AN ANALYSIS OF PARTICIPATION, QUALITY OF CARE AND EFFICIENCY OUTCOMES OF AN INTER-ORGANIZATIONAL NETWORK OF NURSING HOMES

DISSERTATION

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By

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ABSTRACT

In providing for residents, the average nursing home today must deal with complicated and competing issues that involve adhering to regulatory guidelines for quality of care while maintaining operations with limited reimbursement. In response to these challenges, many nursing homes establish external, collaborative efforts or "networks" to further common interests through collective action (Olson, 1965). This dissertation examines the Pioneer Network, an inter-organizational network that claims positive quality of care and efficiency outcomes are associated with network participation. To test these assertions and to further elucidate network participation, this research pursues the following objectives: 1) examine the organizational characteristics of early adopter homes participating in the Pioneer Network and to what extent those characteristics contributed to significant transformations in financial and quality outcomes 2) evaluate the effect of Pioneer Network participation on quality of care and per bed net income of nursing homes.

In the evaluation of the organizational characteristics of early adopter homes of the Pioneer Network, results suggest that the early adopters of the Pioneer Network were more likely to be large, non-profit and composed of a higher percentage of private paying residents. To determine the outcomes of homes participating in the Pioneer Network by

organizational characteristic, this dissertation employs a difference-in-difference approach to examine significant changes from 1996 to 2003 in quality of care and profitability for four organizational characteristics including profit type, home size, chain status and market concentration. Findings imply that non-profit homes exhibited a greater change over for-profit homes in all quality of care and profitability outcomes. In addition, homes in less competitive environments significantly improved in quality of care and profitability over homes in more competitive environments.

This dissertation also evaluates the effect of Pioneer Network participation on quality of care for nursing home residents and the per bed net income of the home from 1996 to 2003. For quality of care, findings indicate homes participating in the Pioneer Network achieved better quality of care outcomes for residents over comparable non-participant homes between the two timeframes. Results of the profitability analysis also suggest that homes participating in the network outperformed control homes during the same timeframe.

Thus, this dissertation provides insight into the Pioneer Network. From a scholarly perspective, this dissertation integrates multiple theoretical frameworks to study the motivations for and outcomes of network participation in a complex environment. Since these results intimate that the relationship between quality and profit in Pioneer Network homes is positive, this research could inform government policy by further elucidating the value of this type of innovation for both homes and residents.

Dedicated to Lois and Kevin

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Every time my grandmother had any type of question, she would pore over her collection of World Book Encyclopedias (the 1969 addition) to determine an answer. As I watched her, I learned more than the story of St. Patrick or the capital of Brazil. I soon realized her philosophy - the greatest gift in life is the daily opportunity to learn. I am so grateful that I had the opportunity to learn at this level with an amazing and supportive group of individuals that inspire and motivate as teachers and mentors.

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We did it, Gram. Thank you.

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CHAPTER 1

1 DISSERTATION INTRODUCTION AND OVERVIEW

1.1 Introduction

In the public discourse of key policy issues for the 21st century, a principal area of concern for policymakers is the provision, financing and quality of long-term care for older Americans. While the term "long-term care" encompasses a wide range of services in a variety of settings, the primary recipients of these services are predominantly older Americans. According to the Administration on Aging (2004), the population of the 65+ demographic is expected to double by 2030. Moreover, the category of the "oldest old" (older than 85) is growing at the fastest rate of all populations and is expected to double or triple in size over the next 5-10 years (Association for Gerontology in Higher Education, 2005). Since the "oldest old" demographic is the most likely to utilize long-term care, this expected growth will have a major effect on the consumption of these services as well as on the financial and operating resources needed to provide quality care to these elders (Institute of Medicine, 2001). In particular, long-term care provided in nursing homes has been targeted both for quality improvements (U.S. Department of Health and Human Services, 2002) and financial efficiency (Institute of Medicine, 2001).

To respond to these external mandates, individual nursing homes have explored various internal methods of organizational development. For example, some nursing homes utilize specialized consulting services of Quality Improvement Organizations to enhance care-giving and streamline patient services (Centers for Medicare and Medicaid Services, 2004). Other facilities encourage the use of Family Councils to assure that the nursing home and family members share a common connection and concern regarding the resident's rights and plan of care (National Citizens' Coalition for Nursing Home Reform, 2004). In another area specific to efficiency, nursing homes can lower costs associated with employee risk of injury by implementing targeted ergonomic guidelines and specialized equipment that aid employees in lifting and transferring residents (OSHA, 2005). Thus, there are varying approaches for nursing homes to respond to external pressures for quality and efficiency improvement on an individual basis.

In addition to individual efforts, the challenge of improving quality while maintaining cost efficiency has resulted in varying types of collaborative, inter-organizational associations with other nursing homes, care professionals in the industry, ombudsman, advocates, Departments of Aging and community members to develop adaptive models that address these quality and efficiency mandates. For instance, grassroots movements such as the National Citizens' Coalition for Nursing Home Reform deal primarily with regulatory and legislative reforms in nursing homes and provide direction and organization for policy development (National Citizens' Coalition for Nursing Home Reform, 2005). In addition, the American Association of Homes and Services for the Aging sponsors a Quality First program for non-profit providers that offers guidance on quality improvement parameters for all aspects of the nursing home

(AAHSA, 2005). In the area of direct care employment, the National Clearinghouse on the Direct Care Workforce informs members of best practices for staffing in long-term care. Other associations such as the Pioneer Network, the Eden Alternative and the Wellspring model explore the use of adaptive techniques and modifications that target all levels of the internal processes of the nursing home.

One mode of diffusion of process modification is through inter-organizational networks (Ahuja, 2000, Oerlemans, et al., 1998). These inter-organizational associations or "networks" occur with other nursing homes, care professionals in the industry, ombudsman, advocates, Departments of Aging and community members. Inter-organizational networks serve as a mechanism for groups and organizations engaged in collective action to pool, exchange and mobilize resources (Diani and Bison, 2004). Networks occur in various types and structures with compositions that range from individual social systems to complex inter-organizational assemblies. Whatever the structure, networks allow members to develop "productive mutual relationships" through "collaborative advantage" (the ability of the individual or organization to achieve something through collaboration that could not have been achieved if acting on its own) (Beech and Huxham, 2003). From an inter-organizational perspective, networks are "characterized as systems of social relationships linking distinct social organizations such as corporations, communities, and volunteer associations" (Martisen and Campbell, 1979). Participation in inter-organizational networks could lead to a number of benefits including improved dissemination of resources, product branding and/or adaptive techniques that aid in process changes.

In an effort to investigate the underpinnings of network participation, this dissertation will focus on an inter-organizational network of nursing homes. Since the network chosen as the focus of this research claims to be dedicated to adaptive techniques that address internal processes and environmental constraints, there are notable opportunities to further the research relating to network participation while also promoting knowledge regarding quality improvement efforts in the nursing home industry. From the perspective of advancing theory and content regarding networks, this dissertation substantively tackles multiple foundational questions, including hypothesized motivations for network participation, as well as potential operational outcomes that validate this type of voluntary effort by an organization. In addition, since context is important to understanding network behavior, a group of nursing homes committed to sharing and communicating quality improvement efforts affords a novel perspective of study. Before providing a more detailed outline of this dissertation, the following section summarizes the general research questions and findings of this research and highlights contributions of this dissertation to literature and theory.

1.2 Overview of Research Questions and Findings

The first investigation of this dissertation explores the characteristics of network participants by studying organizational characteristics of early adopter homes. The question of network engagement is interesting from a theoretical and scholarly perspective, because it assists in uncovering motivations for voluntary organizational

adaptation. Past investigations relating to healthcare found that profit type and the level of available resources contributed to the theoretical understanding of network engagement. For example, non-profit homes are posited to be more driven to outside collaborative or innovative efforts by the opportunity to enhance quality of care. Conversely, the literature concludes that for-profits join in outside endeavors to improve profit and cost efficiency. The level of available resources also contributes to network participation as larger, chain-operated organizations are more likely to engage in this type of behavior.

Since an inter-organizational network of nursing homes is a unique object of study, this dissertation enhances the existing literature by examining the potential motivations of homes joining in this collaborative effort. The findings of this dissertation are consistent with the hypotheses and conclusions of the existing body of literature that indicate that larger, non-profit homes were more likely to join the network. The results also indicate that homes joining the network consisted of a larger number of private-paying individuals. This implies a population of long-term residents that are staying in these homes for reasons other than short-term, intermediate procedures covered by Medicare. Thus, this finding intimates that a shift to long-term residential care could be the catalyst for homes to seek this form of outside collaboration.

Another element of the investigation into the characteristics of network participants evaluates differences in quality of care and efficiency outcomes by the type of organization. Evaluating outcomes by organizational characteristic is interesting from the perspective of efficacy of network participation after engagement. In other words,

scholars attempt to evaluate the ability of an organization to strategically manage any additional resources gained from collaborative or innovative efforts. With a limited amount of prior research, this dissertation contributes to sparse existing theory. In general, previous research hypothesized and concluded that those organizations with more limited resources (e.g. small, independent organizations in competitive environments) benefited from collective efforts such as network participation.

To highlight the findings of this dissertation, non-profit homes in monopolistic environments achieved improved quality of care and profitability outcomes over for-profit counter-parts and homes in competitive environments. Interestingly, these results are somewhat counter-intuitive to the existing literature. For example, while it is not unexpected that non-profits achieve positive differences in profitability, for-profits are expected to excel with the additional resources geared towards improving quality of care. In addition, while homes in monopolistic environments are hypothesized to benefit in quality of care, it is surprising that these homes improved profitability over homes in more competitive environments. These findings allude to intriguing possibilities regarding this type of participation by nursing homes since successful engagement appears to reward homes in both types of outcomes. Thus, the effectiveness of organizational learning could be a component of network participation.

The next questions in this dissertation explore whether network participation is associated with improved quality and financial outcomes. Previous studies predominantly evaluate quality of care and profitability in nursing homes through an analysis of profit motivations and competitive environment. Due to the lack of emphasis on profit margins,

non-profit homes are expected to be more attuned to providing quality care while for-profit homes are anticipated to focus on profit and cost efficiency. Competitive environment is also posited to affect quality of care and profitability. Existing theory and prior research argues that increased competition achieves superior quality of care outcomes when these organizations compete for customers through quality enhancements. Conversely, homes in less competitive environments are hypothesized to enjoy profits associated with dominant market shares. Research on the effects of network participation on quality and profitability generally posits and concludes that network participation is value-added for both aspects of the organization.

In this dissertation, profitability is a measure of advantages for nodes of the network while quality of care evaluates service for the consumers of network participants. By comparing outcomes of homes participating in the network with comparable non-participant homes, the findings of this study concur with previous research that found network participation is value-added for the organization with the unique spin of improvement for the consumer. Of course, as the first initial investigation of this network, these findings only allude to the full effects of network participation for these homes. Still, this dissertation provides an original approach that bridges the literature on quality of care and profitability in nursing homes with the network literature. From a policy standpoint, these findings also connect the topics of quality of care and profitability with adaptive behavior in nursing homes. The implications and contributions of this type of framework to theory and policy will be further discussed throughout this document.

The following sections of this chapter provide a more detailed account of the dissertation. The first section describes the inter-organizational network of nursing homes studied in this research, the Pioneer Network. Subsequent sections outline the conceptual framework, discuss the research questions and methodology by chapter, and summarize the contributions of this research.

1.3 Pioneer Network

The Pioneer Network, the inter-organizational network chosen as the focus of this dissertation, asserts that its brand of adaptive techniques results in improved quality of care and efficiency in network homes. Since the Pioneer Network's claims of improved quality of care and efficiency outcomes are corroborated by case studies and anecdotal evidence, further analysis of this network is compelling. The Pioneer Network association was formed in 1997 after the National Citizens Coalitions for Nursing Home Reform brought together a diverse group of individuals from across the country (Pioneer Network, 2005). Each was a leader of "culture change" in nursing homes. Together, they determined that they shared similar values and missions. These individuals chose to come together to share a common goal and vision and named themselves "The Pioneer Network" (Pioneer Network, 2005). This network centers on a mission to improve communication, networking and relationships and to transform the practice and policy of the culture of aging in America. In March of 1997, the founding members met in Rochester, NY, to identify common elements and define indicators of change for the

elderly (skilled nursing facilities were the initial primary focus of change). The Network has grown over the past 10 years and now includes over 840 professionals representing organizations from all disciplines of long-term care including nursing homes, regulatory offices, ombudsman, universities and government.

The type of adaptive technique that the Pioneer Network advocates is commonly referred to as "culture change." Members of the Pioneer Network state that culture change or deep system change refers to the transformation of nursing homes from an "acute care" medical model to a "consumer-directed" model. Carter Williams, a well-known quality of life advocate, argues that the traditional acute-care paradigm of nursing homes results in residents giving up elements of their everyday lives and becoming dependent and isolated in a perceived atmosphere of oppression (Williams, 1994). Consumer-directed care, on the other hand, is achieved through "culture change" which is described by the Pioneer Network as returning the nucleus of decision-making back to the resident, resulting in a more autonomous environment.

While there is not an "official" definition of culture change or an accreditation that fully defines activities associated with the process, the nursing homes that are proponents of this process state that it commonly refers to techniques associated with consumer-directed care in areas such as bathing, consistent staffing, eliminating nursing stations, promoting challenging activities and recreation, creating home-like environments, consumer-directed councils, and flexibility in sleep and dining schedules. To date, the Pioneer Network recognizes several approaches to these transformations

such as "The Eden Alternative,"[1] the "Regenerative Community,"[2] "Individualized Care,"[3] and "Resident-Directed Care."[4] While these approaches vary in name and leadership, members of the Pioneer Network argue that each contains common themes of change such as autonomy in personal choices for the residents, consistent staffing, improved communication between residents and staff, a less bureaucratic organizational approach, and more "homey" environments.

In 2006, both the National Commission for Quality Long-Term Care and the Centers for Medicare and Medicaid Services included the promotion of organizational "culture change" in their strategic recommendations for nursing homes. In addition, both organizations recognized the Pioneer Network as a primary leader in the successful implementation of culture change in nursing homes. However, before the promulgation of widespread mandates of culture change by the government and industry leaders, research is necessary to verify the veracity of claims from homes engaging in these practices.

[1] This organization was developed by Bill and Judy Thomas who created the Eden Alternative with a mission to combat residents' loneliness and boredom, create a human habitat with plants, pets and young children, improve communication between residents and staff, and move the locus of decision making to the residents and direct care workers (Thomas, 2003).

[2] Developed by Debora and Barry Barkan. This approach advocates for staff members to act as community developers and augment work responsibilities, improved communication between staff and residents through meetings and socialization, and an understanding that residents are elders and deserve paramount respect (McNamara, 1999).

[3] Developed by Joanne Radar. This approach has been noted as one particularly sensitive to dealing with residents with dementia and advocating for a creative and compassionate manner of dealing with daily activities such as bathing (McNamara, 1999).

1.4 Conceptual Framework

Although "transforming the culture of aging" (Pioneer Network, 2005) is the goal of the Pioneer Network, it is not the focus of this research. With the Pioneer Network as the variable of interest, there are many alternative explanations and models for outcomes associated with network participation. One hypothesis would be that homes experience positive outcomes based on process changes and adaptations occurring in homes. A second hypothesis is that culture change (or a full organizational commitment that goes beyond process adaptations) results in superior outcomes. A third hypothesis posits that network participation, in general, improves outcomes in nursing homes. Finally, a fourth alternative explanation for a study of outcomes would be that participation in the Pioneer Network positively influences outcomes for network homes. Given the data available and the scope of this research, this dissertation utilizes the fourth explanation and a theoretical framework that focuses on the Pioneer Network as the treatment variable for analysis.

