',
'836.54', '836.59', '836.60', '836.61',
'836.62', '836.63', '836.64', '836.69',
'837.0', '837.1', '838.00', '838.01', '838.02',
'838.03', '838.04', '838.05', '838.06',
'838.09', '838.10', '838.11', '838.12',
'838.13', '838.14', '838.15', '838.16',
'838.19', '839.00', '839.01', '839.02',
'839.03', '839.04', '839.05', '839.06',
'839.07', '839.08', '839.10', '839.11',
'839.12', '839.13', '839.14', '839.15',
'839.16', '839.17', '839.18', '839.20',
'839.21', '839.30', '839.31', '839.40',
'839.41', '839.42', '839.49', '839.50',
'839.51', '839.52', '839.59', '839.61',
'839.69', '839.71', '839.79', '839.8', '839.9',
'850.0', '850.11', '850.12', '850.2', '850.3',
'850.4', '850.5', '850.9', '851.00', '851.01',
'851.02', '851.03', '851.04', '851.05',
'851.06', '851.09', '851.10', '851.11',
'851.12', '851.13', '851.14', '851.15',
'851.16', '851.19', '851.20', '851.21',
'851.22', '851.23', '851.24', '851.25',
'851.26', '851.29', '851.30', '851.31',
'851.32', '851.33', '851.34', '851.35',
'851.36', '851.39', '851.40', '851.41',
'851.42', '851.43', '851.44', '851.45',
'851.46', '851.49', '851.50', '851.51',
'851.52', '851.53', '851.54', '851.55',
'851.56', '851.59', '851.60', '851.61',
'851.62', '851.63', '851.64', '851.65',
'851.66', '851.69', '851.70', '851.71',
'851.72', '851.73', '851.74', '851.75',
'851.76', '851.79', '851.80', '851.81',
'851.82', '851.83', '851.84', '851.85',
'851.86', '851.89', '851.90', '851.91',
'851.92', '851.93', '851.94', '851.95',
'851.96', '851.99', '852.00', '852.03',

'852.04', '852.10', '852.12', '852.13',
'852.14', '852.15', '852.16', '852.19',
'852.20', '852.21', '852.22', '852.23',
'852.24', '852.25', '852.26', '852.29',
'852.30', '852.31', '852.32', '852.33',
'852.34', '852.35', '852.36', '852.39',
'852.40', '852.41', '852.42', '852.43',
'852.44', '852.45', '852.46', '852.49',
'852.50', '852.51', '852.52', '852.53',
'852.54', '852.55', '852.56', '852.59',
'853.00', '853.03', '853.04', '853.09',
'853.10', '853.11', '853.12', '853.13',
'853.14', '853.15', '853.16', '853.19',
'854.00', '854.01', '854.02', '854.03',
'854.04', '854.05', '854.06', '854.09',
'854.10', '854.11', '854.12', '854.13',
'854.14', '854.15', '854.16', '854.19',
'905.0', '905.1', '905.2', '905.3', '905.4',
'905.5', '905.6', '905.7', '905.8', '905.9',
'906.0', '906.1', '906.2', '906.3', '906.4',
'906.5', '906.6', '906.7', '906.8', '906.9',
'907.0', '907.1', '907.2', '907.3',
'907.4', '907.5', '907.9', '908.0', '908.1',
'908.2', '908.3', '908.4', '908.5', '908.6',
'908.9', '909.0', '909.1', '909.2', '909.3',
'909.4', '909.5', '909.9', '925.1', '925.2',
'926.0', '926.11', '926.12', '926.19', '926.8',
'926.9', '927.00', '927.01', '927.02',
'927.03', '927.09', '927.10', '927.11',
'927.20', '927.21', '927.3', '927.8', '927.9',
'928.00', '928.01', '928.10', '928.11',
'928.20', '928.21', '928.3', '928.8', '928.9',
'929.0', '929.9', '940.0', '940.1', '940.2',
'940.3',
'940.4', '940.5', '940.9', '941.00', '941.01',
'941.02', '941.03', '941.04', '941.05',
'941.06', '941.07', '941.08', '941.09',
'941.10', '941.11', '941.12', '941.13',

'941.14', '941.15', '941.16', '941.17',
'941.18', '941.19', '941.20', '941.21',
'941.22', '941.23', '941.24', '941.25',
'941.26', '941.27', '941.28', '941.29',
'941.30', '941.31', '941.32', '941.33',
'941.34', '941.35', '941.36', '941.37',
'941.38', '941.39', '941.40', '941.41',
'941.42', '941.43', '941.44', '941.45',
'941.46', '941.47', '941.48', '941.49',
'941.50', '941.51', '941.52', '941.53',
'941.54', '941.55', '941.56', '941.57',
'941.58', '941.59', '942.00', '942.01',
'942.02', '942.03', '942.04', '942.05',
'942.09', '942.10', '942.11', '942.12',
'942.13', '942.14', '942.15', '942.19',
'942.20', '942.21', '942.22', '942.23',
'942.24', '942.25', '942.29', '942.30',
'942.31', '942.32', '942.33', '942.34',
'942.35', '942.39', '942.40', '942.41',
'942.42', '942.43', '942.44', '942.45',
'942.49', '942.50', '942.51', '942.52',
'942.53', '942.54', '942.55', '942.59',
'943.00', '943.01', '943.02', '943.03',
'943.04', '943.05', '943.06', '943.09',
'943.10', '943.11', '943.12', '943.13',
'943.14', '943.15', '943.16', '943.19',
'943.20', '943.21', '943.22', '943.23',
'943.24', '943.25', '943.26', '943.29',
'943.30', '943.31', '943.32', '943.33',
'943.34', '943.35', '943.36', '943.39',
'943.40', '943.41', '943.42', '943.43',
'943.44', '943.45', '943.46', '943.49',
'943.50', '943.51', '943.52', '943.53',
'943.54', '943.55', '943.56', '943.59',
'944.00', '944.01', '944.02', '944.03',
'944.04', '944.05', '944.06', '944.07',
'944.08', '944.10', '944.11', '944.12',
'944.13', '944.14', '944.15', '944.16',

'944.17', '944.18', '944.20', '944.21',
'944.22', '944.23', '944.24', '944.25',
'944.26', '944.27', '944.28', '944.30',
'944.31', '944.32', '944.33', '944.34',
'944.35', '944.36', '944.37', '944.38',
'944.40', '944.41', '944.42', '944.43',
'944.44', '944.45', '944.46', '944.47',
'944.48', '944.50', '944.51', '944.52',
'944.53', '944.54', '944.55', '944.56',
'944.57', '944.58', '945.00', '945.01',
'945.02', '945.03', '945.04', '945.05',
'945.06', '945.09', '945.10', '945.11',
'945.12', '945.13', '945.14', '945.15',
'945.16', '945.19', '945.20', '945.21',
'945.22', '945.23', '945.24', '945.25',
'945.26', '945.29', '945.30', '945.31',
'945.32', '945.33', '945.34', '945.35',
'945.36', '945.39', '945.40', '945.41',
'945.42', '945.43', '945.44', '945.45',
'945.46', '945.49', '945.50', '945.51',
'945.52', '945.53', '945.54', '945.55',
'945.56', '945.59', '946.0', '946.1', '946.2',
'946.3', '946.4', '946.5', '947.0', '947.1',
'947.2', '947.3', '947.4', '947.8', '947.9',
'948.00', '948.10', '948.11', '948.20',
'948.21', '948.22', '948.30', '948.31',
'948.32', '948.33', '948.40', '948.41',
'948.42', '948.43', '948.44', '948.50',
'948.51', '948.52', '948.53', '948.54',
'948.55', '948.60', '948.61', '948.62',
'948.63', '948.64', '948.65', '948.66',
'948.70', '948.71', '948.72', '948.73',
'948.74', '948.75', '948.76', '948.77',
'948.80', '948.81', '948.82', '948.83',
'948.84', '948.85', '948.86', '948.87',
'948.88', '948.90', '948.91', '948.92',
'948.93', '948.94', '948.95', '948.96',
'948.97', '948.98', '948.99', '949.0', '949.1',

	'949.2', '949.3', '949.4', '949.5', '959.01', '959.09', '959.11', '959.12', '959.13', '959.14', '959.19', '959.2', '959.3', '959.4', '959.5', '959.6', '959.7', '959.8', '959.9', '991.6', '991.8', '991.9', '992.0', '992.1', '992.2', '992.3', '992.4', '992.5', '992.6', '992.7', '992.8', '992.9', '994.1', '994.2', '994.3', '994.7', '994.8',
Altered mental status/acute confusion/delirium	'290.3', '290.41', '292.81', '293.0', '293.1'
Psychosis; severe agitation; organic brain syndrome	'290.42', '290.43', '290.8', '290.9', '293.81', '293.82', '293.83', '293.84', '293.89', '293.9', '297.0', '297.1', '297.2', '297.3', '297.8', '297.9', '298.0', '298.1', '298.2', '298.3', '298.4', '298.8', '298.9'
Chronic obstructive pulmonary disease (COPD); asthma	'493.00', '493.01', '493.02', '493.10', '493.11', '493.12', '493.20', '493.21', '493.22', '493.81', '493.82', '493.90', '493.91', '493.92', '466.0', '466.11', '466.19', '490.', '491.0', '491.1', '491.20', '491.21', '491.8', '491.9', '492.0', '492.8', '494.0', '494.1', '496.'
Weight loss; malnutrition; adult failure to thrive	'783.21', '783.22', '783.3', '783.7', '260.', '261.', '262.', '263.0', '263.1', '263.2', '263.8', '263.9', '268.0', '268.1'
Seizures	'345.00', '345.01', '345.10', '345.11', '345.2', '345.3', '345.40', '345.41', '345.50', '345.51', '345.60', '345.61', '345.70', '345.71', '345.80', '345.81', '345.90', '345.91', '436.', '780.31', '780.39'

Table 3-9: Individual risk factors for potentially avoidable hospitalizations

Risk factors	Description	MDS item
Demographics		
Age (years)	Continuous	AA3_BIRTH_DT
Gender	=1 if gender is female	AA2_GENDER
Race/ethnicity	=1 if race is white	AA4_RACE_ETH
Diagnoses		
Congestive heart failure	=1 if the resident has congestive heart failure	I1F_CON_HEART_FAIL
Emphysema/COPD	=1 if the resident has COPD	I1II_COPD
Diabetes	=1 if the resident has diabetes	I1A_DIABETES
Dementia	=1 if the resident has Alzheimer's disease or dementia other than Alzheimer's	I1Q_ALZHEIMER I1U_DEMENTIA
Cerebrovascular Accident/Stroke	=1 if the resident has stroke	I1T_STROKE
Arteriosclerotic heart disease	=1 if the resident has arteriosclerotic heart disease	I1D_ASHD
Cancer	=1 if the resident has cancer	I1PP_CANCER
Renal failure	=1 if the resident has renal failure	I1QQ_RENAL_FAIL
Paraplegia and hemiplegia	=1 if the resident has paraplegia, hemiplegia, or quadriplegia	I1V_HEMIPLEGIA I1X_PARAPLEGIA I1Z_QUADRIPEGIA
Functional status	Functional status was measured by the activity of daily living (ADL) score. ADL score ranges from 0 to 28 depending on residents' ability to perform 7 activities (bed mobility, transfer, locomotion on unit, dressing, eating, toilet, and personal hygiene), with a higher score indicating increased dependence.	G1GA_SELF_DRESS G1JA_SELF_HYGIENE G1IA_SELF_TOLIET G1EA_SELF_LOC_UNIT G1BA_SELF_TRANS G1AA_SELF_BED G1HA_SELF_EAT

Cognitive status	Cognitive status was measured by the Cognitive Performance Scale, which ranges from 0 to 6, with 0 indicating intact cognition and 6 indicating most severe cognitive impairment.	B1_COMATOSE B2A_ST_MEMORY B4_DAY_DCSN_MAKING C4_IS_UNDERSTOOD G1HA_SELF_EAT
Resident conditions		
Urinary tract infection	=1 if the resident has urinary tract infection	I2J_UTI_THRTY_DAYS
Oral feeding tube	=1 if the feed tube is present, which delivers food/nutritional substances/fluids/medications directly into the gastrointestinal system	K5B_FEED_TUBE
Pressure ulcer (stage 2 or higher)	=1 if the resident has pressure ulcer (stage 2 or higher)	M2A_PRES_ULCER
Pneumonia	=1 if the resident has pneumonia	I2E_PNEUMONIA
Septicemia	=1 if the resident has septicemia	I2G_SEPTICEMIA
Parenteral/IV nutrition	=1 if the nutritional approach is parenteral/IV	K5A_PARENTERAL_IV
Indwelling catheter	=1 if a catheter is maintained within the bladder for the purpose of continuous drainage of urine	H3D_INDWELL_CATH
Antibiotic resistant infection	=1 if the resident has antibiotic resistant infection	I2A_AB_RES_INFECT
Do-not-resuscitate orders	=1 if the resident, family or legal guardian has directed that no cardiopulmonary resuscitation (CPR) or other life-saving methods will be used to attempt to restore the	A10B_NOT_RECESS

	resident's respiratory or circulatory function in the event of respiratory or cardiac failure.	
Do-not-hospitalize orders	=1 if the resident specifies not to be hospitalized even after developing a medical condition that usually requires hospitalization.	A10C_NOT_HOSPITAL

3.3.2 Outcome variable: nursing home's investment in labor

AB1629 created financial incentives for nursing homes to spend more on labor and labor related resources. Nursing staff levels and wages were included to determine if nursing home has been motivated to invest substantial resources in response to AB1629.

3.3.2.1 Nursing staff levels

The primary data source for the analysis of staffing levels is California Medi-Cal cost reports. Because the cost reports are audited, the Medicaid cost report data are considered more accurate than OSCAR File [164]. However, cost report data may still be sensitive to extreme outliers. According to a CMS report to Congress on staffing [164], the exclusion criteria for facilities with unreliable data included: facilities reporting no RN hours and having 60 or more beds (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 an LPN) on duty evenings and nights); facilities reporting more than 12 total staffing hours per resident day; facilities reporting less than 0.5 total staffing hours per resident day; facilities reporting more residents than beds. On the basis of these exclusion rules, I excluded 22 nursing homes. Furthermore, I

used the graphic of Cook's distance to identify the points with values of Cook's distance that was substantially larger than the rest [165]. The point with the largest cook's distance was deleted, the regression was re-run, and the results of regression were stable. The dependent variables were the number of staff hours per resident-day (HPRD) for registered nurse (RN), licensed practical nurse (LPN), and certified nurse aide (CNA), three types of nurses employed by the nursing homes. The control variables used in the empirical analysis were discussed in section 3.4.3.

3.3.2.2 Nursing staff wages

The Medi-Cal cost reports were used to create wage variables. Salaries and wages were divided by productive hours to obtain wages per hour for RNs, LPNs, and CNAs. To allow comparison over time, wages were inflated to 2008 real dollars using the nursing homes component of the Consumer Price Index (CPI) from Department of Labor Statistics (<http://www.bls.gov/data/>).

3.4 Data analysis

3.4.1 Examining the changes of quality of nursing home care

To estimate the impact of the policy, we must measure what would happen if the policy were not in place. That is, it is necessary to estimate the counterfactual. The difference in outcomes between the intervention group (i.e. with policy implementation) and untreated comparison group gives an estimate of the policy impact. The untreated comparison group could be selected either from other states or a different group of facilities within California. However, AB1629 was introduced state wide, so it is impossible to find a within-state comparison group. AB1629 should affect facilities that

are reliant on Medi-Cal revenues (treatment group), while facilities not reliant on Medi-Cal revenues, i.e. those serving exclusively the Medicare or private-pay residents (comparison group), should not experience the effects of the AB1629. However, facilities not accepting Medi-Cal residents are clearly different from those with Medi-Cal residents, so they cannot be used as a comparison to estimate the impact of AB1629. States not experiencing any payment changes in the Medicaid reimbursement method could potentially serve as comparison group. While several states were considered, I could not find a suitable untreated comparison group because of the substantial differences between states. Therefore, this dissertation focuses on how changes in Medi-Cal payment affected quality of care using a before-after design.

I examined the changes in time trends in the quality measures before and after the implementation of AB1629. The before-after design can be strengthened considerably if outcomes are measured not just at two points in time, i.e. before and after implementation, but at several points in time both before and after implementation. Because I had data for the 3 years before and after the legislation was passed, it is possible to look for an “interruption” or a “shift” in the time series at the time the policy is introduced, and to check if the shift is sustained over time. If the policy change is effective, the trend line should exhibit either a level change at the time policy is introduced, a change in the slope (a trend change), or both a level change and a trend change. Within the pre-post specification, I tested for the improvements in quality of care using logistic regression models controlling for individual risk factors and nursing home fixed effects. The basic model for quality measure has the following form:

$$\ln \frac{p_{ijk}}{1 - p_{ijk}} = \beta_0 + \beta_1 \times t_k + \beta_2 \times AB1629_k + \beta_3 \times t_k \times AB1629_k + \beta_4 \times X_{ijk} + \alpha_i$$

The unit of analyses for the regression models was each eligible long-term care resident. Where p_{ijk} is the probability that the nursing home resident j from nursing home i in the year k experienced the event (pressure ulcers; functional decline; physical restraints; incontinence; and potentially avoidable hospitalizations). The analyses were repeated separately for each of the five quality measures. t is the time variable, which was set to zero for 2006 and increased/decreased by 1 for each year (range: -4 to +2). $AB1629$ is an indicator variable that obtains the value 1 in the post $AB1629$ period and 0 in the pre $AB1629$ period. Thus, the exponentiated coefficient, $\exp(\beta_1)$, indicates the baseline trend (the ratio of two adjacent yearly odds). $\exp(\beta_2)$ indicates a level change (an odds ratio, OR) in the event immediately after $AB1629$ (2006) compared with what was expected had the baseline trend continued. $\exp(\beta_3)$ indicates a trend change (an OR) after the implementation of $AB1629$ compared with the baseline trend. Because quality measures used in the analyses measure adverse outcomes, negative coefficients indicate quality improvement. The post- $AB1629$ trend is represented by $\exp(\beta_1 + \beta_3)$. X_{ijk} is a vector of individual risk factors of outcome. Quality of care is usually dependent on facility characteristics, such as ownership (for-profit, nonprofit, or government-owned), local market conditions, and other factors, which are likely to be stable over time [166-167]. Facility fixed effects, α_i , were included to capture time invariant nursing facility characteristics that might influence the quality measures. The fixed effects model assumes that all nursing homes are following the same trend over the period but they may

have started at different levels in 2002. In this regression, I explicitly examined within-nursing home changes in quality.

3.4.2 Stratification analyses: quality of care

The main weakness of a before-after study is that the changes brought about by the policy cannot be separated out from ‘natural change’ or change brought about by other policies, not related to AB1629, but occurring at the same time. To test whether changes in quality of care were related to AB1629, I stratified the analyses by the proportion of Medi-Cal revenues. Nursing homes with a higher proportion of Medi-Cal revenues should experience a stronger effect from AB1629. The proportion of Medi-Cal revenues was stable during 2002-2004, with correlation coefficient of 0.97 between 2002 and 2003, 0.97 between 2003 and 2004, and 0.94 between 2002 and 2004, respectively. I examined the distribution of nursing homes by their average proportion of Medi-Cal revenues during 2002- 2004 (pre-AB1629). I defined nursing homes with high Medi-Cal revenues as those in the top tertile of the Medi-Cal revenues distribution. Conversely, nursing homes with low Medi-cal revenues were defined as those in the bottom tertile of the Medi-Cal revenues distribution (Table 3-10). The baseline measure of proportion of Medi-Cal revenues was used because it represented the exposure of a nursing home to potential Medi-Cal policy change before it took effect. The coefficients of AB1629 (β_2) and $t \times \text{AB1629}$ (β_3) were compared across the subgroups using the Wald test. Nursing homes in the highest Medi-Cal revenue tertile may be expected to have the strongest incentives to respond to the Medicaid reimbursement policy change, and those in the lowest Medi-Cal revenue tertile to have the least incentive.

$$\text{Wald statistics: } z = \frac{\hat{\beta}_{2H} - \hat{\beta}_{2L}}{SE(\hat{\beta}_{2H} - \hat{\beta}_{2L})} = \frac{\hat{\beta}_{2H} - \hat{\beta}_{2L}}{\sqrt{\text{Var}(\hat{\beta}_{2H}) + \text{Var}(\hat{\beta}_{2L})}}$$

Where $\hat{\beta}_{2H}$ is the $\hat{\beta}_2$ for nursing homes with high Medi-Cal revenues and $\hat{\beta}_{2L}$ is the $\hat{\beta}_2$ for nursing homes with low Medi-Cal revenues. I would expect the magnitude of the coefficients to be larger in nursing homes with high Medi-Cal revenues.

Table 3-10: Distribution of nursing homes by the average proportion of Medi-Cal revenues during 2002-2004

	Number of nursing homes	Minimum (%)	Maximum (%)	Mean (%)	Median (%)
1st Tertile	349	0	44.54	22.85	26.13
2nd Tertile	350	44.58	63.93	54.95	55.26
3rd Tertile	350	63.94	100.00	76.14	73.70

3.4.3 Assessing nursing homes' investment in labor in response to AB1629

$$DEP_{ik} = \beta_0 + \beta_1 \times t_k + \beta_2 \times AB1629_k + \beta_3 \times t_k \times AB1629_k + \beta_4 \times RUG_{ik} + \beta_5 \times MC_{ik} + \alpha_i + \varepsilon_{ik}$$

In this analysis, I focused on the actions that nursing homes might have undertaken, which are tied to the incentives in AB1629. I examined how nursing homes invested in direct care labor in response to the financial incentives built in AB1629.

Where DEP is the staffing levels or nursing staff wages for nursing home i in the year k .