While qualitative case studies of homes that self-identify as engaging in culture change have shown positive quality of care outcomes such as improved toileting and mobility (Simmons and Ouslander, 2005), as of yet, there has been little rigorous, quantitative research using national panel data. There may be a logical reason for the lack of quantitative research in this area since utilizing "culture change" as an independent variable in an empirical study presents challenges. For example, there is no universally accepted definition of culture change or any type of standardized accreditation process.

[4] Developed by Charlene Boyd and Robert Ogden. Organizational and physical structure in resident-directed homes is transformed to small neighborhoods. Each neighborhood has its own budget, consistent staffing, a family style kitchen, social activities and housekeeping (McNamara, 1999).

Thus, researchers are unable to compare facilities with regard to participation and engagement. The end result is the inability to positively state that comparison homes are not also utilizing culture change in varying forms and levels.

Despite this obstacle, there is still another means of differentiating Pioneer facilities from control homes. The answer is to recognize that homes in the Pioneer Network can also be viewed as nodes in an inter-organizational network. The utilization of this theoretical framework allows this dissertation to examine the characteristics of homes in the network and to compare the outcomes of homes in the Pioneer Network versus comparable control homes. Figure 1.1 represents a sample graphical representation of a network. Points A through G are "nodes" that can represent individuals, groups or corporations. Lines connecting the nodes are used to represent the flow of resources between nodes. This graphical representation includes a "focal organization," which is also known as a network administrative organization (NAO) used as an administrative decision-making hub in inter-organizational networks (Milward, 1982). Since the Pioneer Network conforms to current scholarly classifications of an inter-organizational network and possesses many of the agreed upon attributes discussed in current theory and research (see Appendix A for a more detailed explanation), this research can ask and endeavor to answer compelling questions regarding potential collaborative advantage due to involvement in this network.

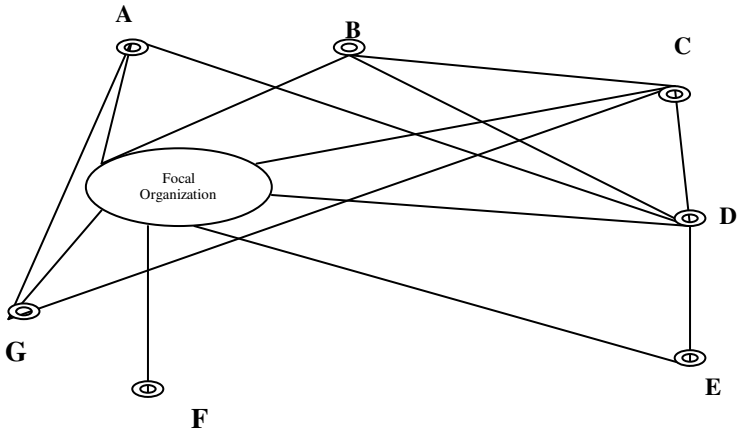

Figure 1.1: Network Representation

1.5 Research Questions

This dissertation is composed of three separate investigations of the Pioneer Network. The questions addressed in each chapter are as follows:

- Chapter 2: What are the organizational characteristics of early participant homes in the Pioneer Network and to what extent do those characteristics contribute to significant transformations in financial and quality outcomes? To further the understanding of network attributes, it is instructive to examine the organizational characteristics of homes that join this type of network and to what extent those characteristics contribute to noteworthy transformations.

- Chapter 3: Are quality outcomes for homes in the Pioneer Network superior to comparable control homes outside of the network? This research is the first

analysis of the Pioneer Network to use a quasi-experimental design at a national level to examine the critical counter-factual of what would happen in the absence of Pioneer Network participation. While this research does not attempt to understand what is actually occurring in this inter-organizational network, the investigation of quality of care outcomes for consumers of homes participating in the Pioneer Network is an important step towards understanding any quality of care advantages associated with network participation.

- Chapter 4: Are financial outcomes for homes in the Pioneer Network superior to comparable control homes outside of the network? While this research does not attempt to understand what is actually occurring in this inter-organizational network, the investigation of profitability outcomes of homes participating in the Pioneer Network is an important step towards understanding any efficiency advantages associated with network participation.

1.6 Research Design

To provide insight into the motivations for joining the Pioneer Network, Chapter 2 investigates the characteristics of homes participating in the Pioneer Network through two empirical analyses. The first studies the characteristics of early participants in the Pioneer Network by estimating a logit model utilizing all homes certified by the Centers for Medicare and Medicaid Services from the pre-participation timeframe where the dependent variable is an indicator of whether the home is a subsequent participant in the

Pioneer Network, and the independent variables are characteristics hypothesized to affect network participation.

To investigate the outcomes of homes participating in the Pioneer Network, the second analysis employs a difference-in-difference approach to examine significant changes from 1996 to 2003 in quality of care and profitability outcomes by organizational characteristic to determine any differences by the type of home. Specifically, this chapter investigates the outcomes by characteristics of profit status, chain affiliation, home size and market concentration. The dependent variables in this study include the following measures: the number of citations from state regulatory government inspections of nursing homes in each calendar year, a summative index of five quality measures collected by the Centers for Medicare and Medicaid Services, and the net income for nursing homes recorded in the Skilled Nursing Facility Cost Reports.

In the analysis of changes in quality of care associated with network participation, Chapter 3 employs a quasi-experimental methodology that matches Pioneer Network homes with control homes and then utilizes a difference-in-difference approach to measure pre- to post- network participation quality of care outcomes contrasted with control homes during the same timeframe. The dependent variables in this study are the number of citations from state regulatory government inspections of nursing homes in each calendar year as well as a summative index of five quality measures collected by the Centers for Medicare and Medicaid Services in 1996 and 2003. In this way, this research investigates whether each of the outcome measures for Pioneer Network homes improved from 1996 to 2003 when compared to control homes.

In addition to the matched sample analysis, Chapter 3 also includes negative binomial regressions utilizing the deficiency outcomes and summative index in 2003 as a cross-sectional exploratory study of the effects of Pioneer Network participation. Specifically, the number of years that a home has been participating in the network as of 2003 acts as a treatment variable representing network participation and is included in the regression with other theoretically relevant independent variables identified by previous research as potentially affecting quality of care. As with the matched sample, these results provide insight into any quality of care outcomes that result from participation in the network.

Finally, in the investigation of changes in profitability associated with network participation, Chapter 4 utilizes a quasi-experimental methodology that matches Pioneer Network homes with control homes and then utilizes a difference-in-difference approach to measure pre- to post- network participation profitability outcomes contrasted with profitability outcomes for control homes during the same timeframe. The dependent variable in this study is per bed net income (or loss) as collected by the Centers for Medicare and Medicaid Services in 1996 and 2003. In this way, this research investigates whether this outcome measure for Pioneer Network homes improved from 1996 to 2003 when compared to control homes.

1.7 Contributions

From a scholarly perspective, the findings of all three chapters contribute to the network literature. For example, this dissertation adds to research that examines the

characteristics of nursing home network participants through an analysis of early adopter homes. In addition, this research goes beyond previous studies by linking the outcome measures of quality of care and profitability to the characteristics of homes participating in the network. This dissertation also supplements existing network literature (that traditionally studies the outcomes of network participants) by examining the consequences for consumers of the network through an analysis of quality of service. These findings also augment the network literature by adding to the relatively few studies that employ an empirical design with the network as the treatment variable. Finally, this investigation coupled with the analysis on quality of care contributes to the understanding of the effects of quality of care on profitability in this network setting. While this profitability inquiry is separate from the examination of quality of care in Pioneer Network homes, it is interesting to posit that quality improvements could be achieved without detrimental effects to profits. If the results of this analysis conclude that profitability is an outcome of network participation, there is powerful support for the hypothesis that network participation could result in positive financial outcomes for homes and improved quality outcomes for consumers in this network setting.

From an industry and policy perspective, advancing knowledge regarding quality improvement and innovation efforts is crucial to an already vulnerable population of older adults residing in these facilities. Arguably, healthcare is one of the most complex industries in the United States. The government serves as a regulator concerned with quality but also a payer concentrating on cost efficiency. Nursing homes are challenged to adhere to the same types of reimbursement and regulatory guidelines as hospitals, even though there is an increasing population of residential, long-term residents requiring care

quite different from the short-term care of a hospital or intermediate care facility. Because these homes are more likely to rely on Medicaid as a primary source of reimbursement, this changing population of older residents exacerbates the already tenuous future of operations.

Given the threatened cuts by states and the Federal government to the payment structure that supports these long-term residents, the future of nursing homes as a resource for older adults is on the brink of crisis. In terms of private policy for industry, these dwindling resources necessitate that nursing homes adapt and operate with greater efficiency while providing more complex and challenging care to an older demographic. Public policy will also require revision due to the combination of regulatory and financial challenges created by this new population. Yet, there is very little research to support operational linkages between quality of care and financing. Accordingly, in order to achieve advancements in policy that further insight into practice, it is essential to study homes that are at least attempting to alter the current state of operational frameworks.

Because the Pioneer Network is included in discussions of organizational change in nursing homes, this dissertation is noteworthy in that it is the first to provide a more rigorous evaluation of the Pioneer Network. This dissertation is also the first analysis of this network to use a quasi-experimental design to examine the critical counter-factual of what would happen in the absence of Pioneer Network participation. Since the Centers for Medicare and Medicaid Services (CMS) and the National Commission for Quality Long-Term Care recognize the Pioneer Network as offering innovative solutions to cost and quality of care challenges, this dissertation provides the first initial estimates of the benefits of network participation and organizational learning occurring in these homes.

Thus, these findings will hopefully aid and help inform government and private policy regarding large scale implementation of Pioneer Network initiatives. The following chapter begins the investigation into the Pioneer Network by evaluating the organizational characteristics of these homes.

CHAPTER 2

2 INVESTIGATION INTO ORGANIZATIONAL CHARACTERISTICS

2.1 Introduction

To begin the study of the Pioneer Network, this chapter first analyzes nursing homes participating in the Pioneer Network by comparing the characteristics of early adopters with non-network participants. This chapter then explores a within group analysis of homes participating in the network by investigating quality of care and efficiency outcomes by organizational characteristic. Through these examinations, this research presents a unique opportunity to analyze the characteristics of homes that join and participate in the Pioneer Network. In addition, answering these questions allows this dissertation to address the scholarly literature by identifying the characteristics of homes that are motivated to pursue organizational improvements through innovation or network participation. For example, is a small or large firm more likely to participate in the network? Are for-profit or non-profit homes more likely to be motivated to this type of change? Are chains more likely to participate in the network? Are more competitive or less competitive market environments representative of homes in the network?

Since this research postulates that the network is a conduit of process adaptation, it is instructive to examine the organizational characteristics of homes that join this type of network and to what extent those characteristics contribute to significant transformations in financial and quality outcomes. Furthermore, although the hospital industry is often the focus for research on innovation, the nursing home industry is rarely studied and lacks substantive theory (Castle, 2001). Thus, this investigation fosters the understanding of innovation in the nursing home industry by contributing to the few studies that develop hypotheses and explicate conclusions regarding the characteristics of network participants and the outcomes of homes by characteristic. In short, the value of this study is a further understanding of "why" and "who" with respect to this type of network participation in nursing homes.

The lack of prior research notwithstanding, process adaptation is still a powerful objective of study in nursing homes. For example, issues of quality of care and profitability are of critical concern for nursing homes. Moreover, a principal constraint in the industry is the additional impasse of improving quality while maintaining financial solvency. It is just this type of complex constraint that could lead to the process innovation and adaptation that the Pioneer Network asserts is successfully occurring in homes participating in the network. According to Castle (2001), identifying characteristics associated with innovation and adoption could "be useful in further facilitating the diffusion of innovations in the nursing home setting" (p. 161). In addition, this chapter studies the quality and profitability outcomes of homes by organizational characteristic. This additional level of inquiry is a reasonable methodological progression since the Pioneer Network asserts that the process adaptation promoted by network

participation produces positive quality of care and efficiency outcomes (quality of care and profitability outcomes will be explored in greater detail in Chapters 3 and 4). Thus, this research goes beyond previous studies by linking the outcome measures of quality of care and profitability to the characteristics of network participants. For example, what are the quality or profitability differences between small and large homes? Are there differences between the profit or quality enhancements between for-profit and non-profit homes? Answering these questions allows this dissertation to augment previous research by identifying the outcomes of homes by the organizational attributes of network participants.

Answering these questions also contributes to theory and informs policy regarding these efforts in this industry. From a public policy perspective, this research is the first to provide an evaluation of claims resulting from prior studies of the Pioneer Network. These findings also contribute to the network literature by adding to the relatively few studies that examine the characteristics of participants in the empirical design. As will be discussed in the literature review, there is a lack of consensus regarding network theory. Thus, these studies are important in formulating theoretical frameworks. It is important to note that this chapter only addresses the outcome variation among participants and not the impact of network participation on outcomes (Chapter 3 focuses on quality of care for consumers in the network setting and Chapter 4 evaluates the effects of network participation on a home's profitability). Yet, the findings of this chapter elucidate any organizational stimulus for network participation which informs policy regarding widespread implementation of network objectives. For example, if non-profit homes are more likely to engage and be successful in network participation, future research or

policy formulation should address any variation in network participation between for-profit and non-profit homes.

This chapter investigates the characteristics of homes participating in the Pioneer Network through two empirical analyses. The first studies the characteristics of early participants in the Pioneer Network by estimating a logit model of all nursing homes certified by the Centers of Medicare and Medicaid Services from the pre-participation timeframe where the dependent variable is an indicator of whether the home is a subsequent participant in the Pioneer Network, and the independent variables are characteristics hypothesized to affect network participation. The second analysis studies the within group outcomes of homes participating in the network through a difference-in-difference approach that measures variations in quality of care and profitability outcomes from pre- to post-network participation. The dependent variables in this study include the number of citations from state regulatory government inspections of nursing homes in each calendar year, the a summative index of five quality measures collected by the Centers for Medicare and Medicaid Services, and the net income for nursing homes recorded in the Skilled Nursing Facility Cost Reports.

The subsequent sections of this chapter include the following sections: Section 2.2 reviews the literature and hypotheses relating to network participation and adaptation in the nursing home setting, outlines the methodology for the analysis of network participation, provides overviews of data and descriptive statistics and summarizes the findings for the analysis on network participation, Section 2.3 reviews the literature and hypotheses relating to outcomes by organizational characteristics, describes the methodology for the study of outcomes of Pioneer Network participants and summarizes

the findings, and Section 2.4 presents a discussion with recommendations for future research.

2.2 Investigation into the Characteristics of Homes that Join the Pioneer Network

2.2.1 Previous Research and Hypotheses

The following review of research and hypotheses will outline the framework to address the crucial questions of "who" and "why" with respect to a nursing home's participation in the Pioneer Network. There is limited prior research on process innovation as one possible benefit of network participation in the nursing home setting. Despite the lack of previous conclusions, the theory of network participation allows for the sharing of information among homes that could enhance organizational operations in areas such as quality of care for consumers. In addition, the highly repetitive nature of the caring activities that occur in nursing homes is illustrative of environments that benefit the most from the types of process adaptations readily disseminated in a network setting (Phelps, 2000). For example, in nursing homes, "the extended period of time a resident may spend in the facility gives adequate opportunity to both assess and monitor quality," and such extensive monitoring could lead to adaptations and organizational improvements that enhance the caring process (Castle, 1999, p. 96). In addition, "the extensive 'care' process encompassing such diverse factors as meal plans, physical activities, and social activities gives nursing homes more opportunity to favorably alter the health of residents" (Castle, 1999, p. 96). Therefore, the environment of nursing

homes is theoretically supportive of the types of innovations that could be communicated through network participation.