The analyses were repeated separately for staff hours and wages of RNs, LPNs, and

CNAs. β_1 denotes pre-AB1629 trend. β_2 captures any potential immediate level change

that may have occurred due to the legislation. β_3 denotes the changes in the slope of the

trend line post-AB1629. RUG is the average Resource Utilization Groups version III (RUG-III) case-mix index for all residents in the facility. Aggregated at the facility level, the average case-mix index was calculated by applying the RUG-III resident classification system [168] currently used by CMS to adjust Medicare payments in recognition of resident acuity. This system classifies residents into homogeneous categories based on their estimated resource utilization. Associated with each of these categories is a case-mix index or weight, which approximates the relative staff time associated with caring for the average resident in each group. Thus, the higher the case-mix index score, the more severe the average acuity profile of the residents in a facility. The resident-level case-mix index was calculated in two steps. First, the RUG-III 5.12 code (44 categories) was used to generate a RUG classification for each resident. Second, the RUG code was converted into a case-mix index value. MC is the proportion of facility residents whose primary payer is Medicare, which is a proxy for the amount of skilled care provided within the facility. Medi-Cal cost reports were used in calculating each facility's percent Medicare. Both the level of care in the facility and the resident case mix affect the need for staffing. Nursing staff wages are not assumed to be dependent on resident acuity, so the models were estimated excluding RUG case-mix index and the proportion of facility residents whose primary payer is Medicare.

I estimated an ordinary least squares (OLS) regression to predict nursing staff levels and wages, which are continuous. If the hypotheses are correct, I expect to see positive coefficients for the AB1629 indicator variable or for the interaction between t and AB1629.

The dependent variables, staffing levels or nursing staff wages, were repeatedly measured over years (2002-2008, excluding 2005). Repeated measurements are correlated. For example, two observations that are closer in time are more likely to be correlated than two observations more distant in time (serial autocorrelation of errors). A variety of options are available to describe the covariance: unstructured covariance, compound symmetry, Toeplitz, first-order autoregressive, and spatial structures. Spatial power covariance structure was chosen because: (1) it allows for unequal spacing between points; (2) correlations decline with increasing spacing between points; (3) it requires estimating two parameters (σ^2 , ρ) (Figure 3-1) [169]. I also performed a sensitivity analysis of unstructured covariance, which is the most complex covariance pattern and assumes a distinct correlation between every pair of measurements. For unstructured covariance, there may be too many parameters to be estimated, leaving too little information available for estimating β [169].

Figure 3-1: Covariance structure of spatial power

Spatial Power

σ^2	1.0	$\rho^{ t_1-t_2 }$	$\rho^{ t_1-t_3 }$	$\rho^{ t_1-t_4 }$
		1.0	$\rho^{ t_2-t_3 }$	$\rho^{ t_2-t_4 }$
			1.0	$\rho^{ t_3-t_4 }$
				1.0

σ^2 : variance; ρ : correlation coefficient; t : time.

3.4.4 Estimating the relationship between staffing levels and quality of care

To provide additional identification of policy effect, I examined whether changes in staffing over time may be responsible for changes in quality over the same time period. Here, I hypothesized that staffing is the main mechanism through which quality of care is affected under AB1629. First-difference fixed effects models were used, which have the following general form:

$$Q_{i,post} - Q_{i,pre} = \beta_0 + \beta_1 \times (S_{i,post} - S_{i,pre}) + \beta_2 \times (X_{i,post} - X_{i,pre}) + (\varepsilon_{i,post} - \varepsilon_{i,pre})$$

where difference are taken between the pre-period (2002-2004) and post-period (2006-2008). $Q_{i,post}$ is the quality of care for nursing home i , averaged over the post-period, and $Q_{i,pre}$ is the quality of care for nursing home i , averaged over the pre-period. The quality of care was measured by percent of long-term care residents who were physically restrained daily; percent of long-term care high-risk residents with pressure ulcers (stage 2 or higher); and percent of long-term care residents losing control of their bowels or bladder in the facility, which I found significant improvement (decline) in section 3.4.1. S_i is the level of staffing for RN, LPN, and CNA. X_i is a vector of covariates, and ε_i is a mean-zero random error for nursing home i . First-difference fixed effects models were used because standard cross-sectional study may suffer from omitted variable bias. The first-difference approach eliminates the unobserved time-constant factors and provides unbiased and consistent estimates [170]. Because the quality measures based on small sample size may not be reliable, nursing homes with less than 10 long-term care residents were excluded (0.05~1.73%) [171]. Robust standard errors

were computed to account for the potential heteroskedasticity caused by aggregating individual data to the nursing home level.

CHAPTER 4 RESULTS

This chapter contains the results from data analysis described in Chapter 3.

Section 4.1 provides a discussion of the changes in quality of nursing home care. Section 4.2 provides a discussion of the stratification analyses with regard to quality of care. Section 4.3 is about nursing homes' investment in labor in response to AB1629. Section 4.4 identifies the relationship between staffing levels and quality of care.

4.1 Changes in quality of nursing home care (Hypothesis 1)

Hypothesis 1: The quality of care in nursing homes improved after the implementation of AB1629.

4.1.1 Descriptive statistics

4.1.1.1 Resident characteristics of analytical samples

In Tables 4-1~4-5, characteristics of nursing home residents related to each outcome variable are presented.

During the study period, 11.57% of long-term care residents experienced functional decline (Table 4-1). The average length between baseline and target assessments was about 12 weeks. Over the study period, there was an increase in the disability levels of nursing home residents. In the baseline assessment, all 4 ADLs have deteriorated. For example, bed mobility ADL score has increased from 1.69 to 1.90. However, the proportion of residents with cognitive skills for daily decision making moderately/severely impaired has decreased from 59.40% to 57.02%. Fewer of the residents had difficulty understanding others or making self understood in the post-

AB1629 period. Residents were also different in the prevalence of other conditions such as depression before and after the implementation of AB1629.

Table 4-1: Descriptive statistics of resident characteristics for functional decline, 2002-2008

	Pre-AB1629 (2002-2004) (N=139,341)	Post-AB1629 (2006-2008) (N=136,266)	Study period (2002-2004, 2006-2008) (N=275,607)
Outcome			
Functional decline, %	11.49	11.65	11.57
Baseline resident characteristics			
Length between baseline and target assessments (in weeks), mean $\pm$ SD	12.44 $\pm$ 1.28	12.43 $\pm$ 1.26	12.44 $\pm$ 1.27
Age (years), mean $\pm$ SD	78.91 $\pm$ 14.06	78.36 $\pm$ 14.09	78.63 $\pm$ 14.08
ADL performance			
ADL bed mobility (0~4), mean $\pm$ SD	1.69 $\pm$ 1.36	1.90 $\pm$ 1.33	1.79 $\pm$ 1.35
ADL transfer (0~4), mean $\pm$ SD	2.19 $\pm$ 1.43	2.31 $\pm$ 1.37	2.25 $\pm$ 1.40
ADL eating (0~4), mean $\pm$ SD	1.06 $\pm$ 1.33	1.12 $\pm$ 1.29	1.09 $\pm$ 1.31
ADL toilet use (0~4), mean $\pm$ SD	2.60 $\pm$ 1.41	2.65 $\pm$ 1.34	2.63 $\pm$ 1.37
Short-term memory problem, %	78.07	77.82	77.95
Cognitive skills for daily decision making moderately/severely impaired, %	59.40	57.02	58.22
Having difficulty understanding others, %	27.18	25.18	26.19
Having difficulty making self understood, %	27.69	25.95	26.83
Depression, %	37.15	43.00	40.04
Bowel incontinence, %	48.52	49.30	48.90

Urinary incontinence, %	58.44	58.54	58.49
Urinary tract infection, %	5.63	6.52	6.07
Weight loss, %	5.57	5.24	5.41
Pressure ulcers (stage 2 or higher), %	3.88	3.83	3.86
Delirium, %	0.99	0.75	0.87
Pain, %	7.50	6.43	6.97
Fall, %	7.28	7.04	7.16

SD: standard deviation; ADL: activity of daily living.

Over the study period, 9.81% of high-risk residents had pressure ulcers (stage 2 or higher, Table 4-2). High-risk residents were physically and cognitively impaired with ADL and CPS scores of 22.73 and 3.59 respectively. The average age was 80 and about 90% of them had incontinence. During the study period, the prevalence rates of diabetes, cardiovascular disease, dementia, other endocrine disease, and musculoskeletal disease increased, while the rates of cancer and stroke decreased. The rates of physical restraint use showed decreasing trend (from 23.33% to 14.68%), while the percent of residents with antipsychotic drug use increased slightly from 22.48% to 22.90%.

Table 4-2: Descriptive statistics of resident characteristics for pressure ulcers, 2002-2008

	Pre-AB1629 (2002-2004) (N=140,963)	Post-AB1629 (2006-2008) (N=144,128)	Study period (2002-2004, 2006-2008) (N=285,091)
Outcome			
Pressure ulcers (stage 2 or higher), %	10.13	9.49	9.81
Resident characteristics			
Age (years), mean $\pm$ SD	80.68 $\pm$ 13.73	80.09 $\pm$ 14.02	80.38 $\pm$ 13.88
Female, %	72.80	70.70	71.74
Functional status (ADL: 0~28), mean $\pm$ SD	22.87 $\pm$ 4.77	22.59 $\pm$ 4.58	22.73 $\pm$ 4.68
Cognitive status (CPS: 0~6), mean $\pm$ SD	3.70 $\pm$ 1.84	3.48 $\pm$ 1.82	3.59 $\pm$ 1.83
Disease diagnosis			
Dementia, %	56.61	56.78	56.70
Stroke, %	30.88	29.00	29.93
Diabetes, %	25.23	31.98	28.65
Cancer, %	5.94	5.90	5.92
Other endocrine disease, %	17.99	20.32	19.17
Cardiovascular disease, %	73.69	79.65	76.70
Musculoskeletal disease, %	42.93	43.77	43.35
At end stage of life (expectancy $\leq$ 6 mo), %	2.90	3.06	2.98
Malnutrition, %	0.34	0.25	0.29
Incontinence, %	90.98	89.80	90.38
Antipsychotic drug use, %	22.48	22.90	22.69
Daily physical restraint use, %	23.33	14.68	18.96

SD: standard deviation; ADL: activity of daily living; CPS: Cognitive Performance Scale.

In the pre-AB1629 period, 17.31% of long-term care residents in California had physical restraints and the rate dropped to 11.22% in the post-AB1629 period (Table 4-3). Although medically unnecessary physical restraints imposed for purpose of discipline or convenience are unwarranted, the use of restraints can be effective while facilitating diagnosis and treatment of the patient and preventing injury to the patient and medical staff [172-173]. Indications for restraint may include imminent harm to others, imminent harm to the patient, and significant disruption of important treatment or damage to the environment. Over the pre- and post-AB1829 years, the prevalence of behavioral issues including physically abusive behavior, socially inappropriate behavior, and resisting care has decreased, while the rate of fall in the last 180 days has increased. Residents' ADL score in bed mobility has increased from 2.14 to 2.28 while residents were less cognitively impaired.

Table 4-3: Descriptive statistics of resident characteristics for physical restraints, 2002-2008

	Pre-AB1629 (2002-2004) (N=224,043)	Post-AB1629 (2006-2008) (N=216,744)	Study period (2002-2004, 2006-2008) (N=440,787)
Outcome			
Physical restraints, %	17.31	11.22	14.32
Resident characteristics			
Age (years), mean $\pm$ SD	79.11 $\pm$ 14.60	78.48 $\pm$ 14.76	78.80 $\pm$ 14.68
Female, %	69.23	67.27	68.27
Making self understood			
Always or usually, %	62.56	65.04	63.77
Sometimes, %	21.38	21.37	21.38
Rarely, %	16.06	13.59	14.85
Behavior problems			
Physically abusive, %	4.77	3.98	4.38
Socially inappropriate, %	11.21	10.04	10.63
Resists care, %	17.18	16.16	16.68
ADL limitation in bed mobility (0~4), mean $\pm$ SD	2.14 $\pm$ 1.51	2.28 $\pm$ 1.43	2.21 $\pm$ 1.47
Fall in last 180 days, %	21.20	21.83	21.51
Cognitive status (CPS, 0~6), mean $\pm$ SD	3.14 $\pm$ 1.85	3.01 $\pm$ 1.80	3.08 $\pm$ 1.83
Ability to understand others			
Always or usually, %	62.17	64.35	63.24
Sometimes, %	24.74	24.53	24.64
Rarely, %	13.09	11.12	12.12

SD: standard deviation; ADL: activity of daily living; CPS: Cognitive Performance Scale.

Nearly 60% of low-risk residents had incontinence (Table 4-4). Their abilities to perform daily activities have decreased after the implementation of AB1629. About 80% of the residents can make self understood and 18% of residents had behavioral symptoms.

Table 4-4: Descriptive statistics of resident characteristics for incontinence, 2002-2008

	Pre-AB1629 (2002-2004) (N=155,413)	Post-AB1629 (2006-2008) (N=156,892)	Study period (2002-2004, 2006- 2008) (N=312,305)
Outcome			
Incontinence, %	57.79	58.79	58.29
Resident characteristics			
Age (years), mean $\pm$ SD	78.99 $\pm$ 14.39	78.42 $\pm$ 14.45	78.70 $\pm$ 14.42
Female, %	67.84	66.30	67.06
Cognitive status (CPS: 0~6), mean $\pm$ SD	2.33 $\pm$ 1.30	2.32 $\pm$ 1.29	2.33 $\pm$ 1.29
Delirium, %	1.19	0.86	1.02
Make self understood			
Always or usually, %	79.99	80.05	80.01
Sometimes, %	18.57	18.62	18.60
Rarely, %	1.44	1.33	1.39
Behavioral symptoms, %	19.02	17.11	18.06
Physically abusive, %	4.34	3.77	4.06
ADLs			
Transfer (0~4), mean $\pm$ SD	2.06 $\pm$ 1.40	2.20 $\pm$ 1.35	2.13 $\pm$ 1.38
Locomotion (0~4), mean $\pm$ SD	1.65 $\pm$ 1.56	1.83 $\pm$ 1.51	1.74 $\pm$ 1.54
Eating (0~4), mean $\pm$ SD	0.92 $\pm$ 1.24	1.04 $\pm$ 1.24	0.98 $\pm$ 1.24
Personal hygiene (0~4), mean $\pm$ SD	2.49 $\pm$ 1.19	2.55 $\pm$ 1.13	2.52 $\pm$ 1.16

Bathing (0~4), mean $\pm$ SD	3.02 $\pm$ 0.99	3.06 $\pm$ 0.96	3.04 $\pm$ 0.97
---------------------------------	-----------------	-----------------	-----------------

SD: standard deviation; ADL: activity of daily living; CPS: Cognitive Performance Scale.

Consistent with previous studies, nearly 20% of the long-term care residents were hospitalized and 9.89% had potentially avoidable hospitalizations (Table 4-5). Over the study period, nursing home residents' acuity levels have increased. The prevalence of congestive heart failure, chronic obstructive pulmonary disease (COPD), diabetes, and renal failure has increased and residents' functional status has worsened. The proportion of residents with do-not-resuscitate or do-not-hospitalize orders has decreased at the same time. Residents were also different with respect to conditions that might be associated with potentially avoidable hospitalizations such as urinary tract infection in the pre- and post-AB1629 period.

Table 4-5: Descriptive statistics of resident characteristics for potentially avoidable hospitalizations, 2002-2008

	Pre-AB1629 (2002-2004) (N=167,481)	Post-AB1629 (2006-2008) (N=161,593)	Study period (2002-2004, 2006-2008) (N=329,074)
Outcome			
Potentially avoidable hospitalizations, %	9.67	10.12	9.89
Resident characteristics			
Demographics			
Age (years), mean $\pm$ SD	77.55 $\pm$ 15.05	76.98 $\pm$ 15.05	77.27 $\pm$ 15.05
Female, %	68.54	66.32	67.45
White, %	68.22	63.06	65.68
Diagnoses			
Congestive heart failure , %	17.73	18.20	17.96
Emphysema/COPD, %	15.65	17.07	16.35
Diabetes, %	24.82	31.34	28.02
Dementia, %	48.44	48.82	48.63
Cerebrovascular Accident/Stroke, %	24.46	23.27	23.88
Arteriosclerotic heart disease, %	10.87	8.80	9.85
Cancer, %	5.31	5.24	5.28
Renal failure, %	5.23	7.45	6.32
Paraplegia and hemiplegia, %	14.62	14.06	14.35
Functional status (ADL: 0~28), mean $\pm$ SD	15.84 $\pm$ 8.85	16.38 $\pm$ 8.49	16.11 $\pm$ 8.68
Cognitive status (CPS: 0~6), mean $\pm$ SD	2.96 $\pm$ 1.82	2.84 $\pm$ 1.78	2.90 $\pm$ 1.80
Resident conditions			
Urinary tract infection, %	5.18	6.09	5.63
Oral feeding tube,	10.51	10.75	10.63

%			
Pressure ulcer (stage 2 or higher), %	5.29	5.41	5.35
Pneumonia, %	5.31	5.40	5.35
Septicemia, %	0.73	0.98	0.86
Parenteral/IV nutrition, %	0.86	1.67	1.26
Indwelling catheter, %	4.71	4.90	4.80
Antibiotic resistant infection, %	1.87	2.16	2.01
Do-not-resuscitate orders, %	45.69	42.26	44.01
Do-not-hospitalize orders, %	7.39	6.56	6.99

SD: standard deviation; COPD: chronic obstructive pulmonary disease; ADL: activity of daily living; CPS: Cognitive Performance Scale.

4.1.1.2 Trends in quality of care

Figure 4-1 shows unadjusted trends for quality of care. A change in trend toward improvement may have occurred for pressure ulcers and physical restraints (Figure 4-1 B and C).

Figure 4-1: Unadjusted trends in quality of care pre- and post-AB1629

Potentially Avoidable Hospitalizations

x-axis: year.

y-axis: (A): Proportion of long-term care residents whose need for help with daily activities has increased;

(B): Proportion of long-term care high-risk residents with pressure ulcers (stage 2 or higher);

(C): Proportion of long-term care residents who were physically restrained;

(D): Proportion of long-term care low-risk residents who lose control of their bowels or bladder;

(E): Proportion of long-term care residents with potentially avoidable hospitalizations.

4.1.2 Hypothesis testing

I examined the changes in time trends in the quality measures before and after the implementation of AB1629. Within the pre-post specification, I tested for the improvements in quality of care by looking for either a level change at the time policy is introduced, a change in the slope (a trend change), or both a level change and a trend change. In the logistic regression models controlling for individual risk factors and nursing home fixed effects, the exponentiated coefficient, $\exp(\beta_1)$, indicates the baseline trend (the ratio of two adjacent yearly odds). $\exp(\beta_2)$ indicates any potential level change (an OR) that may have occurred due to the legislation. $\exp(\beta_3)$ indicates a trend change (an OR) after the implementation of AB1629 compared with the baseline trend. The post-AB1629 trend is represented by $\exp(\beta_1 + \beta_3)$. Table 4-6 summarizes the changes in quality of care after AB1629 was implemented in 2005. Full multivariate regression results testing within-facility changes in quality of care associated with AB1629 are shown in Appendix Tables A2-1~A2-5. The results of control variables were largely as expected.

Table 4-6: Changes in quality of care after AB1629 was implemented in 2005

	Functional Decline (A)	Pressure Ulcers (B)	Physical Restraints (C)	Incontinence (D)	PAHs (E)
Pre-trend (β_1)	0.0344*** (0.0106)	-0.0123 (0.0113)	-0.0763*** (0.0077)	-0.0039 (0.0095)	-0.0028 (0.0104)
AB1629 (β_2)	-0.0251 (0.0356)	-0.0483 (0.0378)	-0.0199 (0.0264)	-0.1242*** (0.0318)	-0.0039 (0.0349)
Time*AB1629 (β_3)	0.0003 (0.0150)	-0.0378** (0.0160)	-0.2540*** (0.0120)	-0.0103 (0.0133)	-0.0014 (0.0147)
Post-trend ($\beta_1 + \beta_3$)	0.0347*** (0.0107)	-0.0501*** (0.0114)	-0.3303*** (0.0092)	-0.0142 (0.0093)	-0.0042 (0.0104)
Number of residents	275607	285091	440787	312305	329074
Number of NHs	1179	1170	1189	1186	1187

** $p \leq 0.05$; *** $p \leq 0.01$; (Standard errors in the parentheses).

PAHs: potentially avoidable hospitalizations; NHs: nursing homes.

Before the implementation of AB1629, there appeared to be a trend toward deterioration of resident functional status (Table 4-6, Column A). During 2002-2004, the odds of functional decline increased significantly by about 3% ($OR=e^{0.0344}$) each year. After the implementation of AB1629 the odds of functional decline did not exhibit any statistically significant changes and continued to increase. In the pre-AB1629 period, the odds of pressure ulcers showed no statistically significant change (Table 4-6, Column B). There was a significant change in the slope of the trend line between the pre- and the post-AB1629 period. In the post period, the odds of pressure ulcers started to decrease at 5% per year ($OR=e^{-0.0501}$). For physical restraints, a declining trend was already occurring in the pre-period, with odds declining at 7% per year ($OR=e^{-0.0763}$, Table 4-6, Column C).

However, this trend significantly accelerated in the post-period with the odds declining at 28% per year ($OR=e^{-0.3303}$). The odds of incontinence decreased about 12% ($OR=e^{-0.1242}$, Table 4-6, Column D) in the year immediately following the launch of AB1629 and the improvement (decline) persisted throughout the post-period. Potentially avoidable hospitalizations did not exhibit any significant changes attributable to AB1629 (Table 4-6, Column E).

Three of the five quality measures in this analysis (Table 4-6): pressure ulcers, physical restraints, and incontinence, exhibited significant improvement (decline) following the implementation of AB1629 while two did not change. Pressure ulcers and incontinence were stable in the pre-AB1629 period and exhibited a significant decline either in the slope of the trend line or in the level of quality immediately after the legislation. The decline in the slope of the trend line indicated gradual change in quality of care overtime, while the level decline indicated instant change. For physical restraints, there was an improvement trend even before AB1629, with an accelerated rate of improvement during the post-AB1629 period.

4.2 Stratification analyses: quality of care (Hypothesis 2)

Hypothesis 2: With the implementation of AB1629, nursing homes with higher proportion of Medi-Cal revenues were more likely to improve quality or had greater quality improvement.

4.2.1 Descriptive statistics

Facilities with high percent of Medi-Cal revenues had more residents with physical restraints across 6 years ($p<0.05$) (Table 4-7, Column B). The proportion of the

residents with incontinence in nursing homes with low Medi-Cal revenues was about 10% higher than that in nursing homes with high Medi-Cal revenues ($p < 0.0001$, Table 4-7, Column C). Although in general nursing homes with high Medi-Cal revenues had more residents with pressure ulcers than nursing homes with low Medi-Cal revenues, the differences were statistically significant in only 3 years (2002, 2004, and 2007) (Table 4-7, Column A). For functional decline and potentially avoidable hospitalizations, which I did not find any change in section 4.1.2, the difference was also noticeable. Nursing homes with high percent of Medi-Cal revenues had higher rates of potentially avoidable hospitalizations compared with nursing homes with low Medi-Cal revenues ($p < 0.01$, Table 4-7, Column E). In 2002-2003, the proportion of the residents with functional decline was lower in nursing homes with high Medi-Cal revenues than in nursing homes with low Medi-Cal revenues, but vice versa in 2007-2008 (Table 4-7, Column D).

Figure 4-2 reports the unadjusted trends (by proportion of Medi-Cal revenues) for the five quality measures. There appeared to be a declining trend for pressure ulcers in nursing homes with high Medi-Cal revenues after the implementation of AB1629 (Figure 4-2 A). In both nursing homes with high and low Medi-Cal revenues, there was a declining trend for physical restraints in the pre-AB1629 period and the proportion of residents with physical restraints was decreasing at a faster pace in the post-AB1629 period (Figure 4-2 B). There was no change in the trend line of incontinence, functional decline, and potentially avoidable hospitalizations (Figure 4-2 C, Figure 4-2 D, and Figure 4-2 E).

Table 4-7: Descriptive statistics for quality measures, 2002-2008: by proportion of Medi-Cal revenues

	Pressure ulcer (%) (A)			Physical Restraints (%) (B)			Incontinence (%) (C)			Functional Decline (%) (D)			PAHs (%) (E)		
	High	Low	p-value	High	Low	p-value	High	Low	p-value	High	Low	p-value	High	Low	p-value
2002	9.83	9.08	0.04	18.97	18.15	0.03	52.01	61.44	<.0001	10.86	12.01	<0.01	9.52	7.26	<.0001
2003	10.12	9.58	0.14	17.82	15.67	<.0001	51.18	62.22	<.0001	10.14	12.16	<.0001	10.62	8.18	<.0001
2004	10.22	9.10	<0.01	16.63	15.00	<.0001	51.84	62.44	<.0001	11.74	11.71	0.94	9.73	7.60	<.0001
2006	9.55	9.14	0.25	15.56	12.59	<.0001	51.92	62.61	<.0001	11.15	11.20	0.88	10.14	8.12	<.0001
2007	9.49	8.62	0.01	12.18	9.22	<.0001	53.33	61.47	<.0001	12.43	11.09	<0.01	10.28	8.18	<.0001
2008	8.75	8.89	0.69	9.05	7.35	<.0001	53.41	62.46	<.0001	12.20	10.41	<.0001	10.10	9.01	<0.01
Number of NHs	343	343		348	347		348	347		347	347		348	348	

PAHs: potentially avoidable hospitalizations; NHs: nursing homes.

4.2.2 Hypothesis testing

Before the implementation of AB1629, the odds of physical restraint were declining at a faster rate in nursing homes with low Medi-Cal revenues ($p \leq 0.05$, Table 4-8, Column B). In nursing homes with low Medi-Cal revenues the odds were declining at 11% per year ($OR = e^{-0.1179}$), while the odds were declining at 7% per year ($OR = e^{-0.0728}$) in nursing homes with high Medi-Cal revenues. I found that in both nursing homes with high and low Medi-Cal revenues, the decline trend significantly accelerated after the implementation of AB1629. However, the acceleration in the rate of decline in physical restraint was significantly larger for high Medi-Cal revenue nursing homes than for low Medi-Cal revenue nursing homes (-0.2979 vs. -0.2025 , $p \leq 0.01$), which provides support for the hypothesis. In the post-AB1629 period, the odds of physical restraints were declining at a faster rate in nursing home with high Medi-Cal revenues than nursing homes with low Medi-Cal revenues ($p \leq 0.05$). In nursing homes with high Medi-Cal revenues the odds were declining at 31% per year ($OR = e^{-0.3707}$, $p \leq 0.01$), while the odds were declining at 27% per year ($OR = e^{-0.3204}$, $p \leq 0.01$) in nursing homes with low Medi-Cal revenues.

In the pre-AB1629 period, the odds of pressure ulcers showed no statistically significant change (Table 4-8, Column A). There was a significant change in the slope of the trend line between the pre- and the post-AB1629 period in nursing homes with high Medi-Cal revenues. In the post period, the odds of pressure ulcers started to decrease at 7% per year ($OR = e^{-0.0689}$, $p \leq 0.01$), while there was no change in the odds of pressure ulcers in nursing homes with low Medi-Cal revenues. However the trend reduction (-

0.0766) was not statistically different from the constant trend for nursing homes with low Medi-Cal revenues.

In nursing homes with low Medi-Cal revenues, the odds of incontinence did not change in the pre-AB1629 period, while the odds were increasing at 3% per year ($OR=e^{0.0281}$) in nursing homes with high Medi-Cal revenues (Table 4-8, Column C). After the launch of AB1629, the odds of incontinence dropped about 17% ($OR=e^{-0.1914}$, $p\leq 0.01$) in nursing homes with high Medi-Cal revenues and 11% ($OR=e^{-0.1133}$, $p\leq 0.10$) in nursing homes with low Medi-Cal revenues in 2006. However the difference of the level decline in incontinence between high and low Medi-Cal nursing homes was not statistically significant.

For functional decline and potentially avoidable hospitalizations, in both nursing homes with high and low Medi-Cal revenues, there was neither level change nor trend change (Table 4-7, Columns D and E). While the odds of functional decline continued increasing in nursing homes with high Medi-Cal revenues, the odds of functional decline remained constant in nursing homes with low Medi-Cal revenues. The odds of potentially avoidable hospitalizations were stable in both nursing homes with high and low Medi-Cal revenues during the study period.

Figure 4-2: Unadjusted trends in quality of care pre- and post-AB1629: by proportion of Medi-Cal revenues

(A)

(B)

(C)

(D)

(E)

x-axis: year.

y-axis: (A): Proportion of long-term care high-risk residents with pressure ulcers (stage 2 or higher);

(B): Proportion of long-term care residents who were physically restrained;

(C): Proportion of long-term care low-risk residents who lose control of their bowels or bladder;

(D): Proportion of long-term care residents whose need for help with daily activities has increased;

(E): Proportion of long-term care residents with potentially avoidable hospitalizations.

High: Nursing homes with high Medi-Cal revenues (top tertile of the Medi-Cal revenues distribution, 2002-2004);

Low: Nursing homes with low Medi-cal revenues (bottom tertile of the Medi-Cal revenues distribution, 2002-2004).

Table 4-8: Changes in quality measures, stratified by nursing homes with high Medi-Cal revenues versus low Medi-Cal revenues

	Pressure Ulcers (A)			Physical Restraints (B)			Incontinence (C)		
	High	Low	Difference	High	Low	Difference	High	Low	Difference
Pre-trend (β_1)	0.0077 (0.0208)	-0.0133 (0.0222)	0.0210	-0.0728*** (0.0133)	-0.1179*** (0.0154)	0.0451**	0.0281* (0.0165)	-0.0148 (0.0191)	0.0429*
AB1629 (β_2)	-0.1029 (0.0698)	-0.0145 (0.0745)	-0.0884	0.0253 (0.0454)	0.0442 (0.0535)	-0.0189	-0.1914*** (0.0552)	-0.1133* (0.0643)	-0.0781
Time*AB1629 (β_3)	-0.0766** (0.0298)	-0.0238 (0.0315)	-0.0528	-0.2979*** (0.0205)	-0.2025*** (0.0247)	-0.0954***	-0.0262 (0.0232)	-0.0305 (0.0270)	0.0043
Post-trend ($\beta_1 + \beta_3$)	-0.0689*** (0.0214)	-0.0371 (0.0224)	-0.0318	-0.3707*** (0.0156)	-0.3204*** (0.0194)	-0.0503**	0.0019 (0.0162)	-0.0453** (0.0190)	0.0472*
Number of residents	82488	78919		145085	110748		103093	79238	
Number of NHs	343	343		348	347		348	347	

	Functional Decline (D)			PAHs (E)		
	High	Low	Difference	High	Low	Difference
Pre-trend (β_1)	0.0730*** (0.0186)	0.0062 (0.0211)	0.0669**	0.0092 (0.0173)	0.0064 (0.0241)	0.0028
AB1629 (β_2)	-0.0814 (0.0618)	-0.0115 (0.0715)	-0.0699	-0.0477 (0.0581)	-0.0358 (0.0806)	-0.0119
Time*AB1629 (β_3)	0.0023 (0.0260)	-0.0314 (0.0307)	0.0337	-0.0238 (0.0247)	0.0298 (0.0338)	-0.0536
Post-trend ($\beta_1 + \beta_3$)	0.0753*** (0.0182)	-0.0253 (0.0223)	0.1006***	-0.0146 (0.0177)	0.0362 (0.0237)	-0.0508
Number of residents	93072	67181		113710	75467	
Number of NHs	347	347		348	348	

* $p \leq 0.10$; ** $p \leq 0.05$; *** $p \leq 0.01$; (Standard errors in the parentheses).

PAHs: potentially avoidable hospitalizations; NHs: nursing homes.

4.3 Nursing homes' investment in labor in response to AB1629 (Hypothesis 3)

Hypothesis 3: After the implementation of AB1629, nursing homes increased staffing levels and/or wages.

4.3.1 Descriptive statistics

Staffing levels and nursing staff wages are summarized in Table 4-9. In California, the average RN, LPN, and CNA hours per resident day were 0.29, 0.71, and 2.42 respectively during the study period. The total nursing hours per resident days were 3.42. The average nursing staff wages were highest for RNs (\$33.90 per hour) and lowest for CNAs (\$12.67 per hour). Figure 4-3 shows unadjusted trends for staffing levels and nursing staff wages. Two of three staffing categories, RN and LPN, show a change in trend toward staffing increase following the implementation of AB1629 (Figure 4-3 A and Figure 4-3 B). After inflation was adjusted for, RN and LPN wages show a declining trend in the post-AB1629 period (Figure 4-3 D and Figure 4-3 E).

4.3.2 Hypothesis testing

After adjusting for resident case-mix and percent of Medicare residents, in the pre-period there was an increasing trend for LPN and CNA staffing and a declining trend for RN staffing (Table 4-10). Nursing homes had statistically significant increases in licensed (RN and LPN) nursing hours in response to the change in Medi-Cal reimbursement. In 2006 immediately after AB1629 was launched, compared to what was expected had the pre-trend continued, RN increased by 0.0145 hours per resident day (i.e. 0.87 minutes per resident day or 5.47%) while LPN increased by 0.0266 hours per resident day (i.e. 1.60 minutes per resident day or 3.75%). RN and LPN staffing

continued to increase after 2006. The declining trend of RN staffing was reversed and the increasing trend for LPN continued at a faster rate (slope increase). These changes were modest in size on average. There was no significant change in the trend line of CNA staffing.

Prior to AB1629, RN wages were flat (Table 4-11). AB1629 was associated with a significant increase of \$1.12 per hour (3.34%) in 2006. However, after 2006, RN wages started to decrease at \$0.39 per hour each year. Prior to AB1629, LPN wages were declining. AB1629 resulted in a significant increase in LPN wages (\$0.49 per hour or 1.89%) in the year immediately following the launch of AB1629. Then LPN wages declined at \$0.63 per hour each year. Prior to AB1629, CNA wages decreased at \$0.40 per hour each year. AB1629 was associated with a significant increase of \$0.72 per hour (6.09%) in 2006. Post AB1629 implementation, the rate of decline decelerated to \$0.17 per hour each year.

Sensitivity analyses show that the results are robust to changes in covariance structure. Similar changes in staffing levels and wages are evident if unstructured covariance is defined.

Table 4-9: Descriptive statistics of staffing levels and nursing staff wages, 2002-2008

	2002	2003	2004	2006	2007	2008	Pre- AB1629 (2002- 2004)	Post- AB1629 (2006- 2008)	Study period (2002- 2004, 2006- 2008)
Staffing level									
RN HPRD	0.28 (0.19)	0.28 (0.20)	0.28 (0.21)	0.29 (0.19)	0.30 (0.21)	0.30 (0.23)	0.28 (0.20)	0.29 (0.21)	0.29 (0.21)
LPN HPRD	0.63 (0.27)	0.64 (0.27)	0.67 (0.30)	0.74 (0.32)	0.79 (0.34)	0.82 (0.34)	0.65 (0.28)	0.78 (0.33)	0.71 (0.32)
CNA HPRD	2.36 (0.37)	2.38 (0.35)	2.40 (0.39)	2.44 (0.35)	2.45 (0.37)	2.45 (0.35)	2.38 (0.37)	2.45 (0.36)	2.42 (0.37)
RN+LPN HPRD	0.91 (0.32)	0.92 (0.32)	0.95 (0.38)	1.02 (0.39)	1.09 (0.42)	1.12 (0.43)	0.93 (0.34)	1.08 (0.41)	1.00 (0.39)
Total HPRD	3.27 (0.56)	3.31 (0.56)	3.35 (0.64)	3.47 (0.61)	3.54 (0.65)	3.57 (0.65)	3.31 (0.59)	3.53 (0.64)	3.42 (0.62)
Staffing wages									
RN wages (\$/hour, 2008)	33.91 (5.13)	33.33 (4.81)	33.73 (4.98)	34.71 (4.93)	33.82 (4.69)	33.89 (4.92)	33.66 (4.98)	34.14 (4.86)	33.90 (4.93)
LPN wages (\$/hour, 2008)	26.43 (4.30)	25.99 (4.09)	26.20 (4.14)	26.47 (4.07)	25.65 (3.76)	25.13 (3.48)	26.21 (4.18)	25.76 (3.82)	25.99 (4.01)
CNA wages (\$/hour, 2008)	13.44 (2.37)	12.91 (2.16)	12.66 (2.10)	12.57 (2.12)	12.25 (2.07)	12.16 (2.00)	13.00 (2.24)	12.33 (2.07)	12.67 (2.18)

HPRD: hours per resident day; (Standard deviation in the parentheses).

Figure 4-3: Unadjusted trends in staffing levels and nursing staff wages pre- and post-AB1629

(A)

(D)

(B)

(E)

(C)

(F)

x-axis: year.

y-axis: (A)(B)(C): Staffing levels (hours per resident day);

(D)(E)(F): Nursing staff wages (\$/hour, 2008).

HPRD: hours per resident day.

Table 4-10: Changes in staffing levels after AB1629 was implemented in 2005

	RN	LPN	CNA
Pre-trend (β_1)	-0.0064*** (0.0022)	0.0193*** (0.0029)	0.0125** (0.0053)
AB1629 (β_2)	0.0145** (0.0070)	0.0266*** (0.0086)	0.0243 (0.0173)
Time*AB1629 (β_3)	0.0111*** (0.0033)	0.0135*** (0.0043)	-0.0090 (0.0077)
Post-trend ($\beta_1 + \beta_3$)	0.0047** (0.0023)	0.0328*** (0.0030)	0.0035 (0.0054)
Medicare percent	0.0011** (0.0005)	0.0023*** (0.0006)	-0.0008 (0.0011)
Case-mix index	0.1439*** (0.0348)	0.1583*** (0.0440)	0.0697 (0.0841)
Number of NHs	5977	5977	5977

** $p \leq 0.05$; *** $p \leq 0.01$; (Standard errors in the parentheses).

Table 4-11: Changes in nursing staff wages after AB1629 was implemented in 2005

	RN wages	LPN wages	CNA wages
Pre-trend (β_1)	-0.09 (0.0703)	-0.11** (0.0434)	-0.40*** (0.0187)
AB1629 (β_2)	1.12*** (0.2354)	0.49*** (0.1463)	0.72*** (0.0627)
Time*AB1629 (β_3)	-0.29*** (0.1042)	-0.52*** (0.0639)	0.23*** (0.0278)
Post-trend ($\beta_1 + \beta_3$)	-0.39*** (0.0720)	-0.63*** (0.0445)	-0.17*** (0.0192)
Number of NHs	6132	6186	6191

** $p \leq 0.05$; *** $p \leq 0.01$; (Standard errors in the parentheses).

4.4 The relationship between staffing levels and quality of care (Hypothesis 4)

Hypothesis 4: The investment in direct care labor was associated with the changes in quality of care during the study period.

4.4.1 Hypothesis testing

I used a first-difference model to examine whether changes in each type of nurse staffing level before and after AB1629 were associated with changes in quality over this period. I looked at the three quality measures which I found significant improvement (decline) in section 4.1.2: pressure ulcers, physical restraints, and incontinence. I found that an increase in 1 RN HPRD led to a statistically significant decrease in physical restraints (4.70 percentage points, $p=0.05$, Table 4-12 Column A). Similarly, an increase in 1 LPN HPRD was significantly associated with a 2.86 percentage point decrease in the physical restraint rate ($p=0.10$, Table 4-12 Column A). That is, 5 minutes per resident day increase in RN staffing was associated with 0.39 percentage points decrease in physical restraint rate and 5 minutes per resident day increase in LPN staffing was associated with 0.24 percentage points decrease in physical restraint rate. None of the coefficients for changes in staffing levels was significantly associated with the changes in pressure ulcers or incontinence (Table 4-12 Columns B and C). Thus, the increase in licensed nurse staffing was directly related to the improvement (decline) in restraint use, but not in pressure ulcers or incontinence. Full multivariate regression results testing the relationship between staffing levels and quality of care are shown in Appendix Tables A2-6~A2-8.

Unlike the relationship between staffing levels and quality of care, the relationship between nursing staff wages and quality of care is not well understood. However, I did not examine the relationship between nursing staff wages and quality due to the following reasons. First, studies have suggested that low salaries were associated with high turnover rates, which may be related to low quality of care in the nursing homes. However, the turnover rates are not available in our datasets, which are crucial for us to understand the relationship between wages and quality of care. Second, wages are not the only factor contributing to the high rates of turnover in the nursing homes. A large number of factors are associated with turnover including characteristics of the worker, the nursing home and the environment [174-180]. In addition, Mukamel found that high turnover was associated with net savings for nursing homes, which may explain the persistence of high turnover over the last decades [181]. Thus, to elucidate the relationship between wages and quality, controlling for all these factors both measurable and immeasurable is required.

Table 4-12: The relationship between staffing levels and quality of care (physical restraints, pressure ulcers, and incontinence)

	Δ Physical Restraints (A)			Δ Pressure Ulcers (B)			Δ Incontinence (C)		
	Estimate	Robust standard error	p-value	Estimate	Robust standard error	p-value	Estimate	Robust standard error	p-value
Δ [RN HPRD]	-0.0470**	0.0235	0.05	0.0185	0.0131	0.16	0.0302	0.0316	0.34
Δ [LPN HPRD]	-0.0286*	0.0176	0.10	0.0035	0.0108	0.74	0.0059	0.0165	0.72
Δ [CNA HPRD]	-0.0124	0.0113	0.27	-0.0043	0.0057	0.45	-0.0147	0.0122	0.23

* $p \leq 0.10$; ** $p \leq 0.05$; HPRD: hours per resident day.

CHAPTER 5 DISCUSSION

This chapter examines the results from the empirical analysis and discusses the limitations of this study. Moreover, implications for nursing home policy are provided.

5.1 Discussion

Encouraging nursing homes to maximize spending on direct care has been an important policy issue. In an effort to align payment incentives with quality improvement, policymakers in California have turned to reforming Medi-Cal reimbursement policy to encourage nursing homes' investment in direct care labor. In this study, I evaluated changes in quality of nursing home care and assessed nursing homes' investment in labor in response to changes in Medi-Cal reimbursement policy using longitudinal data.

5.1.1 Changes in quality of nursing home care

We found that following the implementation of AB1629 quality of care improved for some, but not for all measures. Three of the five quality measures examined in this analysis, pressure ulcers, physical restraints, and incontinence, exhibited significant improvement while two (functional decline and potentially avoidable hospitalization) did not change. Our results showed that there was a declining trend for physical restraints even before AB1629, which may be related to quality report cards as Mukamel and Zinn found that publication of the Nursing Home Compare report cards was associated with the improvement in physical restraints [69, 182] since its implementation at the end of 2002. The declining rate of physical restraint use quadrupled in the post-AB1629 period,

which suggests that the combination of report cards and AB1629 may have a synergetic effect on the improvement of physical restraints. Pressure ulcers and incontinence did not show any change in the pre-AB1629 period and exhibited a significant decline either in the slope of the trend line or in the level of quality immediately after the legislation. The newly exhibited change in pressure ulcers and incontinence may also support the role of AB1629 in the improvement of quality of care.

The three quality measures showing improvement, pressure ulcers, physical restraints, and incontinence, are staffing-dependent and the improvements in quality may be driven by structural changes, such as by increasing staffing levels, as discussed in section 3.3. The fact that different dimensions of care related to nurse staffing were getting better suggests that the improvements in quality were less likely to be driven by targeted changes, such as specific changes in care protocols (e.g. turning the residents every two hours to prevent pressure ulcers). Although residents' functional status is also associated with staffing levels, it did not show any improvement. Why did AB1629 affect some dimensions of quality but not others? Considerably higher investment in nursing interventions might be needed to promote the residents' ability to adapt and adjust to living as independently and safely as is possible compared to the improvement in other quality dimensions such as pressure ulcers, the prevention of which involves frequent position change. In addition, in order to assist or promote the resident's ability to attain his or her maximum functional potential, CNAs must be trained in the techniques to carry out the training and skill practice in ADLs, interventions must be planned and scheduled, and periodic evaluation must be performed by licensed nurse. Therefore, the absence of

improvement in the resident functional status may indicate the challenge to initiate/improve restorative care so as to prevent further impairment in functional status.

Potentially avoidable hospitalizations did not change during the study period. One potential explanation for this is that in addition to the staff investment, the reduction in potentially avoidable hospitalization may need nursing homes to invest in the clinical resources (e.g. diagnostic services, nurse practitioners/physician assistants, intravenous therapy) so as to manage the residents' acute care needs on-site [29, 183-186], or make specific changes in practice such as improvement in preventive services, chronic disease management, to prevent the need for hospitalization. Furthermore, nursing homes have no clear incentives to reduce the likelihood of hospitalization as hospital services are paid by Medicare. Therefore, reducing hospitalization rates may require a change of payment mechanism to incentivize nursing homes to improve care quality or have the resident treated in the nursing home. One recent effort is the Nursing Home Value-based Purchasing Demonstration being implemented in 3 states, in which Medicare savings from decreased avoidable hospitalizations were used to reward nursing homes with good performance [137]. Another possible explanation for the lack of change might be that potentially avoidable hospitalizations have so far not been publicly reported on the Nursing Home Compare website and thus might not be a priority in quality improvement.