In addition to a supportive environment, another reason to explore the characteristics of homes that join and potentially benefit from participation in the Pioneer Network is that research in other industries confirms the viability of the claims of improved quality of care and profitability associated with process adaptations. Quality of care, in particular, has responded well to innovation in hospitals, and it is logical to posit a similar effect in nursing homes (Castle, 2001). In addition, although profitability as an outcome of process innovation is more traditionally studied in "highly dynamic industries," research positively linked innovation "with revenue growth irrespective of the industry in which the innovative firm operates" (Thornhill, 2006, p. 699).[5] Therefore, research in other industries substantiates the potential for a positive correlation between quality, efficiency and adaptations that could be communicated through network participation.

Certainly, the expectation of improved quality and efficiency is one incentive for network participation in the nursing home industry. Chapters 3 and 4 provide more detailed discussions of previous empirical research linking network participation to quality of care and efficiency outcomes. In short, key empirical findings established positive quality outcomes resulting from process adaptations in areas that include the utilization of nurse practitioners in a Medicare Managed Care Program (Kane, 2004), the use of consumer centered care (Kane, 2003a; Samsell, 2003) and targeted intervention in

[5] Although this conclusion was the result of a study of 845 Canadian manufacturing firms, it is interesting to theorize that this type of revenue growth could be a tangible outcome in nursing homes.

toileting and mobility (Simmons and Ouslander, 2005). Other studies correlated innovation and improved efficiency (Rantz, et al, 2004; Yeatts et al, 2004; Anderson, Corrazzini and McDaniel, 2004). The analysis in this chapter will augment previous research by investigating the characteristics of homes that join the Pioneer Network. Since prior quantitative research focused more on capital intensive investments, the findings of this investigation should provide a new perspective on the characteristics of homes that engage in network participation.

Since adaptation in the nursing home setting is affected by multiple organizational and market variables and "an organization's adoption of innovation is highly dependent upon its own characteristics and the nature of the market," theories regarding key organizational and market characteristics are outlined below (Castle, 2001, p. 161). In addition, hypotheses summarize the expected effect of these characteristics on network participation, quality of care and profitability. It should be noted that "Few empirical studies link organizational status and resident outcomes" in nursing homes (Castle and Shea, 1998, p. 250). Of those studies, even fewer attempt to relate organizational status and network participation. Thus, many of the hypotheses regarding outcomes in the following sections are based more on theory than on prior empirical research. The four organizational factors studied in this analysis and discussed in the following literature review include firm size, profit type, chain status and market concentration.

Firm Size - In analyses of the effects of firm size on innovation, empirical research from Cohen and Klepper (1996) maintained that larger firms were able to distribute the fixed costs of R&D over greater quantities of output and were more able to mitigate the costs and risks of innovation. Since the dependent variable in the Cohen and Klepper

study was the ratio of process patents to total patents, the authors attempted to control for process (versus product) innovation. However, as stated previously, it is not clear the extent to which process innovations are patented, especially in healthcare environments. Moreover, innovations from homes participating in the Pioneer Network are not patented at this point in time. Thus, a different measure of innovation, such as network participation, would allow the results of this study to be more generalizable to homes participating in the Pioneer Network.

In contrast to the "large firm innovators" theory, research by Acs and Audretsch (1987) found that environments existed where there were a disproportionately higher number of innovations (relative to R&D opportunities) for small firms. One aspect of the conditions identified by these authors as advantageous to small firm innovation was the use of "a large component of skilled labor" (Acs & Audretsch, 1987, p. 567). Their investigation employed data from the U.S. Small Business Administration in 1982 and utilized a regression analysis of innovations identified from "over 100 technology, engineering, and trade journals" (Acs & Audretsch, 1987, p. 568). Although nursing homes rely heavily on skilled labor (indicating a small firm advantage), "large" and "small" in their study were defined as organizations with over or below 500 employees. While this definition allowed comparisons across industries, it would not be conducive to a "within industry" understanding of firm size as it affects innovation in nursing homes.

With the ongoing debate regarding the effects of firm size on innovation, studies of innovation in nursing homes (although rare) are extremely valuable in guiding the hypotheses regarding the characteristics of homes participating in the Pioneer Network. An investigation of innovation in nursing homes that will inform the investigation in this

chapter was conducted by Nicholas Castle (2001). His analysis utilized a nationally representative sample to identify the characteristics of early adopter homes of special care and sub-acute care units from 1992 to 1997. While the Castle investigation was well designed, one potential limitation is that the capital intensive nature of his study is not generalizable to the process oriented adaptations involved in homes participating in the Pioneer Network. In a similar analysis, Banazak-Holl, Zinn and Mor (1996) studied the adoption of Alzheimer's and sub-acute units in nursing homes in 1992. Again, their investigation was well designed but concentrated on capital intensive innovation. Still, both studies found that larger homes are more likely to participate in early stage innovation activities than smaller homes (Castle, 2001; Banaszak-Holl et al., 1996).

These findings would suggest support for the hypotheses of the industrial organization literature that maintain that larger firms distribute the fixed costs of innovation over greater quantities of output and benefit from economies of scope and scale (Cohen and Klepper, 1996). However, as discussed previously, there is conflicting evidence regarding firm size and innovation, and it is possible that small nursing homes are able to mitigate costs as well as large firms (Acs & Audretsch, 1987).With limited prior evidence in the nursing home industry, this remains an empirical question. For the purpose of this investigation, the hypothesis is based on prior studies of nursing homes, and it is expected that large nursing homes (measured by the number of beds) are more likely to join the Pioneer Network.

- Hypothesis 1 - Large nursing homes are more likely than small homes to join the Pioneer Network.

Profit Type –The findings of research by Banazak-Holl, Zinn and Mor (1996) and Castle (2001) indicated that motivational differences extended to early stage innovation in nursing homes. Specifically, these studies asserted that non-profit homes were more likely to engage in innovative activities motivated to improve quality of care while for-profit firms engaged in activities expected to reduce costs and/or improve profitability (Banaszak-Hall, Zinn and Mor, 1996; Castle 2001). Although both quality and cost advantages are purported outcomes of participation in the Pioneer Network, the initial formation of the Pioneer Network concentrated on improvements to quality of care for consumers (Pioneer Network, 2005). Because quality is the most likely impetus for early network participation, it is expected that non-profit homes are more likely join the Pioneer Network.

- Hypothesis 2 - Non-profit firms are more likely than for-profit homes to join the Pioneer Network.

Chain Status - Homes that are part of a chain have access to additional resources and lower costs associated with economies of scale. Also, the presence of multiple firms in a chain allows the costs associated with network participation and process adaptation to be distributed over multiple homes. Ultimately, "These cost/profit advantages may free-up resources that are used for other purposes" (Castle, 1999, p. 105). In support of this supposition, Castle (1999) investigated quality improvement adoption by 236 nursing homes in 10 states. While it should be noted that Castle's main objective was to study the characteristics of the management teams of these homes, the ancillary analysis of organizational characteristics found that homes that were part of chain were more likely to engage in adoption of these techniques. One limitation of his investigation was that

quality improvement adoption in the survey was self-identified by the nursing home and was not verified in the empirical design.

In another investigation, Banaszek-Holl, Mitchell, Baum and Berta (2006) found that chains filtered adaptation and innovation through "transfer learning."[6] The limitation of their study with respect to the investigation of homes that join the Pioneer Network was that the authors were primarily studying transfer learning of services to newly acquired components of the chains. Also, the authors' model dealt with services provided (such as injection services) and not adaptation. Despite this limitation, it is not unreasonable to expect that transfer learning and information sharing among firms within a chain could be a potential benefit of network participation. In addition, the two previously discussed influential studies found that organizations owned and operated as part of a chain are more likely to be associated with early stage innovation (Banaszak-Hall, Zinn and Mor, 1996; Castle 2001). Thus, it is expected that nursing homes that are members of chains are more likely to join the Pioneer Network.

- Hypothesis 3 - Nursing homes that are a part of a chain are more likely to join the Pioneer Network.

Market Concentration - Market characteristics allow for differences in competitive environment. In terms of market structure, Banaszak-Hall, Zinn and Mor (1996) empirically examined the organizational characteristics of homes that adopted Alzheimer and sub-acute units and found that a competitive market concentration was highly correlated with the adoption of these innovations. Castle (2001) had a similar

result in an empirical study of the adoption of sub-acute and special care units. Thus, previous empirical results favor a competitive market structure in the adoption of innovation in nursing homes. This is based on the theory that homes in more competitive environments are likely to be motivated to compete for customers and to actively pursue quality of care advantages. Since a competitive environment could also lead to a home's consideration of an adaptive technique such as participation in a network, it is expected that nursing homes operating in competitive environments are more likely to join the Pioneer Network.

- Hypothesis 4 - Nursing homes in more competitive environments are more likely to join the Pioneer Network.

Table 2.1 reiterates predictors of particular interest and hypotheses suggested by previous studies of nursing homes.

Organizational Characteristics	Hypotheses of Network Participation
Home Size	Large Homes
Market Concentration	More Competitive
Chain Status	Chain Ownership
Type of Ownership	Non-Profit

Table 2.1 Summary Hypotheses of Network Participation

[6] According to these authors "transfer learning" occurs among members of a chain and is defined as occurring "when one component is affected by or uses the knowledge of another either through sharing experience or by somehow stimulating innovation" (Banaszek-Holl, Mitchell, Baum and Berta, 2006, p.45).

2.2.2 Methodology for Network Participation Analysis

To investigate the characteristics of homes that join the network, the first analysis employs a logit model for homes participating in the Pioneer Network and non-network homes where the dependent variable is an indicator of whether the home is a subsequent participant in the Pioneer Network. Independent and dependent variables are measured at the pre-participation timeframe of 1996. These coefficient estimates of the pre-designation characteristics allow an analysis of significant organizational and market structures of homes that were early entrants into the Pioneer Network.

The logistic regression model for this portion of the analysis is as follows:

$$P_{ij} = \beta_0 + \beta_1 E_{ij} + \beta_2 C_{ij} + \beta_3 M_{ij} + \varepsilon_{ij} \quad (2.1)$$

where for nursing home i in state j

- P is a dummy variable indicating network participation (participating in the Pioneer Network = 1, non-participants = 0)
- E is the vector of organizational characteristics (Type of ownership, Chain status)
- C is the vector of internal organizational characteristics (Number of beds, Staffing ratios, Occupancy rate, Private Pay Census)
- M is market concentration measured by the Herfindahl Index (sum of square market shares of all facilities in a county, values closer to zero are competitive while values close to one are more monopolistic)

The predictors in Equation 2.1 equate to the estimation of the probability of joining the Pioneer Network.

Control Variables - Expected effect of the control variables of staffing ratio, occupancy rate and private pay census are discussed below.

Occupancy Rate - Occupancy rate, as an independent variable, accounts for potential benefits or detriments due to economies of scale or overcrowding. Tesh et al. (2002) employed surveys to examine the characteristics of facilities adopting culture change (via the Eden Alternative) versus non-adopter homes in North Carolina and found that occupancy rates and staffing levels were higher for innovators. A limitation of their study is that conclusions were based on descriptive statistics of survey respondents instead of on an empirical analysis that controlled for theoretically relevant variables. In addition, due to the type of survey administered, Eden adopters or those planning to adopt Eden were over-represented as respondents in the sample. Yet, Castle (2001) found that lower levels of occupancy are associated with the adoption of innovation in nursing homes. For the purpose of this study, the hypothesis will follow the theoretical argument that economies of scale allow for additional resources to innovate. Therefore, it is expected that homes with a higher occupancy rate are more likely to join the Pioneer Network.

Private Pay Census - Castle (2001) found that a higher percentage of privately paying residents in a nursing home resulted in innovation. He theorized that operating margins of privately paying residents exceeded those of Medicare and Medicaid residents due to higher levels of reimbursement (Castle, 1999, p.105). In this way, his findings supported that a higher private pay census accumulated additional resources that could be applied to innovation or process adaptation.

Staffing Hours per Resident - Previous studies indicated that higher levels of staffing per resident lead to more effective quality of care (Institute of Medicine, 2001). However, the composition of overall staffing levels will vary by acuity levels (Quadagno and Stahl, 2003). Thus, higher acuity or occupancy rate will increase costs associated with staffing. Castle (2001) addressed conflicting hypotheses regarding staffing and the propensity to innovate. He noted that while more attentive and trained staff could better execute intricate innovations, the costs of employing staff at these levels could be prohibitive (p. 169). Since minimum staffing levels are determined by regulatory standards, the expected effect of this variable with respect to the Pioneer Network is that Pioneer Network homes will have similar staffing ratios pre-network participation when compared to non-network homes.

2.2.3 Data

Centers for Medicaid and Medicare Services

Historical data for quality of care outcome measures and nursing home characteristics for this dissertation are provided by the Centers for Medicaid and Medicare Services. The unit of analysis is the nursing home, and data are for nursing homes that are Medicare and Medicaid certified by CMS to provide skilled care. Data for quality measures are from resident physical assessments (Nursing Home Compare, 2006). Data are also provided from state government inspections. Data are maintained by CMS for each calendar year and contain relevant information regarding nursing home characteristics, staffing, quality outcomes and information regarding health deficiencies.

These raw data are then compiled to provide data for the Nursing Home Compare website. Data are from two CMS sources:

- The Online Survey, Certification and Reporting (OSCAR) database contains nursing home descriptive statistics and the results of health deficiencies as recorded during state inspections. The results of these surveys are entered into the database by state surveyors. In addition, nursing home characteristics are entered into OSCAR by the nursing homes.
- The Minimum Data Set Repository (MDS) contains data regarding quality measures as mandated by the Nursing Home Quality Initiative. Data regarding quality measures are collected at regular intervals and self-reported by the nursing homes.

Data for the outcome measure of per bed net income are from Skilled Nursing Facility Cost Reports. These data are available for public use from the Centers for Medicare and Medicaid Services. Descriptive and financial information contained in the cost reports include facility characteristics, utilization data, cost and charges by cost center, Medicare settlement data, and financial statement data (Centers for Medicare and Medicaid Services, 2005). Annual submission of the Skilled Nursing Facility Cost Report is required for Medicare-certified nursing homes. Cost report information is stored by the Centers for Medicare and Medicaid Services in the Healthcare Provider Cost Report System.

Data utilized are compiled from calendar years 1996 and 2003. These data are chosen to capture the early adopters of the Pioneer Network pre- and post- network participation. The pre-timeframe represents the time just before the formation of the network. The post-

timeframe represents the timeframe when early adopters had been in the network for one year or more to allow for any potential adjustments associated with network participation (see Appendix B for further discussion of data compilation and cleansing details).

Inventory of Pioneer Network Homes

For the purpose of this study, homes in the Pioneer Network are defined as homes that have been participating in the network for two or more years as of January, 2004. Again, this timeframe was chosen to capture early adopters in the first five years of the Pioneer Network (see Appendix B for a detailed description of data collection). Although it is possible that homes participating in the network for fewer than two years could be selected as control homes, it is statistically unlikely given that the number of homes participating in the network was less than .05 percent of the national sample of homes certified by the Centers for Medicare and Medicaid Services in 2005.

County Business Patterns

The County Business Patterns dataset from the U.S. Census Bureau was the source of wage approximation and also an estimation of rural or urban county location.

2.2.4 Descriptive Statistics

1996 Descriptive Statistics

Table 2.2 represents descriptive statistics for all 17,033 nursing homes monitored by CMS in 1996. Overall, Pioneer homes prior to network participation were more likely than non-network homes to have the following characteristics:

- Have a non-profit organizational type
- Be located somewhere other than in a hospital[7]
- Have fewer LPN hours per resident per day
- Have a higher occupancy rate
- Have more residents
- Have a lower percentage of residents with Medicare as their primary insurance
- Have a higher percentage of residents with a form of payment other than Medicare or Medicaid (i.e. third party insurance or private pay)

2003 Descriptive Statistics

Since the empirical models in this study also highlight a timeframe after homes have been participating in the network for at least one year, descriptive statistics are also presented for 2003. Table 2.2 represents descriptive statistics for all nursing homes in the country that were monitored by CMS in 2003. Overall, homes participating in the Pioneer Network in 2003 were more likely than non-network homes to have the following characteristics:

- Have a non-profit organizational type
- Have fewer LPN hours per resident per day
- Have a higher occupancy rate
- Have a lower percentage of Medicaid residents
- Have a higher percentage of residents with a form of payment other than Medicare or Medicaid (i.e. third party insurance or private pay)

Chapters 3 and 4 provide a more detailed discussion of the relevance of these statistics to quality of care and profitability outcomes associated with network participation. Although these statistics are extremely similar for 1996 and 2003, one difference between the two timeframes is that Pioneer Network homes have a lower percentage of residents on Medicaid in 2003 than non-network homes. This could indicate that Pioneer Network homes have some additional market power in this timeframe and are able to choose private paying residents over the lower Medicaid reimbursement (Grabowski, 2001).