5.1.2 Differential effects of Medicaid reimbursement change on quality of care

In nursing homes, Medicaid payment rate is considerably lower than Medicare rate and private-pay price [187]. The level of resources available has substantial influence on quality of care. Studies have found that nursing homes with high concentrations of

Medicaid patients were more like to have quality of care problems due to very limited resources compared to nursing homes with low concentrations of Medicaid patients [39, 188-189]. In addition, public reporting may increase the divide between providers that are more or less able to improve quality [190]. The public reporting of quality may steer prospective residents away from poor quality nursing homes as report cards increase the likelihood that patients select higher-quality providers. In turn, this will reduce admissions and revenues and make it even harder for these facilities to achieve quality improvement [39].

In 2004, California's average Medi-Cal payment rate was \$124 per day, while the Medicare payment rate per day was \$330 and the private-pay rate per day was \$184 [191]. We found that nursing homes with high percent of Medi-Cal revenues at baseline had more residents with physical restraints compared with facilities with low percent of Medi-Cal revenues. Although both in nursing homes with high and low Medi-Cal revenues, the odds of physical restraint were declining before the implementation of AB1629, the rate was significantly larger in nursing homes with low Medi-Cal revenues than in nursing homes with high Medi-Cal revenues. This is consistent with the fact that nursing homes with high Medi-Cal revenues are usually less capable of achieving quality improvement due to the lack of resources. AB1629 provides nursing homes the financial incentives to improve quality of care, with nursing homes with a higher proportion of Medi-Cal revenues probably facing stronger incentives (section 2.4). My results indicated that the reductions in restraint use varied by the proportion of Medi-Cal revenues. The decline in physical restraints was larger among nursing homes with high Medi-Cal

revenues compared to nursing homes with low Medi-Cal revenues. The findings that nursing homes affected to a greater extent by AB1629 reacted more strongly possibly suggest a positive role of AB1629 in influencing the quality of nursing home care.

Because nursing homes were affected differently by the changes in Medi-Cal reimbursement policy, AB1629 may have helped to diminish the gap in quality between nursing homes with high and low Medi-Cal revenues.

5.1.3 Nursing homes' investment in labor in response to AB1629

5.1.3.1 Nursing homes' investment in staffing levels

Without adequate staff it is not possible to provide quality care for nursing home residents. In 2001, CMS published a report prepared by the Abt Associates on the appropriateness of minimum nurse staffing ratios in nursing homes and found that nursing homes do not provide sufficient staffing to ensure basic quality. Furthermore, they identified a threshold at which point there was no further benefits with respect to quality when additional staff was utilized. These thresholds were 2.80, 1.30, and 0.75 hours per resident day (HPRD) for CNA, licensed nurse (RN and LPN), and RN, respectively [192]. In 2004, in California nursing homes, the average total nursing staff was 3.35 HPRD, which was higher than the required state minimum staff hours of 3.2 HPRD. However, the average levels of CNA, licensed nurse, and RN were 2.40, 0.95, and 0.28 HPRD, respectively. Thus, before the launch of AB1629 in 2005, although the majority of nursing homes in California met the state minimum staff requirement, nursing homes were significantly understaffed in terms of providing sufficient staffing to ensure high quality.

Although the legislation encourages nursing homes' investment in labor, it does not differentiate the investment between staffing levels and wages and benefits. Nursing home could have received the same return on investment regardless of how the increase in labor costs was achieved. After the implementation of AB1629, nursing homes had to decide how best to make investment in direct care labor. We found evidence that AB1629 did have the intended effect of increasing nursing homes' investment in labor. Nursing homes had significant increases in licensed nurse hours (RN and LPN) in response to the changes in Medi-Cal reimbursement, which is consistent with Mukamel's research results [193]. In 2006 alone, compared to what was expected had the pre-trend continued, RN staffing increased by 0.0145 HPRD (i.e. 0.87 minutes per resident day or 5.47%) while LPN staffing increased by 0.0266 HPRD (i.e. 1.60 minutes per resident day or 3.75%). These changes were comparable to other policy initiatives directed specifically at increasing staffing levels. Park and colleague found that state minimum staffing standards led to estimated increases of 0.034 RN HPRD (2.04 minutes per resident day), 0.027 LPN HPRD (1.62 minutes per resident day) and 0.145 CNA HPRD (8.7 minutes per resident day) [60] in nonprofit low-staff nursing homes. The Medicaid wage pass-through policy was associated with 3.0~4.0% net increases in CNA HPRD in the years following adoption, with no effect on either RN or LPN HPRD [61]. However, unlike these policy initiatives, AB1629 induced nursing homes to hire more licensed nursing staff (RN and LPN) rather than mainly increase CNA labor. Although the staffing hours of RN and LPN (0.29 HPRD and 0.71 HPRD, respectively) are much less than that of CNA (2.42 HPRD), RNs and LPNs are the more skilled nurse staffing and play very important

role in the care of nursing home residents. RNs are in charge of supervising CNAs and LPNs, developing patient care plans, interacting directly with doctors regarding patients, and educating staff. The duties of an RN also include administering medications and maintaining nursing notes and medical documentation. LPNs provide basic services such as monitoring vital signs, performing laboratory test, observing medical reactions, and treating and preventing bedsores. Research has suggested that more skilled nurse staffing especially greater RN staffing was associated with higher quality of care. Examples include lower likelihood of pressure ulcers and urinary tract infections [124, 144], lower probability of malpractice paid-losses [194], fewer deficiency citations [38, 195], lower rates of physical restraint use [53], fewer hospitalizations [144], improved survival [50-51] and better functional status [50]. Furthermore, although the increase in licensed nurse hours was modest in size on average, to improve quality nursing homes could best use scarce resources by highlighting at-risk residents and modifying care practices for these residents [196], rather than increase the nursing staff time for all residents.

In the pre-AB1629 period, there has already been an increasing trend for CNA staffing, however, there was no significant change in the trend line of CNA staffing after the launch of AB1629. In the nursing homes, CNAs help patients with bathing, dressing, and making beds. They also feed and move patients, help with exercise, and monitor vital signs. The lack of measurable effect of AB1629 on CNA staffing may be due to several factors. Nursing homes may feel it unnecessary to make further larger investment in CNA staffing because they have already focused on boosting CNAs. In 2000, California's minimum staff hours were increased from 3.0 to 3.2 HPRD, excluding administrative

nurses. At the same time, the double counting of RN and LPN hours was eliminated, which increased the relative weight of CNA hours. Prior to 2000, total nursing staff hours were defined as CNA hours plus two times the sum of RN and LPN hours. Studies have found that low staffing nursing homes increased total nurse staffing mainly by increasing CNA labor [60, 197]. On the other hand, nursing homes may be affected by the existing evidence that more skilled nurse staffing may be more important than CNA in quality improvement. For example, Cohen and Spector found that higher RN intensity was associated with a lower rate of mortality and higher intensity of LPN staffing significantly improved functional outcomes, however, having more CNAs had no impact on resident outcomes [50]. Taken together, these results could be used to anticipate nursing home behavior in response to future policy changes.

5.1.3.2 Nursing homes' investment in wages

The compensation is potentially important for workforce recruitment and retention, which may be key to promoting quality of care in the nursing homes. Research has found that low wages and benefits contributed to high turnover [63, 126]. The CNA wages are close to the minimum wage and the labor market for CNAs is characterized by high turnover rates, which are often more than 100% [63, 198]. High turnover indicates that a large proportion of the CNAs are made up of new workers who are inexperienced and less familiar with facility's work protocols and policies. Inexperienced staff may not be able to care for the residents as experienced staff would [181]. Furthermore, high turnover rates would cause psychological distress of some residents, and interfere with continuity of care [199-201]. High turnover rates may also result in understaffing if the

nursing homes are unable to fill vacant positions, which may increase the work load for remaining staff.

One of the goals of AB1629 was to boost wages or benefits of nursing home staff. We found that nursing homes raised the CNA wages. Although the declining trend for CNA wages was not reversed, CNA wages were declining at a decelerated rate post AB1629 implementation. In 2006, the year immediately after the implementation of AB1629, nursing homes significantly increased wages for RN and LPN. However, the increase in the wages for RN and LPN was temporary, which started to decrease in the following two years. As I discussed in the section 5.1.3.1, nursing home leaders increased the demand for RNs and LPNs after AB1629. When there were shortages of labor, nursing home care providers responded by increasing the wages they offer. The wage increase had effects on the supply of labor. Individuals who previously chose to not work were more likely to seek employment and individuals who were presently working would increase the number of hours they work, which would increase labor supply [202]. In addition, RNs working in nursing care facilities earned less than RNs working in other places such as hospital [202], which may also have induced nursing home providers to increase wages. Although AB1629 encouraged nursing homes to spend more on direct care labor, when it was first implemented it was scheduled to sunset on July 31, 2008. Nursing homes may be uncertain about whether the reimbursement method would be changed substantially after 2008. The uncertainty may have lowered the likelihood that nursing home providers would continue making substantial investment in both staffing

levels and wages. As a result, wages for RN and LPN, the more expensive type of nursing staff in the nursing home, started to decrease after the temporary boost in 2006.

5.1.4 The relationship between staffing levels and quality of care

In addition to the stratification analysis of quality of care by nursing homes' financial incentives, I provided further evidence about the potential of AB1629 to influence quality by linking staffing increase in response to AB1629 to the improvement in the quality of care.

The use of physical restraints was common in nursing homes for the prevention of falls [203-204] and the control of disruptive behavior [204]. However, immobility resulting from physical restraints may increase the risk of pressure ulcers, depression, mental and physical deterioration, and mortality [147-148]. In recent decades efforts have been made to reduce the use of physical restraints. The Nursing Home Reform Act specifically prohibited nursing homes from using physical restraints for discipline or convenience. The quality report card also targeted physical restraints as one of the quality measures.

Previous literature providing restraint reduction guidance has stressed the importance of nursing staff. Staffing level and staff mix may significantly influence decisions on physical restraint use [149, 205-206]. Nursing homes with inadequate staffing levels may substitute restraints for nursing resources. The results presented in this dissertation suggest that Medicaid reimbursement policy change had an important effect on physical restraints in nursing homes through the effect on licensed staffing. Licensed nurses can identify residents at high risk for falls based on clinical judgment

[207]. Interventions that address the resident's greatest risk factors can then be used to reduce the rate of falls and restraint use. For example, medication review with discontinuation of psychotropic medications has been shown to be effective in reducing falls in nursing homes [208-209]. In addition, higher level of licensed nurses may allow for more time to care for at-risk residents, increased vigilance to prevent falls or agitation, and assistance can be provided quicker when needed; all contributing to restraint reduction.

However, I found no relationship between staffing and resident outcomes- pressure ulcers and incontinence-possibly for several reasons. First, these resident outcomes aggregated at the facility level may not be very sensitive to the modest levels of staffing changes induced by the policy. Second, staffing may be a better predictor of facility care processes such as physical restraint use than the clinical outcomes examined. According to the Donabedian model, structure is the foundation of the quality of health care. Structure primarily influences process of care and has only a secondary direct influence on outcome. Structure and processes together influence quality outcomes [210]. Many desirable outcomes may require not only additional staff but better care practices in general. To prevent or treat pressure ulcers, nursing homes require more staffing to frequently change the residents' position. However, pressure ulcer management requires an interdisciplinary approach. Interventions may include pressure relieving devices [211], positioning and turning protocols [143] and specific wound treatments, which must be coordinated to develop, implement, and monitor a plan of care to care for the residents at high risk for developing a pressure ulcer or residents with a pressure ulcer. These services

and interventions involve not only nurses, but physician, dietician, physical therapist, and wound care consultants as well. Similarly, although prompting voiding on a scheduled basis has been found to be effective in reducing daytime incontinence, and it requires more nursing time, practice guidelines of the management of urinary incontinence in the nursing home setting include assessing if the resident has a new, reversible condition causing a decline in continence (e.g., urinary tract infection (UTI), mobility problem, etc.), treating the underlying cause, toileting the resident according to the multiple specified times, monitoring resident's response to the toileting program, and evaluating the effectiveness of the care plan [212-213].

The lack of relationship between nursing home staffing and these resident outcomes does not mean that nurse staffing decisions are unimportant in a nursing home's strategy for ensuring high quality of care. Perhaps there were changes in care practice in addition to changes in staffing levels that led to better clinical outcomes. However, in our analysis, we did not measure the corresponding changes in care practice due to the limitation of the data. Thus improvement in staffing levels might be crucial in quality improvement, but only in combination with other elements. Further research is necessary to sort out these important issues and understand their unique contributions to the quality of care in nursing homes.

5.2 Limitations

This study has several potential limitations. First, as I discussed in section 3.4.1, I examined the changes in quality of care using a before-after design because I could not find a suitable comparison group. However, it is difficult to attribute changes in quality to

AB1629 using a before-after study design. The main weakness of a before-after study is that the change brought about by the policy cannot be separated out from ‘natural change’, change brought about by other policies at the same time, other activities designed to improve quality such as quality report cards, or changes in care practice. For example, a prior study has suggested that nursing homes may simply substitute physical restraint for chemical restraint (antipsychotic medication) as antipsychotic medication was not included on Nursing Home Compare until very recently (mid-2012) [214]. However, we found a decreasing trend of antipsychotic use for the same population subject to the restraints measure in the post-period of the implementation of AB1629 (Appendix Figure A2-1 and Table A2-9), which may exclude the possibility that the decline in physical restraints was caused by the changing of this care practice. No major Medicare payment policy changes occurred during the study period, which have been found to influence quality of care in the nursing home [95-96]. In addition, to my knowledge, there were no changes in nursing home regulations during this time period. California did not change the state minimum staffing standards on nursing home staffing since 2000, which is 3.2 direct care staff HPRD. In this study, the pre-period (2002-2004) included one year before the publication of quality report cards (2002) and two years after the publication of quality report cards (2003-2004), which captured the secular trend of quality report cards. The observed quality change in the pre-period was very similar to what was observed in the previous studies of the impact of quality report cards [68-69, 182, 215]. Thus, comparing the change in the trends before and after AB1629 provides us the effects of the legislation over and above the trend of report cards.

Despite the lack of a comparison group, this study provided the most comprehensive evidence to date regarding the effect of AB1629 on quality of care. The fact that nursing homes facing stronger incentives experienced more quality improvement suggests that the changes were more likely to be due to AB1629 than to a general trend. Moreover, we have shown that quality improvement was driven by quality improvement efforts tied to incentives of AB1629, i.e. increasing staffing levels, which further provides support for the role of AB1629 in quality improvement.

Second, although five separate quality measures were used to represent the quality of care in nursing homes, these measures cannot encompass the multidimensional construct of nursing home quality.

Finally, as in other observational study, the possibility of omitted variable bias should be considered. Unmeasured nursing home characteristics might lead to quality improvement. For example, better management may contribute to higher quality. We therefore used a longitudinal model with facility fixed-effects to control for any omitted time-invariant nursing home characteristics. In addition, we accounted for changes in resident case-mix, however bias from omitted time-variant attributes may still remain.

5.3 Implications for policy

Despite these limitations, this study offers important policy insights as to whether reforming Medicaid reimbursement policy is an effective tool for improving the quality of nursing home care. This dissertation provides evidence that linking Medicaid reimbursement rate to each nursing home's own expenditures and incentivizing nursing homes to invest in direct care were effective ways in encouraging nursing homes to

achieve quality improvement. While improvements in care have occurred, AB1629 led to quality improvement in some but not all areas and significant problems remain. In 2010, 17.33% of California facilities received deficiencies for physical restraints, compared with the national average of 8.79% [9]. Moreover, more than half of California nursing homes (600) are on the CMS's list of more than 4000 nursing homes targeted for pressure ulcer and/or physical restraint improvement [216].

Some barriers may have caused nursing homes to be reluctant to change their behavior as discussed in the section 1.6.2.3. To achieve more robust quality improvement, refinements of current Medicaid reimbursement policy might be needed to encourage nursing homes to make larger investments. First, the state government could reduce the time lag between investment and increase in reimbursement rate or allow upward adjustments in the rates during or after a rate-setting period. Because the facility-specific reimbursement rates were developed based on audited historical cost report, there was a 19 to 30 months delay between the investment nursing homes made and reimbursement recognition. If the nursing homes made the decision to invest in labor in 2006, immediately after the implementation of AB 1629, the nursing homes would see a rate increase reflecting the increase in labor investment in 2008. The delay of return on investment may decrease nursing home's incentives to invest. Using more recent cost reports would allow Medi-Cal to tie the reimbursement rates more closely to current costs associated with quality of care for residents in nursing facilities.

Second, the state government could set higher reimbursement caps for the rate increase. For the 2005/06, 2006/07, 2007/08 rate year, the maximum annual increase in

the weighted average Medi-Cal reimbursement rate was capped at 8%, 5% and 5.5% respectively, which implies that nursing homes that make larger investments may not be able to obtain full “refund”.

Third, one possible way to provide nursing homes with stronger incentives to improve quality is to combine reforming reimbursement method with pay-for-performance. The pay-for-performance program links nursing home performance to performance payments, with nursing homes providing high quality or having substantial quality improvement qualifying for extra payment. Actually, according to the Assembly Bill No.1489, beginning with the 2013-14 rate year nursing homes that improve the quality and accountability of care will be provided supplemental payments [105]. Although the pay-for-performance program is conceptually appealing, there are substantial technical problems about how to design and implement it to maximize effectiveness (e.g. size of incentive, rules linking performance scores to performance payments) [217-218]. It would be necessary to evaluate its effectiveness for improvement purposes in the future.

Finally, our findings suggest that AB1629 was associated with improvement in some quality dimensions but not in others, therefore, maximizing nursing homes’ spending on direct care cannot be relied on as the only policy strategy to improve quality of care. For example, to reduce potentially avoidable hospitalizations, policy makers might need to encourage and incentivize nursing homes to invest in the clinical resources such as diagnostic services, nurse practitioners/physician assistants, or intravenous therapy. Furthermore, broad improvement in quality of care may be achieved through

implementing quality initiatives such as staff education, and developing care standards. However, relatively little is known about whether improvements in quality are driven by changes in protocols, work organization, structural changes (e.g. nurse staffing) or the combination of all these factors. Further studies are necessary for a better understanding of the unique contributions of current care practice to the quality of care in nursing homes so that specific actions could be undertaken to improve quality.

In conclusion, this study addresses an important policy question as to whether changing payment incentives to encourage and reward nursing homes to invest more in direct care labor led to quality improvement. Improvement in the quality of care has been achieved in some areas of care since the implementation of AB1629, yet significant problems remain. This dissertation provides an important opportunity to consider lessons learned, and assess strategies for the future.

References

1. OBRA, *Omnibus Budget Reconciliation Act of 1987. Nursing Home Reform. Public Law 100-203, Subtitle C.-Washington, DC. 1987.*
2. Harrington, C. and H. Carrillo, *The regulation and enforcement of federal nursing home standards, 1991-1997.* Med Care Res Rev, 1999. **56**(4): p. 471-94.
3. *Nursing Home Quality Initiatives.* Available at <http://www.cms.gov/NursingHomeQualityInits/>.
4. Wiener, J.M., M.P. Freiman, and D. Brown, *Nursing Home Care Quality: Twenty Years after the Omnibus Budget Reconciliation Act of 1987.* 2007, Commissioned by the Kaiser Family Foundation.
5. Castle, N.G., H. Degenholtz, and J. Engberg, *State variability in indicators of quality of care in nursing facilities.* J Gerontol A Biol Sci Med Sci, 2005. **60**(9): p. 1173-9.
6. Harrington, C., H. Carrillo, and C. Mercado-Scott, *Nursing facilities, staffing, residents and facility deficiencies, 1998-2004.* 2005, San Francisco: University of California, Department of social and behavioral sciences.
7. Schnelle, J.F., et al., *Study of California's New Medi-Cal Reimbursement System for Nursing Homes 2008.*
8. Harrington C, et al., *Impact of California's 2004 Medi-Cal Long Term Care Reimbursement Act: Changes in Access, Quality and Costs: University of California San Francisco; 2008.*
9. Harrington, C., et al., *Nursing Facilities, Staffing, Residents, and Facility Deficiencies, 2005 Through 2010.* Available at <http://www.pascenter.org>, accessed January 2012, Department of Social and Behavioral Sciences, University of California, San Francisco.
10. *The National Nursing Home Survey: 2004 Overview.* Accessed at <http://www.cdc.gov/nchs/fastats/nursingh.htm>, U.S. Department of Health and Human Services. Centers for Disease Control and Prevention. National Center for Health Statistics.
11. *HCUPnet.* Available at <http://hcupnet.ahrq.gov/>. 2009, Agency for Healthcare Research and Quality.
12. Houser, A., W. Fox-Grage, and M.J. Gibson, *Across the states: Profiles of long-term care and independent living.* 2009, AARP.

13. Kasper, J. and M. O'Malley, *Changes in Characteristics, Needs, and Payment for Care of Elderly Nursing Home Residents: 1999 to 2004*. Available at: <http://www.kff.org/medicaid/7663.cfm>. 2007, Kaiser Commission on Medicaid and the Uninsured: Washington, DC.
14. *National health expenditure data for 2010*. Available at <http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/Downloads/tables.pdf>. Accessed February 18, 2013, Center for Medicare and Medicaid Services.
15. Houser, A., W. Fox-Grage, and K. Ujvari, *Across the states: Profiles of long-term services and supports*. 2012, AARP Public Policy Institute.
16. Miller, E.A., et al., *The devil's in the details: trading policy goals for complexity in medicaid nursing home reimbursement*. J Health Polit Policy Law, 2009. **34**(1): p. 93-135.
17. Grabowski, D.C. and J.J. Angelelli, *The relationship of Medicaid payment rates, bed constraint policies, and risk-adjusted pressure ulcers*. Health Serv Res, 2004. **39**(4 Pt 1): p. 793-812.
18. Day, T., *About Medicaid Long Term Care*. Available at http://www.longtermcarelink.net/eldercare/medicaid_long_term_care.htm. Accessed July 9th, 2013, National Care Planning Council.
19. *Crossing the Quality Chasm: A New Health System for the 21st Century*. March 2001, Institute of Medicine.
20. *Nursing home care in the United States: Failure in public policy*. 1974, U.S. Senate. Senate Special Committee on Aging, Subcommittee on Long-term Care: Washington, D.C.
21. *Improving the Quality of Care in Nursing Homes*. 1986, Institute of Medicine: Washington, DC.
22. Wunderlich, G.S. and P. Kohler, *Improving the Quality of Long-Term Cares*. 2000, Division of Health Care Services, Institute of Medicine: Washington, DC.
23. Abbasi, A.A. and D. Rudman, *Undernutrition in the nursing home: prevalence, consequences, causes and prevention*. Nutr Rev, 1994. **52**(4): p. 113-22.
24. Crogan, N.L., et al., *Barriers to nutrition care for nursing home residents*. J Gerontol Nurs, 2001. **27**(12): p. 25-31.
25. Kayser-Jones, J., et al., *Factors contributing to dehydration in nursing homes: inadequate staffing and lack of professional supervision*. J Am Geriatr Soc, 1999. **47**(10): p. 1187-94.

26. Gurwitz, J.H., et al., *Incidence and preventability of adverse drug events in nursing homes*. Am J Med, 2000. **109**(2): p. 87-94.
27. Spector, W.D. and R.H. Fortinsky, *Pressure ulcer prevalence in Ohio nursing homes: clinical and facility correlates*. J Aging Health, 1998. **10**(1): p. 62-80.
28. Teno, J.M., et al., *Persistent pain in nursing home residents*. JAMA, 2001. **285**(16): p. 2081.
29. Intrator, O., J. Zinn, and V. Mor, *Nursing home characteristics and potentially preventable hospitalizations of long-stay residents*. J Am Geriatr Soc, 2004. **52**(10): p. 1730-6.
30. Grabowski, D.C., A.J. O'Malley, and N.R. Barhydt, *The costs and potential savings associated with nursing home hospitalizations*. Health Aff (Millwood), 2007. **26**(6): p. 1753-61.
31. Saliba, D., et al., *Appropriateness of the decision to transfer nursing facility residents to the hospital*. J Am Geriatr Soc, 2000. **48**(2): p. 154-63.
32. Walsh, E.G., et al., *Potentially avoidable hospitalizations of dually eligible Medicare and Medicaid beneficiaries from nursing facility and Home- and Community-Based Services waiver programs*. J Am Geriatr Soc, 2012. **60**(5): p. 821-9.
33. *2010 National Ombudsman Reporting System Data Tables*. Available at http://www.aoa.gov/AoARoot/AoA_Programs/Elder_Rights/Ombudsman/National_State_Data/2010/Index.aspx, Administration on Aging, Department of Health & Human Services.
34. Harrington, C., *Regulating nursing homes: Residential nursing facilities in the United States*. BMJ, 2001. **323**(7311): p. 507-10.
35. Harrington, C., et al., *Does investor ownership of nursing homes compromise the quality of care?* Am J Public Health, 2001. **91**(9): p. 1452-5.
36. Hillmer, M.P., et al., *Nursing home profit status and quality of care: is there any evidence of an association?* Med Care Res Rev, 2005. **62**(2): p. 139-66.
37. Comondore, V.R., et al., *Quality of care in for-profit and not-for-profit nursing homes: systematic review and meta-analysis*. BMJ, 2009. **339**: p. b2732.
38. Harrington, C., et al., *Nursing home staffing and its relationship to deficiencies*. J Gerontol B Psychol Sci Soc Sci, 2000. **55**(5): p. S278-87.
39. Mor, V., et al., *Driven to tiers: socioeconomic and racial disparities in the quality of nursing home care*. Milbank Q, 2004. **82**(2): p. 227-56.

40. Carter, M.W. and F.W. Porell, *Variations in hospitalization rates among nursing home residents: the role of facility and market attributes*. Gerontologist, 2003. **43**(2): p. 175-91.
41. Teno, J.M., et al., *Terminal hospitalizations of nursing home residents: does facility increasing the rate of do not resuscitate orders reduce them?* J Pain Symptom Manage, 2011. **41**(6): p. 1040-7.
42. Stevenson, D.G., *Nursing home consumer complaints and quality of care: a national view*. Med Care Res Rev, 2006. **63**(3): p. 347-68.
43. Angelelli, J., et al., *Oversight of nursing homes: pruning the tree or just spotting bad apples?* Gerontologist, 2003. **43 Spec No 2**: p. 67-75.
44. Hughes, C.M., K.L. Lapane, and V. Mor, *Influence of facility characteristics on use of antipsychotic medications in nursing homes*. Med Care, 2000. **38**(12): p. 1164-73.
45. Chisholm, L., et al., *Nursing Home Quality and Financial Performance: Does the Racial Composition of Residents Matter?* Health Serv Res, 2013.
46. Li, Y., et al., *Association of race and sites of care with pressure ulcers in high-risk nursing home residents*. JAMA, 2011. **306**(2): p. 179-86.
47. Lutfiyya, M.N., C.E. Gessert, and M.S. Lipsky, *Nursing Home Quality: A Comparative Analysis Using CMS Nursing Home Compare Data to Examine Differences Between Rural and Nonrural Facilities*. J Am Med Dir Assoc, 2013. **14**(8): p. 593-8.
48. *Improving the Quality of Long-Term Care*. 2001, Institute of Medicine: Washington, DC.
49. Zhang, X. and D.C. Grabowski, *Nursing home staffing and quality under the nursing home reform act*. Gerontologist, 2004. **44**(1): p. 13-23.
50. Cohen, J.W. and W.D. Spector, *The effect of Medicaid reimbursement on quality of care in nursing homes*. J Health Econ, 1996. **15**(1): p. 23-48.
51. Porell, F., et al., *A longitudinal analysis of nursing home outcomes*. Health Serv Res, 1998. **33**(4 Pt 1): p. 835-65.
52. Weech-Maldonado, R., et al., *Nurse staffing patterns and quality of care in nursing homes*. Health Care Manage Rev, 2004. **29**(2): p. 107-16.
53. Castle, N.G., *Differences in nursing homes with increasing and decreasing use of physical restraints*. Med Care, 2000. **38**(12): p. 1154-63.

54. *The Nurse Staffing Crisis in Nursing Homes--Consensus Statement of the Campaign for Quality Care.* Available at <http://www.theconsumervoice.org/sites/default/files/Consensus%20Statement%20Staffing%20Crisis%20in%20Nursing%20Homes.pdf>. Accessed July 10, 2013. 2001, National Citizens' Coalition for Nursing Home Reform: Washington, DC.
55. McKeon, E., *Nursing home staffing crisis.* Am J Nurs, 2001. **101**(5): p. 25.
56. Wunderlich, G.S., F.A. Sloan, and C.K. Davis, *Nursing Staff in Hospitals and Nursing Homes: Is It Adequate?* 1996, Division of Health Care Services, Institute of Medicine: Washington, D.C.
57. Mueller, C., et al., *Nursing home staffing standards: their relationship to nurse staffing levels.* Gerontologist, 2006. **46**(1): p. 74-80.
58. Bowblis, J.R., *Staffing ratios and quality: an analysis of minimum direct care staffing requirements for nursing homes.* Health Serv Res, 2011. **46**(5): p. 1495-516.
59. Harrington, C., J.H. Swan, and H. Carrillo, *Nurse staffing levels and Medicaid reimbursement rates in nursing facilities.* Health Serv Res, 2007. **42**(3 Pt 1): p. 1105-29.
60. Park, J. and S.C. Stearns, *Effects of state minimum staffing standards on nursing home staffing and quality of care.* Health Serv Res, 2009. **44**(1): p. 56-78.
61. Feng, Z., et al., *Do Medicaid wage pass-through payments increase nursing home staffing?* Health Serv Res, 2010. **45**(3): p. 728-47.
62. *Results of a Follow-Up Survey to States on Wage Supplements for Medicaid and Other Public Funding To Address Aide Recruitment and Retention In Long-Term Care Settings.* 2000, North Carolina Division of Facility Services: Raleigh, NC.
63. Scanlon, W.J., *Nursing Workforce: Recruitment and Retention of Nurses and Nurse Aides Is a Growing Concern.* 2001, U.S. General Accounting Office: Washington, DC.
64. Walker, J.S., S. Angelotti, and D. Patterson, *Medicaid Funding for Nursing Home Services: A Historical Perspective.* 2000, Michigan Senate Fiscal Agency: Lansing, MI.
65. Mukamel, D.B., et al., *Does risk adjustment of the CMS quality measures for nursing homes matter?* Med Care, 2008. **46**(5): p. 532-41.
66. Arling, G., et al., *Improving quality assessment through multilevel modeling: the case of nursing home compare.* Health Serv Res, 2007. **42**(3 Pt 1): p. 1177-99.

67. *Public Reporting of Quality Indicators Has Merit, but National Implementation Is Premature. Publication No. GAO-03-187.* 2002, General Accounting Office: Washington, DC.
68. Werner, R.M., et al., *Impact of public reporting on quality of postacute care.* Health Serv Res, 2009. **44**(4): p. 1169-87.
69. Mukamel, D.B., et al., *Publication of quality report cards and trends in reported quality measures in nursing homes.* Health Serv Res, 2008. **43**(4): p. 1244-62.
70. Grabowski, D.C., et al., *Recent trends in state nursing home payment policies.* Health Aff (Millwood), 2004. **Suppl Web Exclusives**: p. W4-363-73.
71. Werner, R.M., R.T. Konetzka, and D. Polsky, *The effect of pay-for-performance in nursing homes: evidence from state Medicaid programs.* Health Serv Res, 2013. **48**(4): p. 1393-414.
72. Briesacher, B.A., et al., *Pay-for-performance in nursing homes.* Health Care Financ Rev, 2009. **30**(3): p. 1-13.
73. Birnbaum, H., et al., *Why do nursing home costs vary? The determinants of nursing home costs.* Med Care, 1981. **19**(11): p. 1095-107.
74. Smith, H.L. and M.D. Fottler, *Costs and cost containment in nursing homes.* Health Serv Res, 1981. **16**(1): p. 17-41.
75. Ullmann, S.G., *Ownership, regulation, quality assessment, and performance in the long-term health care industry.* Gerontologist, 1987. **27**(2): p. 233-9.
76. Mukamel, D.B. and W.D. Spector, *Nursing home costs and risk-adjusted outcome measures of quality.* Med Care, 2000. **38**(1): p. 78-89.
77. Weech-Maldonado, R., G. Neff, and V. Mor, *Does quality of care lead to better financial performance?: the case of the nursing home industry.* Health Care Manage Rev, 2003. **28**(3): p. 201-16.
78. Weech-Maldonado, R., G. Neff, and V. Mor, *The relationship between quality of care and financial performance in nursing homes.* J Health Care Finance, 2003. **29**(3): p. 48-60.
79. Weech-Maldonado, R., D. Shea, and V. Mor, *The relationship between quality of care and costs in nursing homes.* Am J Med Qual, 2006. **21**(1): p. 40-8.
80. Grabowski, D.C., F. Zhanlian, and V. Mor, *Medicaid nursing home payment and the role of provider taxes.* Med Care Res Rev, 2008. **65**(4): p. 514-27.
81. Grabowski, D.C., *Medicaid reimbursement and the quality of nursing home care.* J Health Econ, 2001. **20**(4): p. 549-69.

82. Intrator, O. and V. Mor, *Effect of state Medicaid reimbursement rates on hospitalizations from nursing homes*. J Am Geriatr Soc, 2004. **52**(3): p. 393-8.
83. Intrator, O., et al., *Hospitalization of nursing home residents: the effects of states' Medicaid payment and bed-hold policies*. Health Serv Res, 2007. **42**(4): p. 1651-71.
84. Grabowski, D.C., *A longitudinal study of Medicaid payment, private-pay price and nursing home quality*. Int J Health Care Finance Econ, 2004. **4**(1): p. 5-26.
85. Grabowski, D.C., J.J. Angelelli, and V. Mor, *Medicaid payment and risk-adjusted nursing home quality measures*. Health Aff (Millwood), 2004. **23**(5): p. 243-52.
86. Hyer, K., A. Temple, and C.E. Johnson, *Florida's efforts to improve quality of nursing home care through nurse staffing standards, regulation, and Medicaid reimbursement*. J Aging Soc Policy, 2009. **21**(4): p. 318-37.
87. Swan, J.H., et al., *Trends in Medicaid nursing home reimbursement: 1978-89*. Health Care Financ Rev, 1993. **14**(4): p. 111-32.
88. Coburn, A.F., et al., *Effect of prospective reimbursement on nursing home costs*. Health Serv Res, 1993. **28**(1): p. 45-68.
89. Schlenker, R.E., *Comparison of Medicaid nursing home payment systems*. Health Care Financ Rev, 1991. **13**(1): p. 93-109.
90. Schlenker, R.E., *Nursing home costs, Medicaid rates, and profits under alternative Medicaid payment systems*. Health Serv Res, 1991. **26**(5): p. 623-49.
91. Wodchis, W.P., R.A. Hirth, and B.E. Fries, *Effect of Medicaid payment on rehabilitation care for nursing home residents*. Health Care Financ Rev, 2007. **28**(3): p. 117-29.
92. Harrington, C., et al., *State Data Book On Long Term Care, 2007 Program And Market Characteristics*. 2008, San Francisco, CA: Department of Social and Behavioral Science, University of California, San Francisco.
93. Feng, Z., et al., *The effect of state medicaid case-mix payment on nursing home resident acuity*. Health Serv Res, 2006. **41**(4 Pt 1): p. 1317-36.
94. Grabowski, D.C., *The economic implications of case-mix Medicaid reimbursement for nursing home care*. Inquiry, 2002. **39**(3): p. 258-78.
95. White, C., *Medicare's prospective payment system for skilled nursing facilities: effects on staffing and quality of care*. Inquiry, 2005. **42**(4): p. 351-66.
96. Konetzka, R.T., et al., *Effects of Medicare payment changes on nursing home staffing and deficiencies*. Health Serv Res, 2004. **39**(3): p. 463-88.

97. White, C., *Rehabilitation therapy in skilled nursing facilities: effects of Medicare's new prospective payment system*. Health Aff (Millwood), 2003. **22**(3): p. 214-23.
98. Clarke, G., *Evaluation of the Florida Title XIX long term care reimbursement plan*. 1992, Florida Department of Health and Human Services: Tallahassee, FL.
99. Wiener, J. and D. Stevenson, *Long term care for the elderly: Profiles of thirteen states*. 1998, Urban Institute: Washington, DC.
100. Street, D., et al., *Reinventing long-term care: the effect of policy changes on trends in nursing home reimbursement and resident characteristics--Florida, 1989-1997*. Gerontologist, 2003. **43 Spec No 2**: p. 118-31.
101. *Nursing Homes: A System in Crisis*. Available at <http://www.chcf.org/~media/MEDIA%20LIBRARY%20Files/PDF/N/PDF%20NursingHomeSnapshot04.pdf>. 2004, California Healthcare Foundation.
102. *Assembly Bill No. 1107*. Available at http://www.leginfo.ca.gov/pub/99-00/bill/asm/ab_1101-1150/ab_1107_bill_19990722_chaptered.pdf. 1999.
103. Coughlin, T.A. and S. Zuckerman, *States' Use of Medicaid Maximization Strategies to Tap Federal Revenues: Program Implications and Consequences*. 2002, Urban Institute.
104. *AB1629 Legislative*. Available at <http://www.dhcs.ca.gov/services/medical/Documents/AB1629/Legislative/AB%201629.pdf>, California Department of Health Care Services.
105. *Assembly Bill No. 1489*. Available at http://www.dhcs.ca.gov/services/medical/Documents/AB1629/Legislative/ab_1489_bill_20120927_chaptered.pdf. 2012.
106. *Consumer Recommendations to Reform AB 1629, Submitted to the AB 1629 Workgroup on January 12, 2009*. Available at <http://www.dhcs.ca.gov/services/medical/Documents/SNF%20Quality%20Workgroup/AB%201629%20Recommendations%20CANHR-AARP-DRA-OSC.pdf>. Accessed July 14, 2013.
107. *AB1629-Bill Analysis*. Available at http://www.leginfo.ca.gov/pub/03-04/bill/asm/ab_1601-1650/ab_1629_cfa_20040902_151752_asm_floor.html. Accessed July 14, 2013.
108. *Methods and standards for establishing facility-specific reimbursement rates for freestanding skilled nursing facilities level-B and subacute care units of freestanding skilled nursing facilities*, California Department of Health Care Services.

109. Sparer, M.S., *States in a reformed health system: lessons from nursing home policy*. Health Aff (Millwood), 1993. **12**(1): p. 7-20.
110. Scanlon, W.J., *A theory of the nursing home market*. Inquiry, 1980. **17**(1): p. 25-41.
111. Norton, E.C., 'Long-term care', in A.J. Culyer and J.P. Newhouse (eds), *Handbook of Health Economics (Volume 1)*. 2000, New York, NY: Elsevier Science BV.
112. Vogel, R.J. and H.C. Palmer, *Long Term Care: Perspectives from Research and Demonstrations* 1985: Aspen Pub
113. Nyman, J.A., *Prospective and "cost-plus" Medicaid reimbursement, excess Medicaid demand, and the quality of nursing home care*. J Health Econ, 1985. **4**(3): p. 237-59.
114. Harrington, C., et al., *Trends in state certificate of need and moratoria programs for long term care providers*. J Health Soc Policy, 2004. **19**(2): p. 31-58.
115. *Certificate of Need: State Health Laws and Programs*. Available at <http://www.ncsl.org/IssuesResearch/Health/CONCertificateofNeedStateLaws/tabid/14373/Default.aspx>.
116. *Nursing Home State Operations Manual*. Available at https://www.cms.gov/GuidanceforLawsandRegulations/12_NHs.asp. 2011.
117. Grabowski, D.C., J. Gruber, and J.J. Angelelli, *Nursing Home Quality as a Common Good*. Rev Econ Stat, 2008. **90**(4): p. 754-764.
118. Troyer, J.L., *Examining differences in death rates for medicaid and non-medicaid nursing home residents*. Med Care, 2004. **42**(10): p. 985-91.
119. Konetzka, R.T. and R.M. Werner, *Disparities in long-term care: building equity into market-based reforms*. Med Care Res Rev, 2009. **66**(5): p. 491-521.
120. Spector, W.D., T.M. Selden, and J.W. Cohen, *The impact of ownership type on nursing home outcomes*. Health Econ, 1998. **7**(7): p. 639-53.
121. O'Neill, C., et al., *Quality of care in nursing homes: an analysis of relationships among profit, quality, and ownership*. Med Care, 2003. **41**(12): p. 1318-30.
122. Sloan, F.A., 'Nor-for-profit ownership and hospital behavior', in A.J. Culyer and J.P. Newhouse (eds), *Handbook of Health Economics (Volume 1)*. 2000, New York: Elsevier Science BV.
123. Bostick, J.E., et al., *Systematic review of studies of staffing and quality in nursing homes*. J Am Med Dir Assoc, 2006. **7**(6): p. 366-76.

124. Konetzka, R.T., S.C. Stearns, and J. Park, *The staffing-outcomes relationship in nursing homes*. Health Serv Res, 2008. **43**(3): p. 1025-42.
125. Smith, K. and R. Baughman, *Caring for America's aging population: a profile of the direct-care workforce*. Monthly Labor Review. 2007.
126. Temple, A., D. Dobbs, and R. Andel, *Exploring correlates of turnover among nursing assistants in the National Nursing Home Survey*. Health Care Manage Rev, 2009. **34**(2): p. 182-90.
127. Thomas, K.S., et al., *The relationships among licensed nurse turnover, retention, and rehospitalization of nursing home residents*. Gerontologist, 2013. **53**(2): p. 211-21.
128. Castle, N.G., J. Engberg, and A. Men, *Nursing home staff turnover: impact on nursing home compare quality measures*. Gerontologist, 2007. **47**(5): p. 650-61.
129. Castle, N.G. and J. Engberg, *Staff turnover and quality of care in nursing homes*. Med Care, 2005. **43**(6): p. 616-26.
130. Zheng, N.T., et al., *Hospice Utilization in Nursing Homes: Association With Facility End-of-Life Care Practices*. Gerontologist, 2013. **53**(5): p. 817-27.
131. *Quality Measures for National Public Reporting: User's Manual, v1.2*. 2004, Abt Associates Inc.: Cambridge, MA.
132. Mor, V., et al., *Inter-rater reliability of nursing home quality indicators in the U.S*. BMC Health Serv Res, 2003. **3**(1): p. 20.
133. Lawton, M.P., et al., *Psychometric characteristics of the minimum data set II: validity*. J Am Geriatr Soc, 1998. **46**(6): p. 736-44.
134. Mor, V., et al., *Temporal and Geographic variation in the validity and internal consistency of the Nursing Home Resident Assessment Minimum Data Set 2.0*. BMC Health Serv Res, 2011. **11**: p. 78.
135. *Medi-Cal for Seniors*. Available at <http://www.chcf.org/publications/2003/09/medical-for-seniors>, in *Medi-Cal Facts. Number 14, September 2003*, Medi-Cal Policy Institute.
136. Mor, V., et al., *The quality of quality measurement in U.S. nursing homes*. Gerontologist, 2003. **43 Spec No 2**: p. 37-46.
137. *Nursing home value-based purchasing demonstration (Design Refinements Report)*. Available at <http://www.cms.gov/demoprojectsevalrpts/md/itemdetail.asp?itemid=CMS1198946>. Accessed on August 10, 2011. 2009, Abt Associates Inc.