For all homes, average wage rates and total staff hours per resident decreased from 1996 to 2003 while occupancy rates increased during the same timeframe. The decline in total staff hours most likely resulted from the implementation of the Prospective Payment System (PPS) in 1997. Homes responded to the income effects of PPS restrictions by minimizing costs and curtailing resources. Since labor is the largest source of operating costs, homes reallocated care hours from higher paid registered nurses to nurse assistants. Before the cost containment measures of PPS, total staff hours of homes varied from such disparate high and low values that many authors studying staffing utilized the median

[7] SNFs located in a hospital are expected to have higher costs of input than homes not located in a hospital (Nyman, 1999a).

instead of the mean as a more illustrative value (Harrington et al., 2000). Also, to a lesser extent, a slightly higher occupancy rate effectively lowered total hours per resident day, because homes only hired additional full-time employees after more significant increases in occupancy. Thus, the entire nursing home industry struggled to serve more residents with fewer available resources such as labor. This observation emphasizes the potential benefits of innovation in this constrained environment.

2.2.5 Network Participation Analysis Results

Table 2.3 displays the results of the estimation of the logit model from Equation 2.1 utilizing data for 10,468 homes in the states containing the sample of homes participating in the Pioneer Network. This logit investigates the characteristics of homes that join the Pioneer Network while controlling for other theoretically relevant variables. The logit model is based on the cumulative logistic probability function. While the dependent variable is an indicator of whether the home is a participant in the Pioneer Network, independent variables reflect the characteristics of homes hypothesized to affect network participation. While the signs and significance levels of coefficients in logit models and linear regression tend to be similar, the actual estimated coefficients tend to be quite different (Studenmund, 1991). Essentially, coefficient estimates represent the effect of a one-unit change in the independent variable on the odds of a home participating in the Pioneer Network.

Variables	1996 Non-Participating Homes Mean		1996 Non-Participating Homes Standard Deviation	1996 Homes Participating in Pioneer Network Mean	1996 Homes Participating in Pioneer Network Standard Deviation	1996 Total Mean	1996 Total Standard Deviation	2003 Non-Participating Homes Mean		2003 Non-Participating Homes Standard Deviation	2003 Homes Participating in Pioneer Network Mean	2003 Homes Participating in Pioneer Network Standard Deviation	2003 Total Mean	2003 Total Standard Deviation
Number of beds (in hundreds)	1.07		0.76	1.18	0.78	1.07	0.76	1.08		0.62	1.18	0.79	1.08	0.62
Type of ownership (For profit=1)	0.66	**	0.47	0.46	0.50	0.66	0.47	0.67	**	0.47	0.40	0.49	0.67	0.47
Chain Status (Yes=1)	0.52		0.50	0.48	0.50	0.52	0.50	0.52		0.50	0.52	0.50	0.52	0.50
Located in a Hospital (Yes=1)	0.13	*	0.34	0.07	0.25	0.13	0.34	0.07		0.25	0.05	0.22	0.06	0.25
Herfindahl Index	0.20		0.23	0.17	0.22	0.20	0.23	0.18		0.22	0.17	0.19	0.18	0.22
Average Wage Rate	9.79	**	3.23	11.00	2.57	9.80	3.23	8.52	*	4.02	9.34	4.13	8.53	4.02
RN Hours Per Resident Per Day	0.93		1.80	0.82	1.41	0.93	1.80	0.60		0.45	0.64	0.25	0.60	0.45
LPN Hours Per Resident Per Day	0.81	**	1.05	0.55	0.35	0.80	1.04	0.69	*	0.37	0.62	0.41	0.69	0.37
CNA Hours Per Resident Per Day	2.33		1.80	2.34	1.76	2.33	1.80	2.30		0.59	2.35	0.59	2.30	0.59
Total Hours Per Resident Per Day	4.07		3.88	3.72	3.03	4.07	3.87	3.59		0.92	3.60	0.72	3.59	0.92
Occupancy Rate	0.83	*	0.21	0.88	0.18	0.83	0.21	0.85	*	0.14	0.89	0.11	0.85	0.14
% Medicaid	0.61		0.28	0.59	0.24	0.61	0.28	0.63	*	0.22	0.58	0.22	0.63	0.22
% Medicare	0.14	**	0.25	0.08	0.07	0.14	0.25	0.12		0.15	0.09	0.10	0.12	0.15
% Private Pay	0.25	**	0.21	0.34	0.24	0.25	0.21	0.25	**	0.19	0.33	0.22	0.25	0.19
	Non Pioneer = 16096 facilities							*Non Pioneer = 16129 facilities*						
	Pioneer=101 facilities							*Pioneer=110 facilities*						

*Differences in means between homes participating and non-participating in the Pioneer Network statistically significant at the 5% level

**Differences in means between homes participating and non-participating in the Pioneer Network statistically significant at the 1% level

Table 2.2 Descriptive Statistics of Nursing Homes for all States in 1996 and 2003

For example, a one-unit increase in profit type (from non-profit to profit) results in an expected -1.153 decrease in the log-odds of participating in the Pioneer Network, holding all other variables constant. Thus, non-profit homes were more likely to join the network (significant at the .01 level). The coefficient on the percentage of private pay denotes that each additional percentage point of private paying residents increased the log-odds of participating in the Pioneer Network by 2.515 (all other variables constant). In other words, homes joining the Pioneer Network contained a larger percentage of private paying residents than non-participants. This finding was significant at the .05 level. Finally, the less significant coefficient of .002 represents the propensity for larger homes to join the network. The implication, given the higher percentage of private pay and Medicaid residents, is that early adopter homes were more likely to be residential facilities.

Variables	**Coefficient**	**P-Value**
Type of ownership (For profit=1)	-1.153	0.00
Located in a Hospital (Yes=1)	-0.335	0.50
Chain Status (Yes=1)	0.355	0.11
Number of beds (in hundreds)	0.002	0.06
Total Staff Hours Per Resident Per Day	-0.119	0.43
Occupancy Rate	1.038	0.30
% Private Pay	2.515	0.05
% Medicaid	1.318	0.28
Activities of Daily Living Index	0.340	0.30
Market Concentration	-0.241	0.73
LR chi2	179.43	
N	10468	

Table 2.3 Logit Analysis
Characteristics of Network Participation - All States

Thus, of the four hypotheses regarding the characteristics of homes that join the Pioneer Network, findings confirm the hypotheses for the home characteristics of profit type and firm size. The finding of non-profit homes as early adopters provides support for the hypothesis that the incentive to improve quality of care is a powerful stimulus for this type of innovation. The finding of larger homes as early adopters indicates that the additional resources available to homes with these characteristics are important to early stage innovation in this industry. In the next section, the analysis of network participants continues through an investigation of quality of care and profitability outcomes by organizational characteristic.

2.3 Within Group Outcome Analysis by Organizational Characteristic

2.3.1 Previous Research and Hypotheses

In order to fully explore the research applicable to outcomes by organizational characteristic, this literature review first examines quality of care and then details profitability research. The independent variables detailed in this investigation include the following:

- Firm Size
- Profit Status
- Chain Status
- Market Concentration

While small homes and independently owned homes are expected to achieve greater positive differences in both quality of care and per bed net income than large and chain operated homes, the other two characteristics vary by outcome. For example, non-profits are expected to have greater positive differences in profitability while for-profits are hypothesized to achieve greater positive differences in quality of care. In addition, more competitive homes are posited to have greater positive differences in profitability; however, less competitive homes are expected to have greater positive differences in quality of care. Literature supporting each of these hypotheses is discussed first for quality of care outcomes and then for profitability outcomes.

Quality of Care Outcomes

Firm Size - "Larger facilities command greater internal resources" that afford these homes an underlying advantage in the provision of quality of care (Banaszak-Hall, Zinn and Mor, 1996, p. 104). Yet, participation in the network could supplement a smaller home's ability to provide quality of care through the provision of "external professional environments for support" (MacPherson, 1991, p. 145). MacPherson (1991) conducted a study of small manufacturing firms in Toronto and Buffalo. Although a small sample size and survey data allowed only for a relatively weak empirical design of simple correlations, his investigation assessed many aspects of innovation and concluded that small firms benefit from external linkages (such as technology assistance) that support innovative performance (MacPherson, 1991). Given that the network serves as a supportive external support mechanism, it is expected that smaller firms are more likely

to benefit from any quality of care advantages associated with participation in the network.

- Hypothesis 5 - Small nursing homes are more likely to benefit by joining the network in quality of care outcomes than larger homes.

Profit Type - Findings of research that attempted to link organizational status to quality of care were contradictory. For example, Castle and Shea (1998) found that for-profits provided quality of care comparable to non-profits. Their study examined the much smaller sub-population of mentally ill nursing home residents (a particularly vulnerable population) using data from 1985 and 1987. A potential limitation of their analysis was that data were self-reported by nursing homes through a survey dataset. In addition, mortality was the outcome measure in the empirical design. Mortality for mentally-ill residents is not necessarily a representative outcome given that these residents are typically in nursing homes for residential care and not health related issues that would result in death.

Despite the above results, the findings of other research indicated that for-profit nursing homes do not provide quality of care consistent with non-profit homes (Harrington, 2001). For example, Harrington et al. (2001) performed a regression analysis and found that for-profits provided a lower quality of care than non-profit homes. The authors' explanation for this finding was that "profit-seeking diverts funds and focus from clinical care" (Harrington et al., 2001, p.3). Since these studies do not include the element of network participation, the hypothesis regarding the expected effect of participation on quality of care in a for-profit or non-profit setting is based on the

theoretical supposition that for-profits are motivated more by income than by exceptional care provision. As with previous hypotheses, without strong prior research and conclusions, the hypothesis becomes an empirical question for this study. Therefore, since it is expected that for-profit nursing homes that join the network will attain additional knowledge regarding quality of care and are more likely to benefit from any advantages in the provision of quality of care resulting from participation in the Pioneer Network, the hypothesis is as follows:

- Hypothesis 6 - For-profit nursing homes are more likely to benefit by joining the network in quality of care outcomes than non-profit homes.

Chain Status - The concept of transfer learning could allow homes in a chain to incorporate more elements of quality of care improvement (Banaszek-Holl, Mitchell, Baum and Berta, 2006). As with small firms, independently owned facilities lack the economies of scale with care provision that are available to facilities that are part of a chain. Also, independently owned homes lack that advantage of transfer learning. Yet, through a network, those independently owned homes could have a conduit for transfer learning. Ahuja (2000) empirically studied the impact of an inter-organizational collaboration of chemical firms in the US, Europe and Japan on patents and found that network ties escalated patent output. Although not directly related to the benefits of networking for smaller nursing homes in care provision, this study coupled with the concept of transfer learning supports the hypothesis that nursing homes that are independently owned are more likely to benefit from any advantages in the provision of quality of care resulting from participation in the Pioneer Network.

- Hypothesis 7 - Independently owned nursing homes are more likely to benefit by joining the network in quality of care outcomes than homes in a chain.

Market Concentration - In terms of market effects, Nyman investigated consumer demand and established that excess demand does lower quality in nursing homes (Nyman, 1988b). However, one limitation of this study is that it only represented one state (Wisconsin) in 1979, and Nyman found that most homes in the state were operating under conditions of excess demand (thus, making conclusions regarding the counter-factual difficult). In contrast, Grabowski (2001) considered the effects of Medicaid reimbursement in the presence of excess demand of Medicaid residents (i.e., the binding bed constraint for these residents brought on by Certificates of Need) on quality and could not substantiate that these conditions lowered quality of care in the nursing home market. Again, his study employed data from the mid-nineties, and a common challenge in this industry is the use of up-to-date measures to analyze quality of care effects. With limited prior research on the effects of market structure and innovation on quality of care, the supposition for his study is based on the theory that homes in more concentrated (or less competitive) environments are less likely to be motivated to compete for customers and to actively pursue quality of care advantages. Thus, these homes are more likely to benefit from any advantages in the provision of quality of care resulting from participation in the Pioneer Network.

- Hypothesis 8 - Nursing homes in less competitive environments are more likely to benefit by joining the network in quality of care outcomes.

Profit Outcomes

Potential advantages in quality of care and profitability vary by outcome and by organizational characteristic. While the previous hypotheses outlined literature supporting quality of care outcomes, the following hypotheses relate to profitability outcomes by organizational characteristic.

Firm Size– Large organizations have access to "greater resource availability, particularly access to capital for diversification, providing flexibility in responding to the needs of a changing environment" (Banaszak-Hall, Zinn and Mor, 1996, p. 104). As with quality of care provision, participation in the network could supplement resources for small homes allowing a general improvement in profitability and efficiency. According to Cohen and Klepper (1996, p.948) "One policy option that might allow smaller firms to emulate the cost spreading advantages more commonly enjoyed by larger firms is R&D cooperation." Since network participation could mirror this type of cooperation, it is expected that smaller nursing homes are more likely to benefit from any profitability and efficiency advantages associated with participation in the Pioneer Network.

- Hypothesis 9 - Small nursing homes are more likely to benefit by joining the network in profitability outcomes than larger homes.

Profit Type - Prior research indicated that for-profit organizations are more cost efficient than non-profit homes. Knox, Blankmeyer and Stutzman (1999) utilized a translog profit function to conclude that profit-seeking nursing homes were more efficient and profitable than non-profit homes in Texas. The primary limitation with their method was that the sample only included homes with profits. Homes with losses could not be

analyzed which is regrettable since "the line between profit and loss is not hard and fast" (Knox, Blankmeyer & Stutzman, 1999, p. 204). In another study, Arling et al. (1987) applied a cost function analysis to Medicaid certified nursing homes and found non-profit and governmental homes accrued higher costs than for-profit facilities. As one of the first studies of its kind, their investigation provided some of the initial conclusions regarding efficiency as it relates to ownership type. However, the sample size for the study was small and limited to Virginia. In addition, with the vast alterations in Medicaid disbursement over the past 20 years, the study lacks relevance for 2006.

In support of the above findings, Ozcan et al. (1998) employed a DEA analysis and found that in a 1991 sample of 324 nursing homes, for-profit homes were more technically efficient. One limitation of their empirical design is that it did not control for state or regional variations. The authors assert that "Although we recognize that Medicaid policies differ across states, we assume that Medicare certification of SNFs assures that variations in quality and procedures are not drastic" (Ozcan et al., 1998, p. 212). However, many researchers argue that the interpretation of regulations varies across states and should be considered a factor in any analysis of resources employed in care provision. Still, the findings above supported that for-profit homes are more efficient while non-profit homes are presumed to be motivated by care provision (Harrington, et al, 2001). Therefore, it is expected that non-profit nursing homes are more likely to benefit from any profitability and efficiency advantages associated with participation in the Pioneer Network.

- Hypothesis 10 - Non-profit nursing homes are more likely to benefit by joining the network in profitability outcomes than for-profit homes.

Chain Status – Similar to the discussion of findings from prior research regarding chain status on network participation and quality of care, transfer learning among firms in a chain could also extend to profitability. For example, cost efficiency in operational areas such as staffing could be achieved through adaptation in a home that is a member of a chain and then passed on to other homes in the chain. In contrast, independently owned homes only have one environment in which to learn from adaptation. Through the network, those independently owned homes could have a conduit for transfer learning emphasizing cost efficiency and profitability improvements. Thus, it is expected that nursing homes that are not part of a chain are more likely to benefit from any profitability and efficiency advantages associated with participation in the Pioneer Network.