138. Grabowski, D.C., et al., *Predictors of nursing home hospitalization: a review of the literature*. Med Care Res Rev, 2008. **65**(1): p. 3-39.
139. Thomas, D.R., *The new F-tag 314: prevention and management of pressure ulcers*. J Am Med Dir Assoc, 2006. **7**(8): p. 523-31.
140. *Pressure ulcers prevalence, cost and risk assessment: consensus development conference statement--The National Pressure Ulcer Advisory Panel*. Decubitus, 1989. **2**(2): p. 24-8.
141. Thomas, D.R., *Prevention and treatment of pressure ulcers*. J Am Med Dir Assoc, 2006. **7**(1): p. 46-59.
142. Stechmiller, J.K., et al., *Guidelines for the prevention of pressure ulcers*. Wound Repair Regen, 2008. **16**(2): p. 151-68.
143. Reddy, M., S.S. Gill, and P.A. Rochon, *Preventing pressure ulcers: a systematic review*. JAMA, 2006. **296**(8): p. 974-84.
144. Horn, S.D., et al., *RN staffing time and outcomes of long-stay nursing home residents: pressure ulcers and other adverse outcomes are less likely as RNs spend more time on direct patient care*. Am J Nurs, 2005. **105**(11): p. 58-70; quiz 71.
145. Morris, J.N., B.E. Fries, and S.A. Morris, *Scaling ADLs within the MDS*. J Gerontol A Biol Sci Med Sci, 1999. **54**(11): p. M546-53.
146. Morris, J.N., et al., *MDS Cognitive Performance Scale*. J Gerontol, 1994. **49**(4): p. M174-82.
147. Gastmans, C. and K. Milisen, *Use of physical restraint in nursing homes: clinical-ethical considerations*. J Med Ethics, 2006. **32**(3): p. 148-52.
148. Castle, N.G. and J. Engberg, *The health consequences of using physical restraints in nursing homes*. Med Care, 2009. **47**(11): p. 1164-73.
149. Castle, N.G., *Nursing homes with persistent deficiency citations for physical restraint use*. Med Care, 2002. **40**(10): p. 868-78.
150. Castle, N.G. and R.A. Anderson, *Caregiver staffing in nursing homes and their influence on quality of care: using dynamic panel estimation methods*. Med Care, 2011. **49**(6): p. 545-52.
151. Dubeau, C.E., S.E. Simon, and J.N. Morris, *The effect of urinary incontinence on quality of life in older nursing home residents*. J Am Geriatr Soc, 2006. **54**(9): p. 1325-33.

152. Schnelle, J.F. and F.W. Leung, *Urinary and fecal incontinence in nursing homes*. Gastroenterology, 2004. **126**(1 Suppl 1): p. S41-7.
153. Eustice, S., B. Roe, and J. Paterson, *Prompted voiding for the management of urinary incontinence in adults*. Cochrane Database Syst Rev, 2000(2): p. CD002113.
154. Fink, H.A., et al., *Treatment interventions in nursing home residents with urinary incontinence: a systematic review of randomized trials*. Mayo Clin Proc, 2008. **83**(12): p. 1332-43.
155. Ouslander, J.G., A.D. Weinberg, and V. Phillips, *Inappropriate hospitalization of nursing facility residents: a symptom of a sick system of care for frail older people*. J Am Geriatr Soc, 2000. **48**(2): p. 230-1.
156. Binder, E.F., et al., *Predictors of short-term functional decline in survivors of nursing home-acquired lower respiratory tract infection*. J Gerontol A Biol Sci Med Sci, 2003. **58**(1): p. 60-7.
157. Charette, S.L., *Hospitalization of the nursing home patient*. J Am Med Dir Assoc, 2003. **4**(2): p. 90-4.
158. Dobalian, A., *Nursing facility compliance with do-not-hospitalize orders*. Gerontologist, 2004. **44**(2): p. 159-65.
159. Cohen-Mansfield, J. and S. Lipson, *To hospitalize or not to hospitalize? That is the question: an analysis of decision making in the nursing home*. Behav Med, 2006. **32**(2): p. 64-70.
160. *Cost Drivers for Dually Eligible Beneficiaries: Potentially Avoidable Hospitalizations from Nursing Facility, Skilled Nursing Facility, and Home and Community-Based Services Waiver Programs. Final Task 2 Report*. August 2010; Available from: www.cms.gov/Reports/Downloads/costdriverstask2.pdf. Accessed on July 12, 2011.
161. Carter, M.W., *Factors associated with ambulatory care--sensitive hospitalizations among nursing home residents*. J Aging Health, 2003. **15**(2): p. 295-331.
162. Carter, M.W. and F.W. Porell, *Vulnerable populations at risk of potentially avoidable hospitalizations: the case of nursing home residents with Alzheimer's disease*. Am J Alzheimers Dis Other Dement, 2005. **20**(6): p. 349-58.
163. Cai, S., et al., *Validation of the Minimum Data Set in identifying hospitalization events and payment source*. J Am Med Dir Assoc, 2011. **12**(1): p. 38-43.

164. *Report to Congress: Appropriateness of Minimum Nurse Staffing Ratios In Nursing Homes*. 2000, Centers for Medicare and Medicaid Services: Baltimore, MD.
165. Fox, J., *Regression Diagnostics: An Introduction*. 1991: Sage Publications.
166. Grabowski, D.C. and D.G. Stevenson, *Ownership conversions and nursing home performance*. Health Serv Res, 2008. **43**(4): p. 1184-203.
167. Zwanziger, J., D.B. Mukamel, and I. Indridason, *Use of resident-origin data to define nursing home market boundaries*. Inquiry, 2002. **39**(1): p. 56-66.
168. Fries, B.E., et al., *Refining a case-mix measure for nursing homes: Resource Utilization Groups (RUG-III)*. Med Care, 1994. **32**(7): p. 668-85.
169. Fitzmaurice, G., N. Laird, and J. Ware, *Applied Longitudinal Analysis, Second Edition*. 2004, Hoboken, New Jersey: WILEY.
170. Hsiao, C., *Analysis of Panel Data. Second Edition*. 2003, Cambridge, United Kingdom: Cambridge University Press.
171. Donner, A. and M. Eliasziw, *Sample size requirements for reliability studies*. Stat Med, 1987. **6**(4): p. 441-8.
172. Allen, M.H., et al., *The expert consensus guideline series. Treatment of behavioral emergencies 2005*. J Psychiatr Pract, 2005. **11 Suppl 1**: p. 5-108; quiz 110-2.
173. Allen, M.H., *Managing the agitated psychotic patient: a reappraisal of the evidence*. J Clin Psychiatry, 2000. **61 Suppl 14**: p. 11-20.
174. Brannon, D., et al., *An exploration of job, organizational, and environmental factors associated with high and low nursing assistant turnover*. Gerontologist, 2002. **42**(2): p. 159-68; discussion 157-8.
175. Castle, N.G. and J. Engberg, *Organizational characteristics associated with staff turnover in nursing homes*. Gerontologist, 2006. **46**(1): p. 62-73.
176. Banaszak-Holl, J. and M.A. Hines, *Factors associated with nursing home staff turnover*. Gerontologist, 1996. **36**(4): p. 512-7.
177. Anderson, R.A., K.N. Corazzini, and R.R. McDaniel, Jr., *Complexity science and the dynamics of climate and communication: reducing nursing home turnover*. Gerontologist, 2004. **44**(3): p. 378-88.
178. Caudill, M.E. and M. Patrick, *Turnover among nursing assistants: why they leave and why they stay*. J Long Term Care Adm, 1991. **19**(4): p. 29-32.

179. Bishop, C.E., et al., *Nursing assistants' job commitment: effect of nursing home organizational factors and impact on resident well-being*. Gerontologist, 2008. **48 Spec No 1**: p. 36-45.
180. Pillemer, K., et al., *A facility specialist model for improving retention of nursing home staff: results from a randomized, controlled study*. Gerontologist, 2008. **48 Spec No 1**: p. 80-9.
181. Mukamel, D.B., et al., *The costs of turnover in nursing homes*. Med Care, 2009. **47**(10): p. 1039-45.
182. Zinn, J., et al., *Do trends in the reporting of quality measures on the nursing home compare web site differ by nursing home characteristics?* Gerontologist, 2005. **45**(6): p. 720-30.
183. Kane, R.L., et al., *The effect of Evercare on hospital use*. J Am Geriatr Soc, 2003. **51**(10): p. 1427-34.
184. Castle, N.G. and V. Mor, *Hospitalization of nursing home residents: a review of the literature, 1980-1995*. Med Care Res Rev, 1996. **53**(2): p. 123-48.
185. Loeb, M., et al., *Effect of a clinical pathway to reduce hospitalizations in nursing home residents with pneumonia: a randomized controlled trial*. JAMA, 2006. **295**(21): p. 2503-10.
186. Xing, J., D.B. Mukamel, and H. Temkin-Greener, *Hospitalizations Among Nursing Home Residents in the Last Year of Life: Nursing Home Characteristics and Variation in Potentially Avoidable Hospitalizations*. Journal of the American Geriatrics Society, 2013.
187. *A Briefing Chartbook on Shortfalls in Medicaid Funding for Nursing Home Care*. 2002, BDO Seidman, LLP. Prepared for American Health Care Association.
188. Smith, D.B., et al., *Separate and unequal: racial segregation and disparities in quality across U.S. nursing homes*. Health Aff (Millwood), 2007. **26**(5): p. 1448-58.
189. Zinn, J., et al., *Determinants of performance failure in the nursing home industry*. Soc Sci Med, 2009. **68**(5): p. 933-40.
190. Werner, R.M., R.T. Konetzka, and G.B. Kruse, *Impact of public reporting on unreported quality of care*. Health Serv Res, 2009. **44**(2 Pt 1): p. 379-98.
191. Houser, A., W. Fox-Grage, and M.J. Gibson, *Across the states: profiles of long-term care and independent living*. 2006, AARP Public Policy Institute.

192. *Appropriateness of Minimum Nurse Staffing Ratios in Nursing Homes. Executive Summary: Phase II Report.* 2001, Abt Associates Inc: Cambridge, MA.
193. Mukamel, D., J. Schnelle, and J. Chang, *Evaluation of AB1629: "Where Did the Money Go?" A Study of the California Nursing Home Medicaid Reimbursement System.* 2011, Health Policy Research Institute, University of California, Irvine.
194. Zhao, M. and D.R. Haley, *Nursing home quality, staffing, and malpractice paid-losses.* J Health Care Finance, 2011. **38**(1): p. 1-10.
195. Kim, H., et al., *A panel data analysis of the relationships of nursing home staffing levels and standards to regulatory deficiencies.* J Gerontol B Psychol Sci Soc Sci, 2009. **64**(2): p. 269-78.
196. Boraas, D., *Fall prevention: a challenge to the health care team.* S D J Med, 1993. **46**(2): p. 63.
197. Tong, P.K., *The effects of California minimum nurse staffing laws on nurse labor and patient mortality in skilled nursing facilities.* Health Econ, 2011. **20**(7): p. 802-16.
198. Decker, F.H., et al., *Results of the 2002 AHCA Survey of Nursing Staff Vacancy and Turnover in Nursing Homes.* 2003, Health Services Research and Evaluation; American Health Care Association.
199. Cohen-Mansfield, J., *Turnover among nursing home staff. A review.* Nurs Manage, 1997. **28**(5): p. 59-62, 64.
200. Bitzan, J.E. and J.M. Kruzich, *Interpersonal relationships of nursing home residents.* Gerontologist, 1990. **30**(3): p. 385-90.
201. Castle, N.G. and J. Engberg, *The influence of staffing characteristics on quality of care in nursing homes.* Health Serv Res, 2007. **42**(5): p. 1822-47.
202. Spetz, J., et al., *California's nursing labor force: demand, supply, and shortages.* Available at http://www.futurehealth.ucsf.edu/Content/29/2008-06_Californias_Nursing_Labor_Force_Demand_Supply_and_Shortages.pdf. 2008, The center for the health professions, University of California, San Francisco.
203. Sullivan-Marx, E.M., et al., *Predictors of continued physical restraint use in nursing home residents following restraint reduction efforts.* J Am Geriatr Soc, 1999. **47**(3): p. 342-8.
204. Castle, N.G. and V. Mor, *Physical restraints in nursing homes: a review of the literature since the Nursing Home Reform Act of 1987.* Med Care Res Rev, 1998. **55**(2): p. 139-70; discussion 171-6.

205. Sloane, P.D., et al., *Physical and pharmacologic restraint of nursing home patients with dementia. Impact of specialized units.* JAMA, 1991. **265**(10): p. 1278-82.
206. Graber, D.R. and P.D. Sloane, *Nursing home survey deficiencies for physical restraint use.* Med Care, 1995. **33**(10): p. 1051-63.
207. Nordin, E., et al., *Prognostic validity of the Timed Up-and-Go test, a modified Get-Up-and-Go test, staff's global judgement and fall history in evaluating fall risk in residential care facilities.* Age Ageing, 2008. **37**(4): p. 442-8.
208. Zermansky, A.G., et al., *Clinical medication review by a pharmacist of elderly people living in care homes--randomised controlled trial.* Age Ageing, 2006. **35**(6): p. 586-91.
209. Ray, W.A., et al., *A randomized trial of a consultation service to reduce falls in nursing homes.* JAMA, 1997. **278**(7): p. 557-62.
210. Shi, L. and D.A. Singh, *Delivering Health Care in America : A Systems Approach. 4th edition.* 2008, Sudbury, Massachusetts: Jones & Bartlett Publishers.
211. McInnes, E., et al., *Support surfaces for treating pressure ulcers.* Cochrane Database Syst Rev, 2011(12): p. CD009490.
212. Zarowitz, B.J. and J.G. Ouslander, *The application of evidence-based principles of care in older persons (issue 6): urinary incontinence.* J Am Med Dir Assoc, 2007. **8**(1): p. 35-45.
213. *Urinary incontinence in adults: acute and chronic management. Clinical Practice Guideline No. 2. 1996 Update.* 1996, Agency for Health Care Policy and Research: Rockville, MD
214. Konetzka, T., et al., *Teaching to the Test: Physical Restraints vs. Antipsychotic Use Among Nursing Home Residents with Severe Dementia.* Available at <http://academyhealth.org/files/2013/monday/konetzka.pdf>. Accessed on August 6, 2013. 2013, AcademyHealth annual meeting presentation.
215. Castle, N.G., J. Engberg, and D. Liu, *Have Nursing Home Compare quality measure scores changed over time in response to competition?* Qual Saf Health Care, 2007. **16**(3): p. 185-91.
216. *National List: Nursing Homes Targeted for High-risk Pressure Ulcer and/or Physical Restraint Improvement.* Available at http://www.canhr.org/newsroom/newdev_archive/PDF/NursingHomeChart.pdf. 2008, Centers for Medicare and Medicaid Services (CMS).

217. Asch, D.A. and R.M. Werner, *Paying for performance in population health: lessons from health care settings*. Prev Chronic Dis, 2010. **7**(5): p. A98.
218. Werner, R.M., et al., *The effect of pay-for-performance in hospitals: lessons for quality improvement*. Health Aff (Millwood), 2011. **30**(4): p. 690-8.

Appendix 1

- **Legislation**

AB1629

Governor's Signing Message

BILL NUMBER: AB 1629 CHAPTERED
BILL TEXT

CHAPTER 875

FILED WITH SECRETARY OF STATE SEPTEMBER 29, 2004

APPROVED BY GOVERNOR SEPTEMBER 29, 2004

PASSED THE ASSEMBLY AUGUST 28, 2004

PASSED THE SENATE AUGUST 25, 2004

AMENDED IN SENATE AUGUST 24, 2004

AMENDED IN SENATE AUGUST 16, 2004

AMENDED IN SENATE JULY 16, 2003

AMENDED IN ASSEMBLY JUNE 2, 2003

AMENDED IN ASSEMBLY APRIL 28, 2003

INTRODUCED BY Assembly Member Frommer

(Coauthors: Assembly Members Berg, McCarthy, Nunez, Richman, and Strickland)

(Coauthors: Senators Burton and Johnson)

FEBRUARY 21, 2003

An act to add Section 1418.81 to, and to add and repeal Article 7.6 (commencing with Section 1324.20) of Chapter 2 of Division 2 of, the Health and Safety Code, and to amend Section 14105.06 of, to add and repeal Section 14126.033 of, and to repeal and add Article 3.8 (commencing with Section 14126) of Chapter 7 of Part 3 of Division 9 of, the Welfare and Institutions Code, relating to health and dependent care, making an appropriation therefore, and declaring the urgency thereof, to take effect immediately.

LEGISLATIVE COUNSEL'S DIGEST

AB 1629, Frommer. Health and dependent care facilities.

Existing law provides for the licensure and regulation of health facilities by the State Department of Health Services. Existing law provides for the imposition each state fiscal year upon the entire gross receipts of certain intermediate care facilities a quality assurance fee, as a condition of participation in the Medi-Cal program.

This bill would provide for the imposition of a quality assurance fee on each skilled nursing facility, with some exemptions, to be administered by the Director of Health Services and deposited in the State Treasury. The bill would provide that funds assessed pursuant to these provisions shall be available to enhance federal financial participation in the Medi-Cal program or to provide additional reimbursement to, and support facility quality improvement efforts in, licensed skilled nursing facilities. The bill would provide that these provisions are to be implemented as long as 2 conditions are met, including federal approval. The bill would also specify 4 circumstances, concerning continued federal approval of the quality assurance fee, the enactment and continued effect of the Medi-Cal Long-Term Reimbursement Act under this bill, the failure of the state to sustain a continued maintenance of effort for state funding of nursing

facility reimbursement, and any judicial or federal administrative determinations regarding the unavailability of federal financial participation, under which these provisions would become inoperative. In addition, these provisions would become inoperative on July 1, 2008, and would be repealed on January 1, 2009.

Existing law requires the department to perform various activities to promote the quality of care and life of residents, clients, and patients in these facilities.

This bill would require a skilled nursing facility to include in a resident's care assessment the resident's projected length of stay and the resident's discharge potential. The bill would specify additional requirements of a skilled nursing facility and attending physicians at the facility related to resident assessment, care planning, and assistance. The bill would also require the attending physician, if applicable, to indicate in the plan of care the needed care to assist the resident in achieving a resident's preference of return to the community.

Existing law provides for the Medi-Cal program, which is administered by the department and pursuant to which qualified low-income persons receive health care benefits. Existing law required that the Medi-Cal reimbursement rates in effect on August 1, 2003, remain in effect through July 31, 2005, for, among others, freestanding nursing facilities licensed as skilled nursing facilities, intermediate care facilities, and intermediate care facilities for the developmentally disabled.

This bill would delete skilled nursing facilities from the application of this reimbursement rate limitation and would, instead, provide that the reimbursement rate limitation applies to skilled nursing facilities only until the first day of the month following federal approval to implement both the skilled nursing quality assurance fee and the rate methodology.

Existing law provides for the Medi-Cal Long-Term Reimbursement Act of 1990 under which the department is required to develop a reimbursement methodology for freestanding nursing facilities licensed as skilled nursing facilities and intermediate care facilities, and for intermediate care facilities for the developmentally disabled. These provisions, among other things, require the department to implement a facility specific ratesetting system by August 1, 2004, subject to federal approval and the availability of federal or other funds.

This bill would repeal these provisions. The bill would enact the Medi-Cal Long-Term Reimbursement Act, to be under the administration of the director. The act would require the department to implement a facility specific ratesetting system, subject to federal approval, that would be effective commencing on August 1, 2005, and implemented commencing on the first day of the month following federal approval.

The bill would authorize the department to retroactively increase and make payment of rates to facilities under this provision. The act would require the department to develop and implement a cost-based reimbursement rate methodology for free standing nursing facilities. The act would require the department to seek approval of a Medicaid state plan amendment specifically outlining the reimbursement methodology developed pursuant to these provisions and would provide that this methodology shall be effective commencing on August 1, 2005, and implemented on the first day of the month following federal

approval. The act would provide that it shall remain operative only as long as the skilled nursing facility quality assurance fee provisions provided by the bill continues as approved by the federal Centers for Medicare and Medicaid Services and federal financial participation for the methodology implemented under these provisions continues. The rate methodology established pursuant to these provisions would cease to be implemented on and after July 31, 2008.

The bill would make the following appropriations:

(a) \$106,781,000 from both the State Treasury and the Federal Trust Fund to the department for expenditure to fund an increase to the 2004-05 skilled nursing facility Medi-Cal reimbursement rate consistent with the existing rate methodology in the Medicaid state plan.

(b) \$2,000,000 for the 2004-05 fiscal year and \$1,000,000 for the 2005-06 fiscal year to the department from the General Fund for expenditure for purposes of expeditiously implementing the ratesetting system that would be required under this bill.

(c) \$350,000 for both the 2004-05 fiscal year and the 2005-06 fiscal year to the department from the General Fund for expenditure for purposes of funding the implementation of the bill.

(d) \$200,000 for the 2005-06 fiscal year to the Bureau of State Audits from the General Fund for purposes of implementing the bill.

This bill would declare that it is to take effect immediately as an urgency statute.

Appropriation: yes.

THE PEOPLE OF THE STATE OF CALIFORNIA DO ENACT AS FOLLOWS:

SECTION 1. Article 7.6 (commencing with Section 1324.20) is added to Chapter 2 of Division 2 of the Health and Safety Code, to read:

Article 7.6. Skilled Nursing Facility Quality Assurance Fee

1324.20. For purposes of this article, the following definitions shall apply:

(a) "Continuing care retirement community" means a provider of a continuum of services, including independent living services, assisted living services as defined in paragraph (5) of subdivision (a) of Section 1771, and skilled nursing care, on a single campus, that is subject to Section 1791, or a provider of such a continuum of services on a single campus that has not received a Letter of Exemption pursuant to subdivision (b) of Section 1771.3.

(b) "Exempt facility" means a skilled nursing facility that is part of a continuing care retirement community, a skilled nursing facility operated by the state or another public entity, or a skilled nursing facility that is a distinct part of a facility that is licensed as a general acute care hospital.

(c) (1) "Net revenue" means gross resident revenue for routine nursing services and ancillary services provided to all residents by a skilled nursing facility, less Medicare revenue for routine and ancillary services including Medicare revenue for services provided to residents covered under a Medicare managed care plan, less payer

discounts and applicable contractual allowances as permitted under federal law and regulation.

(2) "Net revenue" does not mean charitable contributions and bad debt.

(d) "Payer discounts and contractual allowances" means the difference between the facility's resident charges for routine or ancillary services and the actual amount paid.

(e) "Skilled nursing facility" means a licensed facility as defined in subdivision (c) of Section 1250.

1324.21. (a) For facilities licensed under subdivision (c) of Section 1250, there shall be imposed each state fiscal year a uniform quality assurance fee per resident day. The uniform quality assurance fee shall be based upon the entire net revenue of all skilled nursing facilities subject to the fee, except an exempt facility, as defined in Section 1324.20, calculated in accordance with subdivision (b).

(b) The amount of the uniform quality assurance fee to be assessed per resident day shall be determined based on the aggregate net revenue of skilled nursing facilities subject to the fee, in accordance with the methodology outlined in the request for federal approval required by Section 1324.27 and in regulations, provider bulletins, or other similar instructions. The uniform quality assurance fee shall be calculated as follows:

(1) (A) For the rate year 2004-05, the net revenue shall be projected for all skilled nursing facilities subject to the fee. The projection of net revenue shall be based on prior rate year data. Once determined, the aggregate projected net revenue for all facilities shall be multiplied by 2.7 percent, as determined under the approved methodology, and then divided by the projected total resident days of all providers subject to the fee.

(B) Notwithstanding subparagraph (A), the Director of Health Services may increase the amount of the fee up to 3 percent of the aggregate projected net revenue if necessary for the implementation of Article 3.8 (commencing with Section 14126) of Chapter 7 of Part 3 of Division 9 of the Welfare and Institutions Code.

(2) For the rate year 2005-06 and subsequent rate years through and including the 2007-08 rate year, the net revenue shall be projected for all skilled nursing facilities subject to the uniform quality assurance fee. The projection of net revenue shall be based on the prior rate year's data. Once determined, the aggregate projected net revenue for all facilities shall be multiplied by 6 percent, as determined under the approved methodology, and then divided by the projected total resident days of all providers subject to the fee.

(c) The director may assess and collect a nonuniform fee consistent with the methodology approved pursuant to Section 1324.27.

(d) In no case shall the aggregate fees collected annually pursuant to this article exceed 6 percent of the annual aggregate net revenue for licensed skilled nursing facilities subject to the fee.

(e) If there is a delay in the implementation of this article for any reason, including a delay in the approval of the quality assurance fee and methodology by the federal Centers for Medicare and Medicaid Services, in the 2004-05 rate year or in any other rate year, all of the following shall apply:

(1) Any facility subject to the fee may be assessed the amount the facility will be required to pay to the department, but shall not be required to pay the fee until the methodology is approved and Medi-Cal rates are increased in accordance with paragraph (2) of subdivision (a) of Section 1324.28 and the increased rates are paid to facilities.

(2) The department may retroactively increase and make payment of rates to facilities.

(3) Facilities that have been assessed a fee by the department shall pay the fee assessed within 60 days of the date rates are increased in accordance with paragraph (2) of subdivision (a) of Section 1324.28 and paid to facilities.

(4) The department shall accept a facility's payment notwithstanding that the payment is submitted in a subsequent fiscal year than the fiscal year in which the fee is assessed.

1324.22. (a) The quality assurance fee, as calculated pursuant to Section 1324.21, shall be paid by the provider to the department for deposit in the State Treasury on a monthly basis on or before the last day of the month following the month for which the fee is imposed, except as provided in subdivision (d) of Section 1324.21.

(b) On or before the last day of each calendar quarter, each skilled nursing facility shall file a report with the department, in a prescribed form, showing the facility's total resident days for the preceding quarter and payments made. If it is determined that a lesser amount was paid to the department, the facility shall pay the amount owed in the preceding quarter to the department with the report. Any amount determined to have been paid in excess to the department during the previous quarter shall be credited to the amount owed in the following quarter.

(c) On or before August 31 of each year, each skilled nursing facility subject to an assessment pursuant to Section 1324.21 shall report to the department, in a prescribed form, the facility's total resident days and total payments made for the preceding state fiscal year. If it is determined that a lesser amount was paid to the department during the previous year, the facility shall pay the amount owed to the department with the report.

(d) A newly licensed skilled nursing facility, as defined by the department, shall complete all requirements of subdivision (a) for any portion of the year in which it commences operations and of subdivision (b) for any portion of the quarter in which it commences operations.

(e) When a skilled nursing facility fails to pay all or part of the quality assurance fee within 60 days of the date that payment is due, the department may deduct the unpaid assessment and interest owed from any Medi-Cal reimbursement payments to the facility until the full amount is recovered. Any deduction shall be made only after written notice to the facility and may be taken over a period of time taking into account the financial condition of the facility.

(f) Should all or any part of the quality assurance fee remain unpaid, the department may take either or both of the following actions:

(1) Assess a penalty equal to 50 percent of the unpaid fee amount.

(2) Delay license renewal.

(g) In accordance with the provisions of the Medicaid state plan, the payment of the quality assurance fee shall be considered as an allowable cost for Medi-Cal reimbursement purposes.

(h) The assessment process pursuant to this section shall become operative not later than 60 days from receipt of federal approval of the quality assurance fee, unless extended by the department. The department may assess fees and collect payment in accordance with subdivision (d) of Section 1324.21 in order to provide retroactive payments for any rate increase authorized under this article.

1324.23. (a) The Director of Health Services, or his or her designee, shall administer this article.

(b) The director may adopt regulations as are necessary to implement this article. These regulations may be adopted as emergency regulations in accordance with the rulemaking provisions of the Administrative Procedure Act (Chapter 3.5 (commencing with Section 11340) of Part 1 of Division 3 of Title 2 of the Government Code). For purposes of this article, the adoption of regulations shall be deemed an emergency and necessary for the immediate preservation of the public peace, health and safety, or general welfare. The regulations shall include, but need not be limited to, any regulations necessary for any of the following purposes:

(1) The administration of this article, including the proper imposition and collection of the quality assurance fee not to exceed amounts reasonably necessary for purposes of this article.

(2) The development of any forms necessary to obtain required information from facilities subject to the quality assurance fee.

(3) To provide details, definitions, formulas, and other requirements.

(c) As an alternative to subdivision (b), and notwithstanding the rulemaking provisions of Chapter 3.5 (commencing with Section 11340) of Part 1 of Division 3 of Title 2 of the Government Code, the director may implement this article, in whole or in part, by means of a provider bulletin, or other similar instructions, without taking regulatory action, provided that no such bulletin or other similar instructions shall remain in effect after July 31, 2007. It is the intent of the Legislature that the regulations adopted pursuant to subdivision (b) shall be adopted on or before July 31, 2007.

1324.24. The quality assurance fee assessed and collected pursuant to this article shall be deposited in the State Treasury.

1324.25. The funds assessed pursuant to this article shall be available to enhance federal financial participation in the Medi-Cal program or to provide additional reimbursement to, and to support facility quality improvement efforts in, licensed skilled nursing facilities.

1324.26. In implementing this article, the department may utilize the services of the Medi-Cal fiscal intermediary through a change order to the fiscal intermediary contract to administer this program, consistent with the requirements of Sections 14104.6, 14104.7, 14104.8, and 14104.9 of the Welfare and Institutions Code.

1324.27. (a) (1) The department shall request approval from the federal Centers for Medicare and Medicaid Services for the implementation of this article. In making this request, the department shall seek specific approval from the federal Centers for Medicare and Medicaid Services to exempt facilities identified in subdivision (b) of

Section 1324.20, including the submission of a request for waiver of broad based requirement, waiver of uniform fee requirement, or both, pursuant to paragraphs (1) and (2) of subdivision (e) of Section 433.68 of Title 42 of the Code of Federal Regulations.

(2) The director may alter the methodology specified in this article, to the extent necessary to meet the requirements of federal law or regulations or to obtain federal approval. The Director of Health Services may also add new categories of exempt facilities, such as facilities designated as institutions for mental diseases or special treatment programs, or apply a nonuniform fee to the skilled nursing facilities subject to the fee in order to meet requirements of federal law or regulations. The Director of Health Services may apply a zero fee to one or more exempt categories of facilities, if necessary to obtain federal approval.

(3) If after seeking federal approval, federal approval is not obtained, this article shall not be implemented.

(b) The department shall make retrospective adjustments, as necessary, to the amounts calculated pursuant to Section 1324.21 in order to assure that the aggregate quality assurance fee for any particular state fiscal year does not exceed 6 percent of the aggregate annual net revenue of facilities subject to the fee.

1324.28. (a) This article shall be implemented as long as both of the following conditions are met:

(1) The state receives federal approval of the quality assurance fee from the federal Centers for Medicare and Medicaid Services.

(2) Legislation is enacted in the 2004 legislative session making an appropriation from the General Fund and from the Federal Trust Fund to fund a rate increase for skilled nursing facilities, as defined under subdivision (c) of Section 1250, for the 2004-05 rate year in an amount consistent with the Medi-Cal rates that specific facilities would have received under the rate methodology in effect as of July 31, 2004, plus the proportional costs as projected by Medi-Cal for new state or federal mandates.

(b) This article shall remain operative only as long as all of the following conditions are met:

(1) The federal Centers for Medicare and Medicaid Services continues to allow the use of the provider assessment provided in this article.

(2) The Medi-Cal Long Term Care Reimbursement Act, Article 3.8 (commencing with Section 14126) of Chapter 3 of Part 3 of Division 9 of the Welfare and Institutions Code, as added during the 2003-04 Regular Session by the act adding this section, is enacted and implemented on or before July 31, 2005, or as extended as provided in that article, and remains in effect thereafter.

(3) The state has continued its maintenance of effort for the level of state funding of nursing facility reimbursement for rate year 2005-06, and for every subsequent rate year continuing through the 2007-08 rate year, in an amount not less than the amount that specific facilities would have received under the rate methodology in effect on July 31, 2004, plus Medi-Cal's projected proportional costs for new state or federal mandates, not including the quality assurance fee.

(4) The full amount of the quality assurance fee assessed and collected pursuant to this article remains available for the purposes specified in Section 1324.25 and for related purposes.

(c) If all of the conditions in subdivision (a) are met, this article is implemented, and subsequently, any one of the conditions in subdivision (b) is not met, on and after the date that the department makes that determination, this article shall not be implemented, notwithstanding that the condition or conditions subsequently may be met.

(d) Notwithstanding subdivisions (a), (b), and (c), in the event of a final judicial determination made by any state or federal court that is not appealed, or by a court of appellate jurisdiction that is not further appealed, in any action by any party, or a final determination by the administrator of the federal Centers for Medicare and Medicaid Services, that federal financial participation is not available with respect to any payment made under the methodology implemented pursuant to this article because the methodology is invalid, unlawful, or contrary to any provision of federal law or regulations, or of state law, this section shall become inoperative.

1324.29. The quality assurance fee shall cease to be assessed and collected on or after July 31, 2008.

1324.30. This article shall become inoperative on July 1, 2008, and, as of January 1, 2009, is repealed, unless a later enacted statute, that becomes operative on or before January 1, 2009, deletes or extends the dates on which it becomes inoperative and is repealed.

SEC. 2. Section 1418.81 is added to the Health and Safety Code, to read:

1418.81. (a) In order to assure the provision of quality patient care and as part of the planning for that quality patient care, commencing at the time of admission, a skilled nursing facility, as defined in subdivision (c) of Section 1250, shall include in a resident's care assessment the resident's projected length of stay and the resident's discharge potential. The assessment shall include whether the resident has expressed or indicated a preference to return to the community and whether the resident has social support, such as family, that may help to facilitate and sustain return to the community. The assessment shall be recorded with the relevant portions of the minimum data set, as described in Section 14110.15 of the Welfare and Institutions Code. The plan of care shall reflect, if applicable, the care ordered by the attending physician needed to assist the resident in achieving the resident's preference of return to the community.

(b) The skilled nursing facility shall evaluate the resident's discharge potential at least quarterly or upon a significant change in the resident's medical condition.

(c) The interdisciplinary team shall oversee the care of the resident utilizing a team approach to assessment and care planning and shall include the resident's attending physician, a registered professional nurse with responsibility for the resident, other appropriate staff in disciplines as determined by the resident's needs, and, where practicable, a resident's representative, in accordance with applicable federal and state requirements.

(d) If return to the community is part of the care plan, the facility shall provide to the resident or responsible party and document in the care plan the information concerning services and resources in the community. That information may include information concerning:

(1) In-home supportive services provided by a public authority or other legally recognized entity, if any.

(2) Services provided by the Area Agency on Aging, if any.

(3) Resources available through an independent living center.

(4) Other resources or services in the community available to support return to the community.

(e) If the resident is otherwise eligible, a skilled nursing facility shall make, to the extent services are available in the community, a reasonable attempt to assist a resident who has a preference for return to the community and who has been determined to be able to do so by the attending physician, to obtain assistance within existing programs, including appropriate case management services, in order to facilitate return to the community. The targeted case management services provided by entities other than the skilled nursing facility shall be intended to facilitate and sustain return to the community.

(f) Costs to skilled nursing facilities to comply with this section shall be allowable for Medi-Cal reimbursement purposes pursuant to Section 1324.25, but shall not be considered a new state mandate under Section 14126.023 of the Welfare and Institutions Code.

SEC. 3. Section 14105.06 of the Welfare and Institutions Code is amended to read:

14105.06. (a) Notwithstanding Section 14105 and any other provision of law, the Medi-Cal reimbursement rates in effect on August 1, 2003, shall remain in effect through July 31, 2005, for the following providers:

(1) Freestanding nursing facilities licensed as either of the following:

(A) An intermediate care facility pursuant to subdivision (d) of Section 1250 of the Health and Safety Code.

(B) An intermediate care facility for the developmentally disabled pursuant to subdivision (e), (g), or (h) of Section 1250 of the Health and Safety Code.

(2) A skilled nursing facility that is a distinct part of a general acute care hospital. For purposes of this paragraph, "distinct part" shall have the same meaning as defined in Section 72041 of Title 22 of the California Code of Regulations.

(3) A subacute care program, as described in Section 14132.25 or subacute care unit, as described in Sections 51215.5 and 51215.8 of Title 22 of the California Code of Regulations. (4) An adult day health care center.

(b) (1) The director may adopt regulations as are necessary to implement subdivision (a). These regulations shall be adopted as emergency regulations in accordance with the rulemaking provisions of the Administrative Procedure Act, Chapter 3.5 (commencing with Section 11340) of Part 1 of Division 3 of Title 2 of the Government Code. For purposes of this section, the adoption of regulations shall be deemed an emergency and necessary for the immediate preservation of the public peace, health, and safety or general welfare.

(2) As an alternative to paragraph (1), and Chapter 3.5 (commencing with Section 11340) of Part 1 of Division 3 of Title 2 of the Government Code, the director may implement this article by means of a

provider bulletin, or similar instructions, without taking regulatory action.

(c) The director shall implement subdivision (a) in a manner that is consistent with federal Medicaid law and regulations. The director shall seek any necessary federal approvals for the implementation of this section. This section shall be implemented only to the extent that federal approval is obtained.

(d) The provisions of subdivision (a) shall apply to a skilled nursing facility, as defined in subdivision (c) of Section 1250 of the Health and Safety Code, only until the first day of the month following federal approval to implement both the skilled nursing quality assurance fee imposed by Article 7.6 (commencing with Section 1324.20) of Chapter 2 of Division 2 of the Health and Safety Code and the rate methodology developed pursuant to Article 3.8 (commencing with Section 14126) of Chapter 3 of Part 3 of Division 9.

SEC. 4. Article 3.8 (commencing with Section 14126) of Chapter 7 of Part 3 of Division 9 of the Welfare and Institutions Code is repealed.

SEC. 5. Article 3.8 (commencing with Section 14126) is added to Chapter 7 of Part 3 of Division 9 of the Welfare and Institutions Code, to read:

Article 3.8. Medi-Cal Long-Term Care Reimbursement Act

14126. This article shall be known as the Medi-Cal Long-Term Care Reimbursement Act.

14126.02. (a) It is the intent of the Legislature to devise a Medi-Cal long-term care reimbursement methodology that more effectively ensures individual access to appropriate long-term care services, promotes quality resident care, advances decent wages and benefits for nursing home workers, supports provider compliance with all applicable state and federal requirements, and encourages administrative efficiency.

(b) The department shall implement a facility-specific ratesetting system, subject to federal approval and the availability of federal funds, that reflects the costs and staffing levels associated with quality of care for residents in nursing facilities, as defined in subdivision (c) of Section 1250 of the Health and Safety Code. The facility-specific ratesetting system shall be effective commencing on August 1, 2005, and shall be implemented commencing on the first day of the month following federal approval. The department may retroactively increase and make payment of rates to facilities.

(c) In implementing this section, the department may contract as necessary, on a bid or nonbid basis, for professional consulting services from nationally recognized higher education and research institutions, or other qualified individuals and entities not associated with a skilled nursing facility, with demonstrated expertise in long-term care reimbursement systems. The ratesetting system specified in subdivision (b) shall be developed with all possible expedience. This subdivision establishes an accelerated process for issuing contracts pursuant to this section and contracts entered into pursuant to this subdivision shall be exempt from the requirements of Chapter 1 (commencing with Section 10100) and Chapter 2 (commencing

with Section 10290) of Part 2 of Division 2 of the Public Contract Code.

(d) The department shall implement a facility-specific ratesetting system by August 1, 2004, subject to federal approval and availability of federal or other funds, that reflects the costs and staffing levels associated with quality of care for residents in hospital-based nursing facilities.

14126.021. The department shall develop and implement a cost-based reimbursement rate methodology using the cost categories as described in Section 14126.023, for freestanding nursing facilities pursuant to this article, excluding nursing facilities that are a distinct part of a facility that is licensed as a general acute care hospital as identified pursuant to subdivision (d) of Section 14126.02. The cost-based reimbursement rate methodology shall be effective on August 1, 2005, and shall be implemented on the first day of the month following federal approval.

14126.023. (a) The methodology developed pursuant to this article shall be facility specific and reflect the sum of the projected cost of each cost category and passthrough costs, as follows:

(1) Labor costs limited as specified in subdivision (c).

(2) Indirect care nonlabor costs limited to the 75th percentile.

(3) Administrative costs limited to the 50th percentile.

(4) Capital costs based on a fair rental value system (FRVS) limited as specified in subdivision (d).

(5) Direct passthrough of proportional Medi-Cal costs for property taxes, facility license fees, new state and federal mandates, caregiver training costs, and liability insurance projected on the prior year's costs.

(b) The percentiles in paragraphs (1) through (3) of subdivision (a) shall be based on annualized costs divided by total resident days and computed on a specific geographic peer group basis. Costs within a specific cost category shall not be shifted to any other cost category.

(c) The labor costs category shall be comprised of a direct resident care labor cost category, an indirect care labor cost category, and a labor-driven operating allocation cost category, as follows:

(1) Direct resident care labor cost category which shall include all labor costs related to routine nursing services including all nursing, social services, activities, and other direct care personnel. These costs shall be limited to the 90th percentile.

(2) Indirect care labor cost category which shall include all labor costs related to staff supporting the delivery of patient care including, but not limited to, housekeeping, laundry and linen, dietary, medical records, inservice education, and plant operations and maintenance. These costs shall be limited to the 90th percentile.

(3) Labor-driven operating allocation shall include an amount equal to 8 percent of labor costs, minus expenditures for temporary staffing, which may be used to cover allowable Medi-Cal expenditures.

In no instance shall the operating allocation exceed 5 percent of the facility's total Medi-Cal reimbursement rate.

(d) The capital cost category shall be based on a FRVS that recognizes the value of the capital related assets necessary to care for Medi-Cal residents. The capital cost category includes mortgage principal and interest, leases, leasehold improvements, depreciation of real property, equipment, and other capital related expenses. The FRVS

methodology shall be based on the formula developed by the department that assesses facility value based on age and condition and uses a recognized market interest factor. Capital investment and improvement expenditures included in the FRVS formula shall be documented in cost reports or supplemental reports required by the department. The capital costs based on FRVS shall be limited as follows:

(1) For the 2005-06 rate year, the capital cost category for all facilities in the aggregate shall not exceed the department's estimated value for this cost category for the 2004-05 rate year.

(2) For the 2006-07 rate year and subsequent rate years, the maximum annual increase for the capital cost category for all facilities in the aggregate shall not exceed 8 percent of the prior rate year's FRVS cost component.

(3) If the total capital costs for all facilities in the aggregate for the 2005-06 rate year exceeds the value of the capital costs for all facilities in the aggregate for the 2004-05 rate year, or if that capital cost category for all facilities in the aggregate for the 2006-07 rate year or any rate year thereafter exceeds 8 percent of the prior rate year's value, the department shall reduce the capital cost category for all facilities in equal proportion in order to comply with paragraphs (1) and (2).

(e) For the 2005-06 and 2006-07 rate years, the facility specific Medi-Cal reimbursement rate calculated under this article shall not be less than the Medi-Cal rate that the specific facility would have received under the rate methodology in effect as of July 31, 2005, plus Medi-Cal's projected proportional costs for new state or federal mandates for rate years 2005-06 and 2006-07, respectively.

(f) The department shall update each facility specific rate calculated under this methodology annually. The update process shall be prescribed in the Medicaid state plan, regulations, and the provider bulletins or similar instructions described in Section 14126.027, and shall be adjusted in accordance with the results of facility specific audit and review findings in accordance with subdivisions (h) and (i).

(g) The department shall establish rates pursuant to this article on the basis of facility cost data reported in the integrated long-term care disclosure and Medi-Cal cost report required by Section 128730 of the Health and Safety Code for the most recent reporting period available, and cost data reported in other facility financial disclosure reports or supplemental information required by the department in order to implement this article.

(h) The department shall conduct financial audits of facility and home office cost data as follows:

(1) The department shall audit facilities a minimum of once every three years to ensure accuracy of reported costs.

(2) It is the intent of the Legislature that the department develop and implement limited scope audits of key cost centers or categories to assure that the rate paid in the years between each full scope audit required in paragraph (1) accurately reflects actual costs.

(3) For purposes of updating facility specific rates, the department shall adjust or reclassify costs reported consistent with applicable requirements of the Medicaid state plan as required by Part 413 (commencing with Section 413.1) of Title 42 of the Code of Federal Regulations.

(4) Overpayments to any facility shall be recovered in a manner consistent with applicable recovery procedures and requirements of state and federal laws and regulations.

(i) (1) On an annual basis, the department shall use the results of audits performed pursuant to subdivision (h), the results of any federal audits, and facility cost reports, including supplemental reports of actual costs incurred in specific cost centers or categories as required by the department, to determine any difference between reported costs used to calculate a facility's rate and audited facility expenditures in the rate year.

(2) If the department determines that there is a difference between reported costs and audited facility expenditures pursuant to paragraph (1), the department shall adjust a facility's reimbursement prospectively over the intervening years between audits by an amount that reflects the difference, consistent with the methodology specified in this article.

(j) For nursing facilities that obtain an audit appeal decision that results in revision of the facility's allowable costs, the facility shall be entitled to seek a retroactive adjustment in its facility specific reimbursement rate.