- Hypothesis 11 - Independently owned nursing homes are more likely to benefit by joining the network in profitability outcomes than homes in a chain.

Market Concentration - Qualitative studies of the Pioneer Network have shown that homes participating in the network have an enhanced reputation in the community (Fagan, 2003) which may equate to higher occupancy rates and a greater proportion of private pay residents. If participation in the network does result in a competitive advantage, homes in more competitive environments should benefit from the acquisition of additional market power and profit from higher occupancy rates and private pay residents (firms in more monopolistic environments are assumed to already benefit from these factors).

- Hypothesis 12 - Nursing homes in less concentrated market environments are more likely to benefit by joining the network in profitability outcomes than homes in less competitive market environments.

Thus, the above hypotheses outline the expected effects of organizational variables on joining the network and on potential quality of care and efficiency advantages from network participation. Findings from this investigation contribute to the existing literature by adding to the relatively few studies that examine the characteristics of network participants. As stated previously, this inquiry explores a within group analysis of homes in the network, and the results of this study only address the outcome variation among network participants (the impact of network participation on outcomes is studied in Chapters 3 and 4). All of the hypotheses are summarized in Table 2.4. The following section provides the framework and methodology to study outcomes by organizational characteristic of homes participating in the Pioneer Network.

Organizational Characteristics	Quality of Care	Net Income
Home Size	Small Homes	Small Homes
Market Concentration	More Concentrated	Less Concentrated
Chain Ownership	Independently Owned	Independently Owned
Profit Status	For-Profit	Non-Profit

Table 2.4 Hypotheses of Change in Outcome by Organizational Characteristic

2.3.2 Outcome Analysis Methodology

To investigate the outcomes of homes participating in the Pioneer Network by organizational characteristic, the second analysis employs a difference-in-difference approach to examine significant changes in quality of care and profitability outcomes from the pre-participation timeframe of 1996 to the post-participation timeframe of 2003. The pre-timeframe represents the time just before the formation of the network. The post-timeframe represents the timeframe when early adopters had been in the network for one year or more to allow for any potential adjustments associated with network participation. To determine whether the organizational attributes of homes participating in the Pioneer Network have any effect on quality of care, this investigation utilizes two dependent variables. The first is the number of citations from state regulatory government inspections of nursing homes in a calendar year. The inspections occur to "ensure that the nursing home residents receive quality care and services in a safe and comfortable environment in accordance with rules established by CMS" (Nursing Home Compare, 2006b). Inspections occur at least every 15 months or when an outside complaint is received regarding a home. These citations include health deficiencies as well as life and safety code deficiencies for failure to meet federal regulations. In the event that there were multiple surveys on record for a home in a calendar year, the first survey of the year was the data source for this study.

A strength of this measure is that it captures many aspects of quality including "resident care processes, staff/resident interaction, and environment" (Nursing Home

Compare, 2006). Although some citations are more severe (surveyors rate each deficiency on an ascending level from A to L. Levels G through L indicate that a patient was actually harmed by the deficiency), the subset of citations that result in actual resident harm is minimal (Harrington et al, 2001). In addition, "CMS makes every attempt to ensure consistency among how the States report their findings" (Nursing Home Compare, 2006). Another strength of this outcome is that it is a potential measure of the success of network branding (a regulator might elect to be less vigilant of Pioneer participants, because they enjoy the brand). A weakness of this quality measure is that "the quality of a nursing home may improve or deteriorate significantly in a short period of time. These changes can occur when a nursing home's administrator or ownership changes or when a nursing home's financial health suddenly changes" (Nursing Home Compare, 2006). Thus, given the above circumstances and the infrequency of inspections, the relevance of citations could vary given circumstance or timeframe.

The second dependent variable is a summative "dependence index" of five quality measures collected by the Centers for Medicare and Medicaid Services. Initial analyses of these data indicated that the five quality outcomes are correlated and could be more accurately assessed in a single measure. As a result, the "dependence index" outcome is a summative index of five quality measures (percentage of residents with too much weight loss, percentage of residents with pressure sores, percentage of residents with physical restraints, percentage of residents who lose control of their bowels or bladder, and percentage of residents who spend most of their time in a bed or chair). While it could be stated that the outcomes included in the index are also reflective of resident acuity, these measures are a composite of quality indicators utilized by the Nursing Home Quality

Initiative to evaluate elements of care where "nursing homes are different from one another" (Nursing Home Compare, 2006a). In other words, these measures reflect areas where residents are dependent on the facility, but "there are things that nursing homes can do to improve" (lower) this rate of dependence (Nursing Home Compare, 2006a). For example, a facility's lack of support for resident toileting results in a resident's loss of control of bowels or bladder. In addition, a facility's lack of support in resident movement could result in a resident with pressure sores and/or a resident spending most of their time in a bed or chair. Thus, by current CMS evaluation, the index reflects areas where a resident suffers a loss of autonomy and becomes more dependent on the home. As such, this index should be particularly sensitive to any adaptation advantages associated with the claims that Pioneer makes regarding process changes.

In addition, recent literature finds that a single summative index that reflects multiple components is also a valid outcome measure (Kane, 2003, Harrington, et al., 2003, Harrington, Mullan & Carrillo, 2004). This type of index is an appropriate method of measurement as long as quality measures are correlated. As recommended by Harrington, Mullan and Carrillo (2004), Pearson correlation coefficients among the five measures were assessed and found to be significant and highly positive indicating the expected result that all were aspects of quality of care. To calculate the index, all five scores (the number of residents with each of the outcomes) are summed for each home, divided by the number of residents in the home and then standardized to an index per 100 residents. Thus, the index, *I*, is defined for home *i* in year *t* as follows:

$$I_{it} = \frac{(\sum O^{m}_{it})}{R_{it}} * 100 \qquad (2.2)$$

where *O* represents the number of residents with each outcome measure *m* the category of outcome measure (weight loss, pressure sores, restraints, incontinence, or bedfast), and *R* represents the number of residents in a home.

It should be noted that data regarding outcome measures and the number of residents for a home are collected at a single point in time (typically during state inspections) rather than over an extended period. To further illustrate the meaning of this index, if the number of outcomes (weight loss, pressure sores, physical restraints, incontinence, and/or bedfast) experienced in a standardized 100 resident home equaled zero, the dependence index would also equal zero. In contrast, if all 100 residents experienced each of the five outcomes described above, the dependence index would equal 500. Of course, most homes will have individual residents experiencing fewer than all five outcomes, so the mean expected index will vary. Thus, a higher score could reflect both patient mix acuity and resident dependence in a home. Conversely, a lower score (or a lowering of the score from the pre- to post-timeframe) means that fewer residents are dependent on the facility (either via a lower acuity of residents or improved performance of the home).

To measure profitability outcomes, this analysis utilizes the dependent variable of per bed net income measures. Net income in the CMS Skilled Nursing Facility Cost Reports (CMS, 2005) is defined specifically as the following:

Patient Revenues + Total Other Income - Total Operating Expenses - Total Other Expenses.

Operating expenses that could lower net income in the skilled cost reports include general service cost centers (e.g. capital related costs, employee benefits, plant operation, housekeeping and dietary), inpatient cost centers and ancillary cost centers. Total other income that could increase net income pertains to contributions, donations, bequests, income from investments and government appropriations. Thus, net income includes operating elements such as net patient revenue and operating costs; yet it also integrates the other vital fiscal concepts such as investments, contributions (donations) and depreciation. The choice to utilize this particular data element as the outcome measure for this investigation is justifiable given the detail and precision of its calculation in the Cost Reports. Also, a high percentage (93 percent) of homes populated this field (indicating the field was viewed as mandatory). Thus, this variable presented a complete and more accurate sample for potential matches in the propensity score estimation.[8] In this investigation, net income from a fiscal perspective is represented in a "per bed" capacity to assess a home's ability to employ resources, generate revenue and minimize costs (Section 4.6.1 provides a more detailed discussion of the potential effect of network participation on net income). A benefit of this unit of measure is that it standardizes net income for homes regardless of home size or number of residents. A detriment is that it does not fully assess the overall profit.

Based on previous studies of nursing homes, this study focuses on hypotheses relating to four organizational characteristics (hypotheses are reiterated in Table 2.4).

[8] The most common alternative measure of efficiency utilized in other studies is total cost per resident day (Nyman, 1999a). However, this outcome measurement requires identifiable data and was not an option for this investigation.

Each of these variables is operationalized as a dichotomous variable. Interval-level data are operationalized as dichotomous[9] and are defined in the following manner:

- ***Home size*** is defined by the number of beds in a home (smaller homes = 0, large homes = 1). Smaller homes are classified as homes with fewer than 100 beds (n=42). Large homes are identified as homes with 100 or more beds. Since this is a continuous variable, guidelines for variable cataloging are drawn from the literature (n=48). In this case, the use of 100 beds or more to define large homes is modeled after a study of voluntary workers in nursing homes completed for the U.S. Department of Health and Human Services (Moss & Remsburg, 2005). Although the study did not involve network participation, the specification guidelines for home size were created after consultation with the Department of Health and Human Services and careful examination of industry performance and standards.
- ***Market concentration*** refers to the competitiveness of the county in which a home is located (less competitive = 0, more competitive =1). Less competitive environments are classified as homes with a Herfindahl index (sum of square market shares of all facilities in a county) greater than or equal to nine percent (n=46). Contrastingly, homes in a more competitive environment are defined as homes with a Herfindahl index less than nine percent (n=44). Values closer to zero are competitive while values close to one are more monopolistic. This specification is also

[9] With so few homes, these dichotomous variables do not change for each home from the pre- to post-timeframe (e.g. a non-profit

based on a study of the employment of nurse practitioners by Intrator, et al. (2005) for the reasons discussed above.

- ***Chain ownership*** indicates whether a home is part of a chain (n=45) or independently owned (n=45). The specifications for these variables are as follows: independently owned =0 and chain owned =1.
- ***Profit status*** indicates whether a home is for-profit (n=40) or non-profit (n=50). The specifications for these variables are as follows: non-profit=0, for-profit=1).

Data in these analyses are for homes in the Pioneer Network from 1996 (pre-participation in the network timeframe) and 2003 (participating in the network for at least one year). Negative binomial regressions examine quality of care outcomes by organizational characteristic while controlling for other variables. Negative binomials are well suited for dependent variables of counts and, unlike Poisson regressions, allow for the conditional variance to exceed the conditional mean which provides more efficient estimates of zero counts. In the case of the quality of care outcomes, the dependence index is simply a count of residents in a home with each outcome. Likewise, citations are simply a count of citations received by a home in a given year. Regressions contain dummy variables to identify the organizational characteristic's timing of before/after participation while other control variables are left in their continuous forms. A similar series of OLS regressions investigates changes to per bed net income. Next, a difference-in-difference approach is employed to test for statistically significant changes in quality of care and profitability pre- to post-Pioneer Network participation by the designated

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home in 1996 is a non-profit home in 2003).

parameters of each organizational characteristic. By using this analysis, the DID estimator can take into account "unobserved variables that may affect outcomes" (e.g. state or federal regulatory policies that alter operations in nursing homes) (Bryson, 2002, p. 8). Appendix B presents a detailed discussion of the extraction of data from files and relevant decision rules.

To ascertain the extent to which pre-to-post quality of care and profitability outcomes are significantly different by the dichotomous variable representing each organizational characteristic, the negative binomial and OLS regression models are estimated as follows:

$$O_{it} = \delta_0 + \delta_1 SMALLPOST_{it} + \delta_2 LARGEPRE_{it} + \delta_3 LARGEPOST_{it} + \delta_4 C_{it} + \varepsilon_{it} \quad (2.3)$$

$$O_{it} = \delta_0 + \delta_1 MONOPOST_{it} + \delta_2 COMPPRE_{it} + \delta_3 COMPPOST_{it} + \delta_4 C_{it} + \varepsilon_{it} \quad (2.4)$$

$$O_{it} = \delta_0 + \delta_1 INDPOST_{it} + \delta_2 CHAINPRE_{it} + \delta_3 CHAINPOST_{it} + \delta_4 C_{it} + \varepsilon_{it} \quad (2.5)$$

$$O_{it} = \delta_0 + \delta_1 NPPOST_{it} + \delta_2 PROFPRE_{it} + \delta_3 PROFPOST_{it} + \delta_4 C_{it} + \varepsilon_{it} \quad (2.6)$$

where O_{it} is the quality of care or profitability outcome for home *i* in year *t*.

In Equation 2.3, *SMALLPOST* is a dummy variable equal to one if the outcome is for a smaller home in the post-timeframe and equal to 0 otherwise, *LARGEPRE* is a dummy variable equal to one if the outcome is for a large home in the pre-timeframe and equal to 0 otherwise, and *LARGEPOST* is a dummy variable equal to one if the outcome is for a large home in the post-timeframe and equal to 0 otherwise. For Equation 2.4, $MONOPOST_i$ is a dummy variable equal to one if the outcome is for a home in a less competitive environment in the post-timeframe and equal to 0 otherwise, *COMPPRE* is a

dummy variable equal to one if the outcome is for a home in a competitive environment in the pre-timeframe and equal to 0 otherwise, and *COMPPOST* is a dummy variable equal to one if the outcome is for a home in a competitive environment in the post-timeframe and equal to 0 otherwise. In Equation 2.5, $INDPOST_i$ is a dummy variable equal to one if the outcome is for an independently owned and operated home, *CHAINPRE* is a dummy variable equal to one if the outcome is for a home owned by a chain in the pre-timeframe and equal to 0 otherwise, and *CHAINPOST* is a dummy variable equal to one if the outcome is for a home owned by a chain in the post-timeframe and equal to 0 otherwise. In Equation 2.6, *NPPOST* is a dummy variable equal to one if the outcome is for a non-profit home in the post-timeframe and equal to 0 otherwise, *PROFPRE* is a dummy variable equal to one if the outcome is a for-profit home in the pre-timeframe and equal to 0 otherwise, and *PROFPOST* is a dummy variable equal to one if the outcome is for a for-profit home in the post-timeframe and equal to 0 otherwise.

Since the omitted category equates to outcomes in the pre-timeframe, the coefficient δ_1 corresponds to the difference for the designated variable from 1996 to 2003. In each of the four equations, δ_1 represents the coefficient on the difference between 2003 and 1996 for the following measures:

- Smaller homes
- Homes in more concentrated market environments
- Independently owned homes
- Non-profits

Similarly, the change in outcomes for the following:

- Larger homes
- Homes in less concentrated market environments
- Homes that are part of a chain
- For-profit homes

can be calculated from (δ_3-δ_2). Finally, the difference-in-difference estimate is calculated as the change in quality and profitability outcomes or (δ_3-δ_2) - δ_1. *C* is a vector of control variables. These variables include the following:

- Number of beds – to control for home size (Eq. 2.4, 2.5, 2.6)
- Herfindahl Index – to control for market concentration (Eq. 2.3, 2.5, 2.6)
- Chain status – to control for chain affiliation (Eq. 2.3, 2.4, 2.6)
- Profit type – to control for profit motivations (Eq. 2.3, 2.4, 2.5)
- Total staff hours (RN, LPN, CNA) per resident per day – to control for differences due to more attentive care and acuity
- Percentage Private Pay – to control for reimbursement
- Percentage Medicaid – to control for reimbursement/resident acuity.
- Occupancy rate – to control for potential benefits or detriments due to economies of scale or overcrowding

Since the dependence index is represented as an index ranging from zero to 500, a positive final difference-in-difference estimation indicates that homes in each equation with the coefficient estimated by δ_1 (smaller homes, more concentrated, independently owned, non-profits) achieved either a greater improvement (reduced dependency) or a smaller increase in this outcome when compared to homes represented by (δ_3-δ_2) (larger, less concentrated, chain owned, for-profit) from 1996 to 2003. Since the number of

citations can range from zero to infinity, a positive final difference-in-difference estimation for this outcome measure also indicates that homes in each equation with the coefficient estimated by δ_1 (smaller homes, more concentrated, independently owned, non-profits) achieved greater improvement (reduced the number of citations) compared to homes represented by (δ_3-δ_2) (larger, less concentrated, chain owned, for-profit) during the same timeframe. Similarly, OLS regressions are employed to achieve estimations of per bed net income for Equations 2.3 through 2.6. A negative final difference-in-difference estimation for per bed net income indicates that homes in each equation with the coefficient estimated by δ_1 increased profit more than homes represented by (δ_3-δ_2) during the same timeframe.

2.3.3 Descriptive Statistics

Table 2.5 illustrates the comparisons of means of home participating in the Pioneer Network for each of the outcome measures by organizational characteristic from 1996 to 2003. This comparison indicates that larger homes achieved a greater reduction in citations from 1996 to 2003 (by 2.4 deficiencies) and larger decrease in the dependence index (by 7.8). However, smaller homes achieved an increased per bed net income by an additional $472 from 1996 to 2003 over larger homes. The comparison by market concentration suggests that homes in less competitive market environments attained a greater reduction in citations from 1996 to 2003 (by 4.8 deficiencies) and a larger decrease in the dependence index (by 4.7). These homes also earned an added

$1,911 in per bed net income over homes in more competitive market environments from the pre- to post-timeframe.

The comparison by chain status implies that homes that are independently owned accomplished a greater reduction in citations from 1996 to 2003 (by 3.2 deficiencies) and a reduced dependence index (by 11.8). These homes also garnered an added $1,051 in per bed net income from the pre- to post-timeframe over homes that are part of a chain. Finally, the comparison of means by profit type indicates that homes that are non-profit achieved a greater reduction in citations from 1996 to 2003 (by 5.3 deficiencies) and a greater reduction in the dependence index (by 11.2). These homes also achieved a larger increase in per bed net income ($2,798) from 1996 to 2003 over for-profit homes. It is important to note that this descriptive comparison of means does not control for other variables. However, the results of the regression analyses in the next section will explore outcome variations by organizational characteristic while controlling for theoretically relevant variables.

2.3.4 Outcome Analysis Results

Table 2.6 displays the results of both the negative binomial regressions measuring quality of care outcomes and the OLS regressions measuring per bed net income for equations 2.3 through 2.6. The purpose of these regressions is to investigate the outcomes of homes that join the network by organizational characteristic while controlling for independent variables. The difference-in-difference estimations for each of the three outcome measures (dependency index, number of citations, and net income) are also

reported. A Wald test is employed for both the negative binomial and OLS regressions to determine whether the differences by characteristic are significantly different from zero

Organizational Characteristic	Change in Deficiencies	Change in Dependence Index	Change in Per Bed Net Income
Large Homes	-1.2	-65.8	-98
Smaller Homes	1.1	-58.1	374
Difference	***-2.4***	***-7.8***	***-472***
Lower Market Concentrations	2.3	-59.8	-585
Higher Market Concentrations	-2.4	-64.5	1,326
Difference	***4.8 ****	***4.7***	***-1,911***
Chain Homes	1.5	-56.3	-347
Independent Homes	-1.7	-68.1	704
Difference	***3.2***	***11.8 ****	***-1,051***
For Profit Homes	2.8	-56.0	-1,177
NonProfit Homes	-2.5	-67.2	1,621
Difference	***5.3 *****	***11.2 ****	***-2,798 ******
*p-value ≤ 0.1 **p-value ≤ 0.5 *** p-value ≤ 0.01	n=90	n=90	n=72

Table 2.5 Mean Change of Early Adopter Homes Participating in the Pioneer Network by Outcome Measure: 1996 to 2003

Overall, changes in quality of care as measured by deficiencies per 100 residents varied by organizational characteristic. In the analysis of home size, the coefficient of .2 indicates that small homes actually increased deficiencies from 1996 to 2003 more than large homes, which experienced a negligible change. This resulted in a non-significant -.2 difference indicating all but zero difference in this outcome between small and large homes. For the characteristic of market concentration, the coefficient of -0.3 for homes in higher market concentrations indicates a decrease in deficiencies while homes in lower

market concentrations actually increased deficiencies (coefficient of 0.5). The difference in differences estimation (.8) is significant at the .01 level. For the characteristic of chain status, the coefficient of -0.1 indicates that independently owned homes decreased deficiencies while homes that were part of a chain increased deficiencies resulting in an insignificant difference.

In a more noteworthy finding, the difference in difference estimation is significant at the (.01) level by profit status. For this characteristic, non-profit homes decreased deficiencies (coefficient of -0.3) from 1996 to 2003 while for-profit homes increased deficiencies. Profit status also produced the only significant DiD estimate for the dependence index outcome. Notably, all organizational characteristics fell in this outcome from 1996 to 2003. However, non-profit homes decreased more than for-profit homes and the difference between the two (.1) was significant at the .1 level. These findings as they relate to the quality of care hypotheses proposed in Section 2.3.1 are as follows:

- *Hypothesis – Small nursing homes are more likely to benefit by joining the network in quality of care outcomes.* – Not supported.
- *Hypothesis – Nursing homes in less-competitive market environments are more likely to benefit by joining the network in quality of care outcomes.* – Supported.
- *Hypothesis – Independently owned nursing homes are more likely to benefit by joining the network in quality of care outcomes.* – Not Supported.

- *Hypothesis – For-profit nursing homes are more likely to benefit by joining the network in quality of care outcomes than non-profit homes.* – Rejected (Non-profit homes benefit).

As with deficiencies, the outcome of per bed net income varied by organizational characteristic. In the analysis of home size, the positive coefficients (controlling for independent variables) resulted in a non-significant -46.6 difference indicating little difference between small and large homes. For the characteristic of market concentration, homes in higher market concentrations increased net income while homes in lower market concentrations actually decreased net income. The difference in differences estimation (-2,645) is significant at the .1 level. For the characteristic of chain status, independently owned homes improved net income whereas net income fell for homes that were part of a chain resulting in an insignificant difference. Finally, non-profit homes enhanced per bed net income from 1996 to 2003, but for-profits declined in this outcome. The final difference of -2,472 between non- and for-profits was significant at the .1 level. These findings as they relate to the net income hypotheses proposed in Section 2.3.1 are as follows:

- *Hypothesis – Small nursing homes are more likely to benefit by joining the network in net income than larger homes.* – Not supported.

- *Hypothesis – Nursing homes in competitive market environments are more likely to benefit by joining the network in net income than homes in less competitive market environments.* – Rejected (Homes in less competitive market environments benefit).

- *Hypothesis – Independently owned nursing homes are more likely to benefit by joining the network in net income than homes in a chain.* – Not Supported.

- *Hypothesis – Non-profit nursing homes are more likely to benefit by joining the network in net income than for-profit homes.* – Supported.

In interpreting these results and examining hypotheses, it is important to note that this analysis is less an evaluation of network participation and more a comparison of the outcomes among network participants. Overall, the characteristics with the most interesting findings include market concentration and profit status. For example, homes in more concentrated market environments achieved statistically significant positive quality of care and profitability outcomes. Non-profit homes also accomplished positive results in each measure. Implications of these findings will be discussed further in the following section. All hypotheses are reviewed in Table 2.7.

2.4 Discussion

The primary motivation of this investigation was to address the "why" and "who" with respect to Pioneer Network participation in nursing homes. Although there is an established tradition of research that has focused on innovation in diverse organizational settings, few studies have investigated this phenomenon in nursing homes. While the research in this chapter did not attempt to investigate the processes associated with the Pioneer Network's claims of quality of care and profitability improvements, it did analyze the differences in outcomes of network participants by organizational

characteristic. With a limited amount of prior research in the nursing home industry, the hypotheses put forth in this study were predominantly based on the few existing inquiries of nursing home innovation. Most of these prior investigations related to the adoption of capital intensive adaptations such as sub-acute units. An interesting component of this study was the juxtaposition of these hypotheses with the results of the analysis of the process-oriented adaptations associated with participation in the Pioneer Network.

Organizational Characteristic	Deficiencies[a]	Dependence Index[a]	Per Bed Net Income[b]
Smaller Homes	0.2	-1.3	213
Large Homes	0.0	-1.2	167
Difference	***-0.2***	***0.1***	***-46.6***
Higher Market Concentrations	-0.3	-1.2	1,872
Lower Market Concentrations	0.5	-1.3	-763
Difference	***0.8*** ***	***-0.1***	***-2,635*** *
Independent Homes	-0.1	-1.3	994
Chain Homes	0.3	-1.2	-462
Difference	***0.4***	***0.1***	***-1,455***
NonProfit Homes	-0.3	-1.3	1,533
For Profit Homes	0.5	-1.2	-939
Difference	***0.8*** ***	***0.1*** *	***-2,472*** *
*p-value ≤ 0.1 **p-value ≤ 0.5 *** p-value ≤	n=90	n=90	n=72

[a] The table entries for Deficiencies and Dependence Index represent the results of negative binomial regressions
[b] The table entries for Per Bed Net Income represent the results of OLS regressions

Table 2.6 Regression Results of Change by Outcome Measure: 1996 to 2003

Organizational Characteristic	Quality of Care Hypothesis	Quality of Care Results	Profitability Hypothesis	Profitability Results
Home Size	Small Homes	Not Supported	Small Homes	Not Supported
Market Concentration	Less Competitive	Supported	More Competitive	Rejected
Chain Ownership	Independently Owned	Not Supported	Independently Owned	Not Supported
Profit Status	For-Profit	Rejected	Non-Profit	Supported

Table 2.7 Hypotheses and Results of Characteristics of Homes by Outcome

The first component of this study investigated the characteristics of homes that join the network. While this analysis yielded only a few statistically significant results, these findings are still noteworthy in the context of network participation in the nursing home setting. Of particular interest is the most significant finding that non-profit homes are more likely to be early adopters of the Pioneer Network, all else equal. Since one of the goals of the Pioneer Network is to improve quality of care for residents in nursing homes, this supported the idea that non-profits are more likely to invest in innovation with the hope of improving quality of care for clients. However, this finding contradicted previous research that found for-profits were more likely to engage in the adoption of sub-acute units (Castle, 2001). These conflicting findings could be explained by the potential lack of ancillary funds available to non-profits for investment into product innovations. In contrast, process innovations could provide less cost-restrictive options for adaptations. This supposition combined with the finding that larger homes with a higher private pay census are also more likely to join the network intimated that hypotheses regarding the necessity of additional resources or economies of scale to promote innovation are correct. However, although the motivation to improve quality of care is more congruent with the non-profit home, less expensive process innovations such as joining a network could be a more attainable method of achieving this goal.

As with the decision to join the network, non-profit status was also the predominant characteristic in the analyses of quality of care and net income outcomes of network participants. In fact, improvement occurred in all three of the outcome measures for non-profit homes. These homes reduced the dependence index and citations more than for-profits from 1996 to 2003. In addition, non-profit homes were more able to substantially increase net income during the same timeframe. Thus, the hypothesis that for-profits would benefit more in quality of care improvements was rejected, but the hypothesis that non-profits would benefit more in net income was supported.

One reason for this finding could be due to an enhanced awareness of efficiency that non-profits attain from Pioneer Network participation. If the methods employed in these homes yield greater efficiencies while also improving quality of care, the homes that are able to best integrate these practices would yield the superlative results. Since non-profits are posited to be motivated by quality of care, these homes could be committed to more fully incorporate Pioneer Network techniques into operational processes (Banaszak-Holl et al., 1996). This finding supported that successful innovators in the Pioneer Network are motivated primarily by improvements in quality of care but experience a supplementary outcome of increased net income due to the enhanced efficiencies associated with network participation or network branding.

Interestingly, homes in more concentrated market environments also achieved significant improvements in quality of care and profitability over more competitive market concentrations. Unlike non-profits, these homes are not more likely to enter the network; however, homes that do choose to participate with the network appear to

accomplish successful outcomes. One possible explanation is that homes in higher market concentrations do not perceive competitors as a threat to the loss of residents or staff due to changes associated with process adaptations. Thus, these homes are uninhibited to more fully engage in network participation.

Thus, the overall findings of this investigation were instructive and supplemented the relatively few studies of network participation in this setting. For example, these results contributed to the insight regarding "why" homes undertake this type of innovation by revealing that non-profits are more likely to join the network. Since there are relatively more for-profits in the nursing home industry, it is interesting that non-profits self-select into the Pioneer Network. This finding intimated that the incentive to improve quality of care is most likely the stimulus for network participation. These results also indicated that organizational status contributed to success, because non-profit homes in less competitive market environments improved both quality of care and increased net income.

As the first extensive empirical investigation of the internal characteristics of homes in the Pioneer Network, this research affords a wide range of possibilities for future inquiries. While this research contributes to an understanding of the "innovation decision" in the nursing home setting, it is limited in that it only studies the early adopters of the Pioneer Network. With so few homes, inferences from these findings lack statistical influence and authority. Since the network has expanded over the past few years, there are legitimate opportunities to build upon this research with a more substantial treatment group from a larger geographical area. In addition, findings from this investigation suggest that organizational profit status could influence the choice

between process-oriented adaptations and more capital intensive innovation. Thus, the type of innovation as it relates to organizational profit status should be more fully explored.

According to Banazak-Hall, Zinn and Mor (1996) "The cost, access, and quality implications of innovation in nursing facilities should be of great concern to policymakers" (p.113). As one of the first studies to link the characteristics of a nursing home network with outcomes, findings from this analysis suggested that certain homes benefit in all three of these areas from Pioneer Network participation. One limitation of this research is that network participation is a proxy for innovation. Future research could uncouple the effects of participation and process adaptations. Also, since this research employed methods that separated organizational characteristics and outcomes, further explorations could employ methods that scrutinize the interactions of these characteristics on outcomes. For example, do small non-profits benefit more than large non-profits? The following two chapters will progress from this chapter's investigation of Pioneer Network participants to empirical investigations of the effect of network participation on quality of care and financial outcomes.

CHAPTER 3

3 EFFECTS OF NETWORK PARTICIPATION ON QUALITY OF CARE

3.1 Introduction

The previous chapter focused on a study of the organizational characteristics of participants in the Pioneer Network. This chapter broadens the investigation of the Pioneer Network by examining the effect of network participation on quality outcomes. This area of study is relevant since the quality of care provided to residents is one of the predominant concerns for stakeholders in the nursing home industry. Although the intense pressure to reduce costs makes it difficult to maintain or improve quality, Lowe,et al. (2003) observe that the Omnibus Budget Reconciliation Act of 1987 shifted evaluations of health care quality from a focus on structure and process criteria to clinical outcomes, resident satisfaction, and quality of life. In an effort to assist homes in re-directing quality efforts to an outcome oriented, quality of life perspective, governmental programs such as the Nursing Home Quality Initiative (NHQI) implemented detailed objectives and policies for homes and regulators.

Yet, despite the intensified focus on quality of care presented by programs such as NHQI, there is considerable ongoing debate regarding the most relevant factors affecting

quality of care in nursing homes. For example, some researchers argue that internal process changes are the key element in the improvement of care-giving for residents, because these processes are the dominant component of direct care in nursing homes (Kane, 2003; Sampsell, 2003; Berlowitz et al., 2003). Other researchers posit that nursing home characteristics such as profit status are more important determinants of quality of care because profit motivations influence the provision of care-giving resources (e.g., Harrington et al, 2001; Grabowski and Hirth, 2002; Nyman, 1988b). As discussed in the previous two chapters, another potential method of improvement is through inter-organizational networks. Participation in inter-organizational networks could lead to a number of possible benefits including improved dissemination of resources, product branding and/or adaptive techniques that aid in process changes. While each of these benefits allows a network to serve as an information-sharing and screening mechanism, it is unclear to what extent network participation filters down to end-users or consumers in the form of improved quality of service. The existence of inter-organizational networks in the nursing home industry coupled with the efforts of home administrators to improve quality of care for residents affords an opportunity for further investigation of outcomes for consumers of an inter-organizational network.