(k) Compliance by each facility with state laws and regulations regarding staffing levels shall be documented annually either through facility cost reports, including supplemental reports, or through the annual licensing inspection process specified in Section 1422 of the Health and Safety Code.

14126.025. (a) The department shall seek approval of an amendment to the Medicaid state plan specifically outlining the reimbursement methodology developed pursuant to this article not later than February 1, 2005.

(b) The amendment to the Medicaid state plan pursuant to subdivision (a), and any regulations, provider bulletins, or other similar instructions, shall be prepared in consultation with representatives of the long-term care industry, organized labor, seniors, and consumers.

14126.027. (a) (1) The Director of Health Services, or his or her designee, shall administer this article.

(2) The regulations and other similar instructions adopted pursuant to this article shall be developed in consultation with representatives of the long-term care industry, organized labor, seniors, and consumers.

(b) (1) The director may adopt regulations as are necessary to implement this article. The adoption, amendment, repeal, or readoption of a regulation authorized by this section is deemed to be necessary for the immediate preservation of the public peace, health and safety, or general welfare, for purposes of Sections 11346.1 and 11349.6 of the Government Code, and the department is hereby exempted from the requirement that it describe specific facts showing the need for immediate action.

(2) The regulations adopted pursuant to this section may include, but need not be limited to, any regulations necessary for any of the following purposes:

(A) The administration of this article, including the specific analytical process for the proper determination of long-term care rates.

(B) The development of any forms necessary to obtain required cost data and other information from facilities subject to the ratesetting methodology.

(C) To provide details, definitions, formulas, and other requirements.

(c) As an alternative to the adoption of regulations pursuant to subdivision (b), and notwithstanding Chapter 3.5 (commencing with Section 11340) of Part 1 of Division 3 of Title 2 of the Government Code, the director may implement this article, in whole or in part, by means of a provider bulletin or other similar instructions, without taking regulatory action, provided that no such bulletin or other similar instructions shall remain in effect after July 31, 2007. It is the intent that regulations adopted pursuant to subdivision (b) shall be in place on or before July 31, 2007.

14126.031. (a) In implementing this article, the department may use the process outlined in subdivision (c) of Section 14126.02 to obtain professional consulting services for the purpose of finalizing design of the system, procurement of required technical hardware and software, establishing operational parameters, implementation, and transitional management pending assumption of operational management by state staff.

(b) The ratesetting system described in subdivision (b) of Section 14126.02 shall be developed expeditiously in order to meet the implementation date required under Section 14126.02.

(c) To ensure compliance with the timeframes set forth in this article, it is the intent of the Legislature that the department be authorized to hire up to three full-time equivalents to support implementation and continuous operation of the system.

14126.033. (a) This article, including Section 14126.031, shall be funded as follows:

(1) General Fund moneys appropriated for purposes of this article pursuant to Section 6 of the act adding this section shall be used for increasing rates, except as provided in Section 14126.031, for freestanding skilled nursing facilities, and shall be consistent with the approved methodology required to be submitted to the Centers for Medicare and Medicaid Services pursuant to Article 7.6 (commencing with Section 1324.20) of Chapter 2 of Division 2 of the Health and Safety Code.

(2) (A) Notwithstanding Section 14126.023, for the 2005-06 rate year, the maximum annual increase in the weighted average Medi-Cal rate required for purposes of this article shall not exceed 8 percent of the weighted average Medi-Cal reimbursement rate for the 2004-05 rate year as adjusted for the change in the cost to the facility to comply with the nursing facility quality assurance fee for the 2005-06 rate year, as required under subdivision (b) of Section 1324.21 of the Health and Safety Code, plus the total projected Medi-Cal cost to the facility of complying with new state or federal mandates.

(B) Beginning with the 2006-07 rate year, the maximum annual increase in the weighted average Medi-Cal reimbursement rate required for purposes of this article shall not exceed 5 percent of the weighted average Medi-Cal reimbursement rate for the prior fiscal year, as adjusted for the projected cost of complying with new state or federal mandates.

(C) Beginning with the 2007-08 rate year, the maximum annual increase in the weighted average Medi-Cal reimbursement rate required

for purposes of this article shall not exceed 5.5 percent of the weighted average Medi-Cal reimbursement rate for the prior fiscal year, as adjusted for the projected cost of complying with new state or federal mandates.

(D) To the extent that new rates are projected to exceed the adjusted limits calculated pursuant to subparagraph (A) or (B), the department shall adjust the increase to each skilled nursing facility's projected rate for the applicable rate year by an equal percentage.

(b) The rate methodology shall cease to be implemented on and after July 31, 2008.

(c) (1) It is the intent of the Legislature that the implementation of this article result in individual access to appropriate long-term care services, quality resident care, decent wages and benefits for nursing home workers, a stable workforce, provider compliance with all applicable state and federal requirements, and administrative efficiency.

(2) Not later than December 1, 2006, the Bureau of State Audits shall conduct an accountability evaluation of the department's progress toward implementing a facility-specific reimbursement system, including a review of data to ensure that the new system is appropriately reimbursing facilities within specified cost categories and a review of the fiscal impact of the new system on the General Fund.

(3) Not later than January 1, 2007, to the extent information is available for the three years immediately preceding the implementation of this article, the department shall provide baseline information in a report to the Legislature on all of the following:

(A) The number and percent of freestanding skilled nursing facilities that complied with minimum staffing requirements.

(B) The staffing levels prior to the implementation of this article.

(C) The staffing retention rates prior to the implementation of this article.

(D) The numbers and percentage of freestanding skilled nursing facilities with findings of immediate jeopardy, substandard quality of care, or actual harm, as determined by the certification survey of each freestanding skilled nursing facility conducted prior to the implementation of this article.

(E) The number of freestanding skilled nursing facilities that received state citations and the number and class of citations issued during calendar year 2004.

(F) The average wage and benefits for employees prior to the implementation of this article.

(4) Not later than January 1, 2008, the department shall provide a report to the Legislature that does both of the following:

(A) Compares the information required in paragraph (2) to that same information two years after the implementation of this article.

(B) Reports on the extent to which residents who had expressed a preference to return to the community, as provided in Section 1418.81, were able to return to the community.

(5) The department may contract for the reports required under this subdivision.

(d) This section shall become inoperative on July 31, 2008, and as of January 1, 2009, is repealed, unless a later enacted statute, that

is enacted before January 1, 2009, deletes or extends the dates on which it becomes inoperative and is repealed.

14126.035. (a) This article shall remain operative only as long as Article 7.6 (commencing with Section 1324.20) of Chapter 2 of Division 2 of the Health and Safety Code, which imposes a skilled nursing facility quality assurance fee continues as approved by the federal Centers for Medicare and Medicaid Services pursuant to Section 1324.27 of the Health and Safety Code.

(b) In the event of a final judicial determination made by any state or federal court that is not appealed, or by a court of appellate jurisdiction that is not further appealed, in any action by any party or a final determination by the administrator of the Centers for Medicare and Medicaid Services, that federal financial participation is not available with respect to any payment made under the methodology implemented pursuant to this article because the methodology is invalid, unlawful, or is contrary to any provision of federal law or regulations, or of state law, this section shall become inoperative.

SEC. 6. (a) The following amounts are hereby appropriated to the State Department of Health Services for expenditure to fund an increase to the 2004-05 skilled nursing facility Medi-Cal reimbursement rate consistent with the existing rate methodology in the Medicaid state plan:

(1) The sum of one hundred six million seven hundred eighty-one thousand dollars (\$106,781,000) from the State Treasury.

(2) The sum of one hundred six million seven hundred eighty-one thousand dollars (\$106,781,000) from the Federal Trust Fund.

(b) The sum of two million dollars (\$2,000,000) for the 2004-05 fiscal year and one million dollars (\$1,000,000) for the 2005-06 fiscal year is hereby appropriated to the State Department of Health Services from the General Fund for expenditure for purposes of implementing Section 14126.031 of the Welfare and Institutions Code.

(c) The sum of three hundred fifty thousand dollars (\$350,000) for both the 2004-05 fiscal year and the 2005-06 fiscal year is hereby appropriated to the State Department of Health Services from the General Fund for expenditure for purposes of implementing Section 14126.033 of the Welfare and Institutions Code.

(d) The sum of two hundred thousand dollars (\$200,000) for the 2005-06 fiscal year is hereby appropriated to the Bureau of State Audits from the General Fund for expenditure for purposes of implementing Section 14126.033 of the Welfare and Institutions Code.

SEC. 7. This act is an urgency statute necessary for the immediate preservation of the public peace, health, or safety within the meaning of Article IV of the Constitution and shall go into immediate effect. The facts constituting the necessity are:

In order to make the necessary statutory changes to implement a comprehensive program to improve the quality of care provided in health facilities at the earliest possible time, it is necessary that this act take effect immediately.

Appendix 2

Table A2-1: Changes in functional decline after AB1629 was implemented in 2005

	Estimate	Standard Errors	p-value
Main variables of interests			
Pre-trend (β_1)	0.0344***	0.0106	<.01
AB1629 (β_2)	-0.0251	0.0356	0.48
Time*AB1629 (β_3)	0.0003	0.0150	0.98
Post-trend ($\beta_1+\beta_3$)	0.0347***	0.0107	<.01
Individual risk factors			
Length between baseline and target assessment (in weeks)	0.0325***	0.0049	<.0001
Age (years)	0.0145***	0.0006	<.0001
Baseline ADL performance			
ADL bed mobility	-0.2604***	0.0090	<.0001
ADL transfer	-0.0507***	0.0099	<.0001
ADL eating	-0.1201***	0.0064	<.0001
ADL toilet use	-0.0042	0.0092	0.65
Short-term memory problem	0.1591***	0.0197	<.0001
Cognitive skills for daily decision making moderately/severely impaired	0.1494***	0.0170	<.0001
Having difficulty understanding others	0.0450*	0.0249	0.07
Having difficulty making self understood	0.1069***	0.0249	<.0001
Depression	0.0843***	0.0127	<.0001
Bowel incontinence	0.2285***	0.0194	<.0001
Urinary incontinence	0.3362***	0.0195	<.0001
Urinary tract infection	0.1945***	0.0245	<.0001
Weight loss	0.2941***	0.0248	<.0001
Pressure ulcers (stage 2 or higher)	0.3662***	0.0305	<.0001
Delirium	0.2388***	0.0582	<.0001
Pain	0.1368***	0.0244	<.0001
Fall	0.2894***	0.0210	<.0001

* $p \leq 0.10$; ** $p \leq 0.05$; *** $p \leq 0.01$; ADL: activity of daily living.

Table A2-2: Changes in pressure ulcers after AB1629 was implemented in 2005

	Estimate	Standard Errors	p-value
Main variables of interests			
Pre-trend (β_1)	-0.0123	0.0113	0.28
AB1629 (β_2)	-0.0483	0.0378	0.20
Time*AB1629 (β_3)	-0.0378**	0.0160	0.02
Post-trend ($\beta_1+\beta_3$)	-0.0501***	0.0114	<.0001
Individual risk factors			
Age (years)	0.0008	0.0006	0.19
Female	-0.3205***	0.0150	<.0001
Functional status	0.1520***	0.0022	<.0001
Cognitive status	-0.0776***	0.0048	<.0001
Disease diagnosis			
Dementia	-0.0689***	0.0157	<.0001
Stroke	-0.2368***	0.0150	<.0001
Diabetes	0.4372***	0.0142	<.0001
Cancer	0.1647***	0.0261	<.0001
Other endocrine disease	0.0017	0.0172	0.92
Cardiovascular disease	0.0602***	0.0167	<.01
Musculoskeletal disease	0.0857***	0.0141	<.0001
At end stage of life (expectancy ≤ 6 mo)	0.6704***	0.0306	<.0001
Malnutrition	0.8404***	0.1023	<.0001
Incontinence	-0.2765***	0.0267	<.0001
Antipsychotic drug use	-0.0482***	0.0168	<.01
Daily physical restraint use	-0.4636***	0.0197	<.0001

* $p \leq 0.10$; ** $p \leq 0.05$; *** $p \leq 0.01$.

Table A2-3: Changes in physical restraints after AB1629 was implemented in 2005

	Estimate	Standard Errors	p-value
Main variables of interests			
Pre-trend (β_1)	-0.0763***	0.0077	<.0001
AB1629 (β_2)	-0.0199	0.0264	0.45
Time*AB1629 (β_3)	-0.2540***	0.0120	<.0001
Post-trend ($\beta_1+\beta_3$)	-0.3303***	0.0092	<.0001
Individual risk factors			
Age (years)	0.0040***	0.0004	<.0001
Female	-0.1339***	0.0110	<.0001
Making self understood (reference: always or usually)			
Sometimes	-0.0279	0.0195	0.15
Rarely	-0.3094***	0.0278	<.0001
Behavior problems			
Physically abusive	0.5018***	0.0210	<.0001
Socially inappropriate	0.3700***	0.0147	<.0001
Resists care	0.0565***	0.0140	<.0001
ADL limitation in bed mobility	0.2404***	0.0046	<.0001
Fall in last 180 days	0.6960***	0.0117	<.0001
Cognitive status	0.3684***	0.0054	<.0001
Ability to understand others (reference: always or usually)			
Sometimes	0.4379***	0.0188	<.0001
Rarely	0.2438***	0.0280	<.0001

* $p \leq 0.10$; ** $p \leq 0.05$; *** $p \leq 0.01$; ADL: activity of daily living.

Table A2-4: Changes in incontinence after AB1629 was implemented in 2005

	Estimate	Standard Errors	p-value
Main variables of interests			
Pre-trend (β_1)	-0.0039	0.0095	0.68
AB1629 (β_2)	-0.1242***	0.0318	<.0001
Time*AB1629 (β_3)	-0.0103	0.0133	0.44
Post-trend ($\beta_1+\beta_3$)	-0.0142	0.0093	0.13
Individual risk factors			
Age (years)	0.0063***	0.0005	<.0001
Female	0.2974***	0.0124	<.0001
Cognitive status	0.4000***	0.0059	<.0001
Delirium	-0.3656***	0.0551	<.0001
Make self-understood (reference: always or usually)			
Sometimes	0.0893***	0.0197	<.0001
Rarely	0.6343***	0.0729	<.0001
Behavioral symptoms	0.2029***	0.0164	<.0001
Physically abusive	0.2956***	0.0324	<.0001
Activities of daily living (ADLs)			
Transfer	0.7507***	0.0069	<.0001
Locomotion	0.0855***	0.0053	<.0001
Eating	0.1979***	0.0068	<.0001
Personal hygiene	0.7074***	0.0089	<.0001
Bathing	0.4851***	0.0115	<.0001

* $p \leq 0.10$; ** $p \leq 0.05$; *** $p \leq 0.01$.

Table A2-5: Changes in potentially avoidable hospitalizations after AB1629 was implemented in 2005

	Estimate	Standard Errors	p-value
Main variables of interests			
Pre-trend (β_1)	-0.0028	0.0104	0.79
AB1629 (β_2)	-0.0039	0.0349	0.91
Time*AB1629 (β_3)	-0.0014	0.0147	0.92
Post-trend ($\beta_1+\beta_3$)	-0.0042	0.0104	0.68
Individual risk factors			
Demographics			
Age (years)	0.0068***	0.0006	<.0001
Female	-0.1417***	0.0135	<.0001
White	0.0241*	0.0147	0.10
Diagnoses			
Congestive heart failure	0.2904***	0.0150	<.0001
Emphysema/COPD	0.3518***	0.0151	<.0001
Diabetes	0.1823***	0.0133	<.0001
Dementia	0.0002	0.0144	0.99
Cerebrovascular Accident/Stroke	0.0176	0.0161	0.28
Arteriosclerotic heart disease	0.0866***	0.0196	<.0001
Cancer	-0.0269	0.0266	0.31
Renal failure	0.2981***	0.0213	<.0001
Paraplegia and hemiplegia	-0.0693***	0.0198	<.01
Functional status	0.0128***	0.0010	<.0001
Cognitive status	-0.0305***	0.0048	<.0001
Resident conditions			
Urinary tract infection	0.2925***	0.0235	<.0001
Oral feeding tube	0.3751***	0.0200	<.0001
Pressure ulcer (stage 2 or higher)	0.2438***	0.0241	<.0001
Pneumonia	0.3801***	0.0222	<.0001
Septicemia	-0.0278	0.0542	0.61
Parenteral/IV nutrition	0.1575***	0.0464	<.01
Indwelling catheter	0.2876***	0.0256	<.0001
Antibiotic resistant infection	0.1456***	0.0350	<.0001

Do-not-resuscitate orders	-0.1817***	0.0147	<.0001
Do-not-hospitalize orders	-0.6834***	0.0346	<.0001

* $p \leq 0.10$; ** $p \leq 0.05$; *** $p \leq 0.01$; COPD: chronic obstructive pulmonary disease.

Table A2-6: The relationship between staffing levels and physical restraints

	Estimate	Robust standard error	p-value
Δ [RN HPRD]	-0.0470**	0.0235	0.05
Δ [LPN HPRD]	-0.0286*	0.0176	0.10
Δ [CNA HPRD]	-0.0124	0.0113	0.27
Δ Age	0.0017*	0.0010	0.09
Δ Female	0.0167	0.0480	0.73
Making self understood			
Δ Sometimes	-0.0268	0.0869	0.76
Δ Rarely	0.0693	0.1098	0.53
Behavior problems			
Δ [Physically abusive]	0.1055	0.0812	0.19
Δ [Socially inappropriate]	0.0368	0.0492	0.46
Δ [Resists care]	-0.0110	0.0326	0.74
Δ [ADL limitation in bed mobility]	0.0041	0.0089	0.64
Δ [Fall in last 180 days]	0.0010	0.0416	0.98
Δ [Cognitive status]	0.0275**	0.0131	0.04
Ability to understand others			
Δ Sometimes	0.0453	0.0648	0.49
Δ Rarely	0.0683	0.1030	0.51
Number of nursing homes		995	

* $p \leq 0.10$; ** $p \leq 0.05$; *** $p \leq 0.01$; HPRD: hours per resident day.

Table A2-7: The relationship between staffing levels and pressure ulcers

	Estimate	Robust standard error	p-value
Δ [RN HPRD]	0.0185	0.0131	0.16
Δ [LPN HPRD]	0.0035	0.0108	0.74
Δ [CNA HPRD]	-0.0043	0.0057	0.45
Δ Age	-0.0001	0.0007	0.89
Δ Female	-0.0391*	0.0240	0.10
Δ [Functional status]	0.0028*	0.0016	0.09
Δ [Cognitive status]	0.0064	0.0045	0.16
Disease diagnosis			
Δ [Dementia]	-0.0312*	0.0166	0.06
Δ [Stroke]	0.0012	0.0170	0.94
Δ [Diabetes]	0.0505**	0.0244	0.04
Δ [Other endocrine disease]	-0.0632***	0.0245	0.01
Δ [Cardiovascular disease]	-0.0397*	0.0219	0.07
Δ [Musculoskeletal disease]	0.0464***	0.0148	<.01
Δ [Cancer]	0.0603*	0.0370	0.10
Δ Incontinence	-0.0362	0.0281	0.20
Δ [At end stage of life]	0.0085	0.0287	0.77
Δ [Daily physical restraint use]	0.0187	0.0137	0.17
Δ [Antipsychotic drug use]	-0.0062	0.0204	0.76
Δ Malnutrition	-0.1230	0.1336	0.36
Number of nursing homes	965		

* $p \leq 0.10$; ** $p \leq 0.05$; *** $p \leq 0.01$; HPRD: hours per resident day.

Table A2-8: The relationship between staffing levels and incontinence

	Estimate	Robust standard error	p-value
Δ [RN HPRD]	0.0302	0.0316	0.34
Δ [LPN HPRD]	0.0059	0.0165	0.72
Δ [CNA HPRD]	-0.0147	0.0122	0.23
Δ Age	0.0046***	0.0011	<.01
Δ Female	0.0976**	0.0407	0.02
Δ [Cognitive status]	0.0373***	0.0116	<.01
Δ Delirium	-0.3891***	0.1521	0.01
Make self-understood			
Δ Sometimes	0.0973***	0.0361	0.01
Δ Rarely	0.2573*	0.1550	0.10
Δ [Behavioral symptoms]	0.0390	0.0378	0.30
Δ [Physically abusive]	0.0851	0.0751	0.26
Activities of daily living (ADLs)			
Δ Transfer	0.1157***	0.0156	<.01
Δ Locomotion	0.0004	0.0106	0.97
Δ Eating	0.0175*	0.0098	0.08
Δ Personal hygiene	0.0468***	0.0157	<.01
Δ Bathing	0.0141	0.0155	0.36
Number of nursing homes	988		

* $p \leq 0.10$; ** $p \leq 0.05$; *** $p \leq 0.01$; HPRD: hours per resident day.

Figure A2-1: Unadjusted trends in antipsychotic use pre- and post-AB1629

x-axis: year.

y-axis: Proportion of long-term care residents who received an antipsychotic medication.

Table A2-9: Changes in antipsychotic use after AB1629 was implemented in 2005

	Estimate	Standard Errors	p-value
Main variables of interests			
Pre-trend (β_1)	0.0941***	0.0067	<.0001
AB1629 (β_2)	-0.1902***	0.0225	<.0001
Time*AB1629 (β_3)	-0.1052***	0.0096	<.0001
Post-trend ($\beta_1+\beta_3$)	-0.0111*	0.0068	0.10
Individual risk factors			
Age (years)	-0.0246***	0.0003	<.0001
Female	0.0897***	0.0089	<.0001
Making self understood (reference: always or usually)			
Sometimes	-0.5652***	0.0167	<.0001
Rarely	-1.2963***	0.0263	<.0001
Behavior problems			
Physically abusive	0.9798***	0.0190	<.0001
Socially inappropriate	1.2141***	0.0124	<.0001
Resists care	0.4192***	0.0110	<.0001
ADL limitation in bed mobility	-0.2257***	0.0034	<.0001
Fall in last 180 days	0.2350***	0.0095	<.0001
Cognitive status	0.3456***	0.0040	<.0001
Ability to understand others (reference: always or usually)			
Sometimes	0.2104***	0.0159	<.0001
Rarely	-0.1623***	0.0273	<.0001

* $p \leq 0.10$; ** $p \leq 0.05$; *** $p \leq 0.01$; ADL: activity of daily living.