The analysis in this chapter addresses this opportunity through a study of the Pioneer Network, an inter-organizational network that asserts that positive quality of care outcomes are associated with the network's adaptive techniques and process changes occurring in network homes. To test this assertion, this study employs a negative binomial regression utilizing data from 2003 in a cross-sectional exploratory analysis of the effects of Pioneer Network participation. The dependent variables in this study are the

number of citations from state regulatory government inspections of nursing homes in each calendar year as well as the summative index of five quality measures collected by the Centers for Medicare and Medicaid Services in 2003. In addition, the number of years that a home has been participating in the network as of 2003 acts as a treatment variable representing network participation and is included in the regression with other theoretically relevant independent variables identified by previous research as potentially affecting quality of care.

In addition to the cross-sectional analysis, a quasi-experimental methodology matches Pioneer Network homes with control homes and then utilizes a difference-in-difference approach to measure pre- to post- network participation quality of care outcomes contrasted with quality of care outcomes for control homes during the same timeframe. The dependent variables in this study are also the number of citations from state regulatory government inspections of nursing homes in each calendar year as well as the summative index of five quality measures collected by the Centers for Medicare and Medicaid Services in 1996 and 2003. In this way, this research investigates whether each of the outcome measures for Pioneer Network homes improved from 1996 to 2003 when compared to control homes.[10] Two sets of analyses are utilized to design an extensive investigation into quality of care differentials for network participants. These results provide insight into any quality of care outcomes that result from participation in the network.

The subsequent sections of this paper include the following: Section 3.2 reviews the relevant literature including empirical work on networks and quality of care in

[10] These timeframes are chosen to capture the early adopters of the Pioneer Network pre- and post- network participation.

nursing homes, Section 3.3 outlines the methodology for the negative binomial regressions, Section 3.4 lists descriptive statistics for differences in outcomes from 1996 and 2003, Section 3.5 presents findings for the negative binomial regressions, Section 3.6 discusses the method and findings for the matched sample analysis, and Section 3.7 provides a discussion with recommendations for future research.

From a scholarly perspective, this dissertation goes beyond existing network literature (that traditionally studies the outcomes of network participants) by studying the consequences for consumers of the network through an analysis of quality of service. These findings also contribute to the network literature by adding to the relatively few studies that employ an empirical design with the network as the treatment variable. From a public policy perspective, this research is the first analysis of the Pioneer Network to use a quasi-experimental design at a national level to examine the critical counter-factual of what would happen in the absence of Pioneer Network participation. While this research does not attempt to understand what is actually occurring in this inter-organizational network, the investigation of quality of care outcomes for consumers of homes in the Pioneer Network is an important step towards informing government policy-making regarding future research and evaluation.

3.2 Previous Research

In order to fully explore the pertinent research within the focal areas of this investigation, a comprehensive literature review must explore two significant themes:

- Networks –Relevant literature will facilitate defining the Pioneer Network as an "inter-organizational network" and will establish networks as primary

independent variables in previous empirical studies of network participation on nodes and clients.

- Quality outcomes in nursing homes - Previous qualitative and quantitative findings will be reviewed in order to outline the results and conclusions of earlier studies and establish the network hypothesis in the realm of other theoretical frameworks.

3.2.1 Networks

Early studies of networks attempted to define networks and ascertain motivations for network participation. Olson (1965) hypothesized that groups or organizations form to further the common interests of their members through collective action. For example, a network is often described as a mechanism for groups and organizations engaged in collective action to pool, exchange and mobilize resources (Diani and Bison, 2004). This process of external linkages allows a network to serve as an information-sharing and screening mechanism that allows a firm to obtain a collaborative advantage that it would not achieve without cooperation (Ahuja, 2000).

However, many of the early examinations of implementation and coordination among networks of government agencies did not always conclude that network participation leads to positive outcomes. Pressman and Wildavsky (1973) cautioned that horizontal command and control in public policy led to a "complexity of joint action" (p. 87). According to these authors, multiple actors and perspectives in policy led to complications such as "incompatibility," "differences of opinion" and "substantial

delays" which factored into a "decreasing probability of program success" (Pressman and Wildavsky, 1973, p. 100). Additional research and theory regarding implementation in public administration argued that coordination worked best only in areas of high conflict and high ambiguity while lower levels of conflict and ambiguity required more direct administrative intervention (Matland, 1995). While this theory attempted to synthesize "top-down" and "bottom-up" approaches of policy implementation, it failed to extensively delve into distinct classifications of coordination and provide a framework for further study. With this perspective on the benefits and detriments of coordination, these earlier evaluations lacked a theoretical foundation to propel further research in this area of inquiry.

Yet, recently, researchers such as Milward and Provan argued for studies of networks, because this type of analysis "holds the prospect of righting the balance" between administrative and policy research (Milward and Provan, 1998, p. 388). They reason that an assessment of a network's relationships over time allows for an estimation of "social learning" (Milward and Provan, 1998, p. 405). This type of evaluation illuminates the gap for policymakers between initial expectations and the resulting operational outcomes. In later work, these authors also argue that "…a reasonable assessment of network effectiveness is critical to justify involvement by provider agencies and to justify public support of the concept" (Provan and Milward, 2001, p. 415). Other authors also argue the value of network research. Toonen (1998) states that "If the network concept is not used loosely and the analysis is indeed restricted to relations and institutions that imply a form of interdependency, network analysis

generally brings a new focus to the analysis of traditional questions and issues from a bargaining exchange perspective" (p. 250).

In recent years, empirical work in this area focused on varying theoretical frameworks. As stated previously, this chapter investigates outcomes associated with network participation. Although the diffusion of information into network homes is one possible theoretical explanation for any positive findings, one limitation of this investigation is that it does not include a direct measurement of information dissemination into network homes. Thus, another possible theoretical explanation for any findings is that the link between network participation and outcomes may be a signaling benefit of wearing the network brand. In effect, voluntary participation in a network or a club could establish a level of legitimacy through a larger collective action that a single firm may not be able to accomplish on its own (Prakash and Potowski, 2007). Because this is also attributed to an increased reputation and image, the authenticity of network branding can be particularly powerful with external stakeholders in a regulatory environment (Prakash and Potowski, 2007).

In addition to multiple potential benefits of network participation, empirical work in this area focused on varying units of analyses (network level, organizational level, individual level). Of particular interest with relation to the Pioneer Network are studies focused on outcomes of nodes in an inter-organizational network. For example, O'Toole and Meier (2004) performed an empirical analysis of Texas school districts and the effects of intergovernmental networking on standardized test scores. In their investigation, the Texas Public Education system represented a network. The nodes of the network included school districts as well as governmental agencies. Their results

concluded that superintendents' networking with school board members, local business leaders, other school superintendents, state legislators and the Texas Education Agency has a positive impact on scores (especially when school districts have a strong dependence on external sources of funding). Juenke et al. (2005) expanded upon O'Toole and Meier's findings by adding "length of time in the network" to the regression analysis and determining that length of time in the network and test scores were positively correlated. In critical assessment, the findings of these authors' studies are quite persuasive. The framework of methods that Meier and O'Toole created is corroborated by Juenke's replication and substantiation of results from the first study while also adding the important concept of "time in the network" into the model.

In more market sensitive environments, Terluin (2003) employed case studies to conclude that economic development in rural regions was more likely to occur in areas with stronger internal networks (defined as local actors) and external networks (defined as local actors' interactions with actors outside of the region) (p. 339). The success of these networks in Terluin's study depended largely on geographic location. Although the results of Terluin's investigation build upon previous theories of regional networks, the operationalization of variables in this study is unclear and would be difficult to replicate. Garmaise and Moskowitz (2003) utilized regression analysis to deduce that networks improved buyers' access to lenders in financial markets. In addition, Li (2001) used case studies of 21 British and Canadian manufacturers exporting to China to find that networking through trading companies was helpful to performance; however, the expense of participating in certain markets was a potential restriction. While interesting investigations, the conditions of the networks in their studies were complex and based on

rich historical traditions that are not necessarily generalizable to other areas. Thus, a general conclusion for these authors' studies is that networking achieves positive outcomes for participants with some caveats on findings; however, the studies would be difficult to replicate in other types of networks.

3.2.2 Innovation in Networks

Since the Pioneer Network claims results from adaptive techniques, literature encompassing innovation as an outcome of networks is also of interest. In this area, Oelermans et al. (1998) utilized survey results of industrial firms in the Netherlands to conclude that inter-organizational networking increased innovation. Ahuja (2000) empirically studied the impact of inter-organizational collaboration of chemical firms in the US, Europe and Japan on patents and found that network ties escalated patent output. Sobrero (2000) researched major European R&D organizations in the steel industry and deduced that network activity improved R&D performance. Smith-Doerr, et al. (2004) interviewed project managers in a R&D lab to determine that increased centrality and network ties produced more innovative outcomes. Owen-Smith and Powell (2004) quantitatively studied innovative outcomes in industrial districts and found that network ties and location led to more innovation. Of these findings, Ahuja (2000) and Owen-Smith and Powell (2004) are most often cited, because their work empirically assessed the deeper ties and conduits of networks. In addition, the quantitative designs of the above investigations are more likely to be utilized as frameworks for research of network innovation in other settings. However, the varying approaches and theoretical foundations

demonstrate a lack of consensus among researchers in this field. Consequently, these authors' analyses into innovative outcomes resulting from network participation do not emulate other areas of network studies where researchers are able to engage in verification though replication and methodological expansion (e.g. Meier & O'Toole, 2005; Juenke, 2005).

Thus, the above discussion of previous literature appears to support the idea that networking scaffolds innovation and could provide a conduit for the adaptive techniques practiced by the Pioneer Network. As the first extensive empirical investigation of Pioneer Network participation as it relates to quality of care for consumers in nursing homes, the study in this chapter adds to the qualitative and anecdotal studies that suggest there are potential benefits to this type of networking. In addition, the findings contribute to the general studies of networks by expanding upon the relatively few evaluations that use the network as a treatment variable. Moreover, this research contributes to the network literature by examining the outcomes for the consumers of homes in this inter-organizational network.

3.2.3 Quality of Care Outcomes in Nursing Homes

Literature reviewing the effects of organizational characteristics (such as profit type and market environment) is reviewed in Section 2.3.1. Additional independent variables hypothesized to affect quality of care in nursing homes are discussed below.

Process Adaptations - Several quantitative investigations explore the effects of process oriented changes to quality of care outcomes. For example, Kane et al. (2004)

employed a regression analysis to examine a Medicare Managed Care Program that utilized nurse practitioners and concluded that positive quality outcomes resulted from the program. Their study provides a compelling framework for future research since the empirical design employed a control and a treatment group as well as multiple quality of care outcome measures. Another investigation linked the Nursing Home Reform Act's quality requirements to improved quality outcomes (Zhang and Grabowski, 2004). Zhang and Grabowski's study is another historical examination utilizing data from 1987 to 1993. Hence, it is problematic to make generalizations regarding the effectiveness of current policy requirements.

In addition to quantitative research, other studies have applied qualitative measures to investigate organizational processes that could affect nursing home quality. For example, one examination of quality of care applied quantitative and observational techniques to describe key exemplar processes of care facilities with superior resident outcomes (Rantz et al., 2003). Their study is interesting in that it quantitatively assessed quality of care measures and then substantiated findings through qualitative assessment. Another study employed an observational analysis and determined that consumer-centered care results in higher quality (Kane, 2003). In addition, Sampsell (2003) performed a qualitative analysis on returning the locus of care to the resident and found improved quality of care. In another case study, residents with more targeted intervention in toileting and mobility improved in each outcome (Simmons and Ouslander, 2005). Also, Berlowitz et al. (2003) utilized survey analysis to identify that quality improvement was more effective in homes with an organizational culture emphasizing innovation and teamwork. The primary criticism of these types of case studies and qualitative

assessments is the lack of consensus on the operationalization of terms such as "consumer-directed" care. Researchers construct varying frameworks to define these operational processes that would be difficult to replicate on a large scale.

Staffing - Another variable that is studied as a potential causal factor in quality of care is staffing. A study by the U.S. Department of Health and Human Services entitled Emerging Practices in Nursing Homes (2005) cites programs such as peer mentoring of direct care staff as improving quality of care for residents. In a study of a random sample of facilities in four states, Barry, Brannon and Mor (2005), note that empowerment defined as "a set of strategies provided by the organization to foster a sense of individual empowerment among workers" results in improved quality of care for residents (p. 310). Since their survey was performed in 1996, it represents an earlier state in a changing industry. Thus, definitions of empowerment, as an independent variable, would have to be adjusted to reflect recent adaptations (such as consistent staffing) to determine if these currently accepted methods also result in improved quality of care. In other research, an exploratory group study was used in an investigation of the effects of staff team-working on quality but concluded that there were barriers to team-working in a hierarchal culture (Wicke et al., 2004). However, the authors utilized a small exploratory study in England that may not be generalizable to this country. In a less conclusive finding, Burgio et al. (2004) employed a between-groups comparison study of staff assignment techniques on quality of care and interpreted the results on clinical outcomes as insignificant. Their study builds upon earlier studies by utilizing a between groups study; however, only four nursing homes were utilized. Thus, as with many of the independent variables posited to

have an influence on quality, conclusions regarding the effect of staffing on quality of care in nursing homes vary by study.

Since the Pioneer Network emphasizes adaptive techniques in areas such as organizational processes and staffing, the investigation employed in this chapter contributes to the literature on quality of care in nursing homes through a quantitative analysis that evaluates the quality outcomes of homes in the Pioneer Network versus comparable organizational counterparts. In order to fully implement this investigation, prior research regarding networks and quality of care provide guidelines to additional variables utilized in the matching process and in the negative binomial regression. Again, it should be noted that while this study does not attempt to identify specific practices within organizations in this inter-organizational network, it does evaluate the claims that the Pioneer Network, as a network, leads to superior outcomes for participants.

3.3 Methodology

3.3.1 Empirical Specification

To determine whether participation in the Pioneer Network has any effect on quality of care, this investigation utilizes two dependent variables (each dependent variable is discussed in detail in Section 2.2.3). The first is the number of citations from state regulatory government inspections of nursing homes in a calendar year. The second dependent variable is a summative "dependence index" of five quality measures collected by the Centers for Medicare and Medicaid Services. Both of the dependent variables

discussed above are employed in two empirical analyses. Since this is the first quantitative analysis of nursing homes in the Pioneer Network, the use of two separate methodologies provides additional insight into any quality of care differentials that result from participation in the network. The first analysis regresses each of the dependent variables on a treatment variable and a set of independent variables identified by previous research as potentially affecting quality of care in nursing homes. As with previous studies of networks (Juenke et al., 2005), the treatment variable in this first study represents the number of years that a home has participated in the network. Data for this analysis are from 2003 (the timeframe when Pioneer Network homes had been participating in the network for at least one year).

In addition to the cross-sectional model, a second empirical analysis utilizes propensity score matching in a quasi-experimental design to compare the quality of care outcomes of Pioneer Network homes with a group of analogous control homes. Data in this analysis are from 1996 (pre-participation in the network timeframe) and 2003 (participating in the network for at least one year). A difference-in-difference approach then examines if the change in quality of care outcomes for Pioneer homes from 1996 to 2003 is superior to the change for comparable control homes during the same timeframe. The use of these two separate methodologies provides insight into any quality of care outcomes that result from participation in the network. Each of the above methods is discussed in further detail in the subsequent sections.

Although homes participating in the Pioneer Network are matched to control homes by state (to control for regulatory differences), there are so few Pioneer homes that performing separate regressions by state decreases the potential for statistically

significant findings. To address this limitation, homes are grouped into state clusters based on an analysis of regulatory enforcement stringency (Harrington, Mullan & Carrillo, 2004). One primary focus of their study was the investigation of the type and frequency of regulatory sanctions employed by states to enforce quality of care in nursing homes. According to the authors, "In response to the identified quality problems in nursing facilities, state survey agencies have a wide range of intermediate sanctions that they may issue" (Harrington, Mullan & Carrillo, 2004, p. 53). Examples of potential sanctions include civil monetary penalties, denial of payment for new admissions, decertification, and/or revocation (termination) of licenses.

Through interviews and statistical analysis, the authors created a summary score of regulatory stringency which was then employed to group homes into regulatory quartiles (Harrington, Mullan & Carrillo, 2004). Although grouping by geographic region is another option utilized in studies of nursing home outcomes (Harrington et al., 2004), regulatory obstacles are more often cited as obstacles to Pioneer Network efficacy and should provide more meaningful clusters for an analysis with the network as the treatment variable. Accordingly, the 31 states that encompass Pioneer Network homes in this analysis are grouped into four cluster quartiles based on the conclusions of this comprehensive study of intermediate sanctions (e.g. civil monetary penalties, decertification) and enforcement indicators (Harrington, Mullan & Carrillo, 2004). State groupings are in quartiles with the first quartile indicating the most severe states in regulatory enforcement and the fourth quartile indicating the weakest states in enforcement. For easier interpretation, these groupings are labeled more descriptively as

"most stringent," "strict," "moderate," and "limited". Groupings are as follows (Harrington, Mullan & Carrillo, 2004, p. 66)[11]:

Most Stringent: WA, AR, CA, OR, *ID*, SC, MI, *AL*, *IN*, *KY*, KS, *NV*, AZ

Strict: IL, AK, DE, *NC*, OH, FL, MS, NM, *TN*, *MT*, NH, GA, MO

Moderate: *HI*, ND, *ME*, *WV*, CT, TX, SD, PA, MN, MD, *WY*, MA

Limited: IA, *UT*, WI, *OK*, NY, *LA*, *NE*, *NJ*, *VT*, *VA*, RI, *DC*, CO

Despite the use of these regulatory groupings for the purpose of clustering in this analysis, it is important to note that while sanctions are a viable option for states in the regulatory process, there is ongoing dialogue regarding the effectiveness of such actions. For example, Harrington, Mullan and Carillo (2004) interviewed state officials and found conflicting opinions regarding monetary penalties. According to the authors, some state regulatory agencies avow that civil monetary penalties are a sound method of assuring compliance in quality of care; however, other states are philosophically opposed to fines and assert that these funds should be utilized on quality of care improvements (Harrington, Mullan & Carillo, 2004, p.57). In addition, many state officials "expressed strong frustration with the CMS regulatory process" citing issues such as lack of federal funds and administrative nightmares (Harrington, Mullan & Carillo, 2004, p.57).

Thus, as one of the first studies to empirically analyze quality of care outcomes resulting from network participation of nursing homes, interpretation of these findings are made without the support of results and conclusions drawn from prior research in this area. With the lack of consensus regarding the effects of various types of regulatory enforcement on quality of care, the quartile state groupings are employed solely for the

[11] Pioneer Network homes are not in every state. States that were not part of the sample and are not represented in the regressions are

purpose of statistical analysis and not to test any hypotheses regarding regulatory outcomes.

3.3.2 **Negative Binomial Regression Method**

In an effort to examine quality of care differentials for homes participating in the Pioneer Network, the following analysis examines this data from a cross-sectional perspective. A negative binomial regression utilizes 2003 data for all homes in states with Pioneer Network homes to separately regress the number of nursing home citations and the dependence index on a treatment variable and a set of independent variables identified in the literature as affecting quality of care. The treatment variable in this model specification represents the number of years that a home has participated in the network. In addition, this model includes organizational, market and state-level independent variables. Thus, the regression model for this portion of the analysis is as follows:

$$Q_i = \beta_0 + \beta_1 P_i + \beta_2 S_i + \beta_3 E_i + \beta_4 M_i + \varepsilon_i \qquad (3.1)$$

where for nursing home *i*, Q is the quality of care outcome (dependence index or number of citations), and *P* is a proxy variable for Pioneer Network participation indicating the number of years a home has participated in the network as of 2003. A value of zero is

italicized.

assigned to non-network homes. *S* is a vector of state-level characteristics including the following:

- State - The location of the home is controlled through state dummy variables (coefficients not reported in findings).
- Certificate of Need - A dummy variable indicating certificate of need and moratoria policy at the state level (Harrington, Anzaldo, Burdin, Kitchener & Miller, 2004).

E is a vector of organizational (facility) characteristics including the following variables:

- Type of ownership (For profit=1) - A dummy variable controls for potential motivational differences due to profit status.
- Located in a Hospital (Yes=1) - A dummy variable controls for potential operational, motivational and acuity differences due to hospital location.
- Chain status (Yes=1) - A dummy variable controls for potential motivational and economy of scale differences due to profit status.
- Number of beds - Number of beds allows for an approximation of size of facility and is a measurement of capital (Knox, Blankmeyer, & Stutzman, 1999).
- Census Medicare -Medicare census is an indicator of acuity and case mix as well as reimbursement.
- ADL index - The ADL (activities of daily living) index is also a measure of case mix and is calculated as the summed number of ADLs (transferring, toileting, eating) per resident, divided by the number of residents in a home standardized to ADL's per 100 residents (Grabowski, 2001).

- High Medicaid - High Medicaid is a dummy variable equal to 1 if a home has a Medicaid census ≥ 90 percent and equal to 0 otherwise. This variable controls for case-mix as well as reimbursement differentials (Grabowski, 2001).
- Total Staff Hours Per Resident Per Day - This variable is used as a proxy for more attentive/less attentive care and acuity mix.
- Occupancy Rate - Occupancy rate is a profitability indicator and could also affect economies of scale in a home.

M is a vector of market characteristics including the following:

- Average Hourly Wage Rate - This is an exogenous supply variable that controls for motivational differences due to wage incentives and is also used as a proxy for urban/rural location (Grabowski, 2001).
- Herfindahl index (sum of square market shares of all facilities in a county) - This market variable indicates the level of competitiveness for a home in a county (values closer to zero are competitive while values close to one are more monopolistic) (Grabowski, 2001).
- Population over 65 - This is an exogenous demand variable used to estimate the level of demand in a county.

3.4 Descriptive Statistics

Overall descriptive statistics are outlined in Section 2.2.4 and descriptive statistics by state are displayed in Appendix C. However, Tables 3.1 and 3.2 illustrate the

comparisons of means for each of the outcome measures employed in this chapter (citations and the dependence index) from 1996 to 2003. For citations, overall and in three of the clusters, Pioneer Network homes received more citations per 100 residents than control homes in 1996. However, by 2003, this mean outcome changed dramatically, when overall and in each of the four clusters, Pioneer Network homes were cited less often per 100 residents than control homes. In contrast, quite the opposite effect occurred for the matched sample of control homes where overall and in three of the clusters, citations increased from 1996 to 2003. This effect is significant for the overall matched sample of Pioneer Network homes compared to control homes from 1996 to 2003 (an additional reduction of 2.7 deficiencies per 100 residents). The effect is also significant for the "strict" cluster where Pioneer Network homes decreased citations from 1996 to 2003 by an added 4.4 citations (per 100 residents) over control homes.

Table 3.2 displays the comparisons of means for the dependence index from 1996 to 2003. To clarify, since the dependence index is represented as an index ranging from zero to 500, a negative change indicates that Pioneer Network homes achieved mean improvement (decline in resident dependence) in this outcome from 1996 to 2003. For example, in 1996, an average of 87.2 dependence measures (a resident with too much weight loss, a resident with pressure sores, a resident with physical restraints, a resident who lost control of their bowels or bladder, and/or a resident who spent most of their time in a bed or chair) per 100 residents occurred in a Pioneer Network home. By 2003, this number fell to an average of only 24.8 dependence measures per 100 residents in a Pioneer Network home. Hence, the difference from pre-to post-network participation was a reduction of 62.3 dependence measures per 100 residents. In the control group of

ALL STATES	Year	Non Pioneer Homes N=81	Pioneer Homes N=85	*Difference-in-Difference Estimate*
	1996	5.1	6.3	1.2
	2003	7.7	6.1	-1.5
	Change	**2.6**	**-0.2**	**-2.7 ***
Most Stringent	Year	Non Pioneer Homes N=20	Pioneer Homes N=21	*Difference-in-Difference Estimate*
	1996	7.1	9.1	2.0
	2003	9.9	7.7	-2.2
	Change	**2.7**	**-1.4**	**-4.1**
Strict	Year	Non Pioneer Homes N=14	Pioneer Homes N=14	*Difference-in-Difference Estimate*
	1996	6.7	8.0	1.3
	2003	5.9	2.7	-3.2
	Change	**-0.8**	**-5.3**	**-4.4 ***
Moderate	Year	Non Pioneer Homes N=28	Pioneer Homes N=29	*Difference-in-Difference Estimate*
	1996	3.3	4.9	1.6
	2003	7.9	6.7	-1.2
	Change	**4.6**	**1.8**	**-2.8**
Limited	Year	Non Pioneer Homes N=19	Pioneer Homes N=21	*Difference-in-Difference Estimate*
	1996	4.4	4.3	-0.1
	2003	6.3	6.0	-0.3
	Change	**1.9**	**1.8**	**-0.2**

*p-value ≤ 0.1 **p-value ≤ 0.05 *** p-value ≤ 0.01

Table 3.1 Change in mean number of health and life safety citations (per 100 residents) by regulatory environment

homes, the average sum of facility dependence measures for all homes in 1996 was 86.0 per 100 residents. By 2003, this rate fell to 26.6 resulting in a reduction of 59.4. Thus, the mean difference for all homes in the Pioneer Network and the comparison group sample is -62.3 – (-59.4) = -2.9. This indicates that there was on average a reduction of an

additional 2.9 quality measures per 100 residents in a Pioneer Network home when compared to an analogous control home. The results of the regression analyses in the next section will further explore outcome variations by network participation.

ALL STATES	Year	NonPioneer Homes N=81	Pioneer Homes N=85	***Difference-in-Difference Estimate***
	1996	86.0	87.2	1.2
	2003	26.6	24.8	-1.8
	Change	**-59.4**	**-62.3**	**-2.9**
Most Stringent	Year	NonPioneer Homes N=20	Pioneer Homes N=21	***Difference-in-Difference Estimate***
	1996	88.5	91.1	2.6
	2003	26.5	27.7	1.2
	Change	**-62.0**	**-63.4**	**-1.4**
Strict	Year	Non Pioneer Homes N=14	Pioneer Homes N=14	***Difference-in-Difference Estimate***
	1996	79.1	88.0	8.9
	2003	29.9	25.9	-4.0
	Change	**-49.2**	**-62.1**	**-12.9 ***
Moderate	Year	Non Pioneer Homes N=28	Pioneer Homes N=29	***Difference-in-Difference Estimate***
	1996	85.9	88.0	2.1
	2003	22.9	24.5	1.6
	Change	**-63.0**	**-63.4**	**-0.4**
Limited	Year	Non Pioneer Homes N=19	Pioneer Homes N=21	***Difference-in-Difference Estimate***
	1996	88.6	81.6	-7.0
	2003	29.8	21.6	-8.1
	Change	**-58.9**	**-60.0**	**-1.1**

*p-value ≤ 0.1 **p-value ≤ 0.5 *** p-value ≤ 0.01

Table 3.2 Change in mean dependence index (per 100 residents) by regulatory environment

3.5 Negative Binomial Results

To clarify, a negative coefficient for "Years in the Network" for each regression (dependence index and the citation analysis), indicates that more years in the network results in fewer dependency measures and deficiency citations when compared to non-network homes.

Table 3.3 represents the results in the regression of citations. All five of the coefficients for years participating in the Pioneer Network (all states, most stringent cluster, strict cluster, moderate cluster and limited cluster) are negative indicating that network participation resulted in fewer deficiencies for homes participating in the network in 2003. For all homes, the coefficient of -.0623 for years in the network is significant at the .05 level. This coefficient denotes that, for each additional year in the Pioneer Network, the difference in the logs of expected counts of citations would decrease by -.0623, (holding other variables constant). In addition, the coefficients for the most stringent cluster (-.0907) and the limited cluster (-.1635) are significant at the .05 level. Given that the mean number of citations in 2003 was 12.45 and that the average length of participation in the network was 3.4 years, these coefficients imply a meaningful reduction in citations for homes participating in the Pioneer Network. The statistical significance of years of participation in the network is persuasive given that Pioneer Network homes represent only a small fraction of the overall sample.

Thus, these findings support that network participation reduced citations in Pioneer Network homes. Other variables in the analysis have expected signs and significance. For example, while a greater than 90 percent Medicaid census is most likely

reflective of the spending down of resident resources and not resident dependence, these homes are traditionally more often cited for health deficiencies. Also, it would be expected that fewer total staff hours per resident day results in more citations for the home.

Table 3.4 displays the results for the dependence index regression. As with citations, the coefficients for years in the network indicate that network participation resulted in a lower dependence index (fewer residents with these needs) overall and for each of the four clusters. In particular, the coefficient estimate for homes overall (-.0237) denotes that, for each year in the Pioneer Network, the difference in the logs of expected counts of dependence measures would decrease by -.0237, holding other variables constant (significant at the .05 level). In addition, the coefficient for the most stringent cluster (-.0504) is also significant at the .05 level. Given that the average dependence index for a home in 2003 was 31, these coefficient estimates are not as compelling as those for citations. Still, these are noteworthy reductions for homes participating in the Pioneer Network.

Again, the frequently studied independent variables adhere to existing theories from prior research. For the most part, for-profit homes have a significantly higher index which coincides with previous studies that suggest for-profits do not provide the same level of care as non-profit homes. In addition, homes located in hospitals and with a higher Medicare census would be expected to have an elevated index due to acuity issues. Also, increased acuity should result in more total staff hours per resident per day. Finally, a home with a greater than 90 percent Medicaid census is most likely reflective of residents staying in the home due to lack of resources and not increased acuity or

dependence on the facility. While each of these analyses provides initial support for the theory that network participation has an effect on quality of care outcomes, the methodology allows for potential collinearity between Pioneer Network participation and the other covariates in the analysis. To correct for this issue, the matched sample model of the next section continues the investigation into quality of care differentials while controlling for other covariates.

	ALL STATES Negative Binomial	**Most Stringent Negative Binomial**	**Strict Negative Binomial**	**Moderate Negative Binomial**	**Limited Negative Binomial**
Variables	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Years In Pioneer Network	-0.0623 **	-0.0907 **	-0.0764	-0.0159	-0.1635 **
Type of ownership (For profit=1)	0.1400 ***	0.1766 ***	0.1917 ***	0.0614 *	0.1643 ***
Located in a Hospital (Yes=1)	0.2464 ***	0.2184 ***	0.2227 ***	0.3067 ***	0.2017 **
Chain Status (Yes=1)	-0.0171	0.0328	-0.0768 ***	-0.0344	0.0748
Number of beds	-0.0065 ***	-0.0074 ***	-0.0068 ***	-0.0061 ***	-0.0057 ***
Census Medicare	0.0004	-0.0006	-0.0007	0.0030 **	-0.0056 ***
ADL Index	0.0009 ***	0.0004	0.0011 **	0.0007	0.0025 ***
High Medicaid	0.2212 ***	0.0825	0.2572 ***	0.3933 ***	0.0565
Average Hourly Wage Rate	0.0009	0.0041	-0.0081 *	0.0053	0.0041
Total Staff Hours Per Resident Per Day	-0.0522 ***	-0.0543 ***	-0.0225	-0.0887 ***	-0.0294
Occupancy Percentage	-0.0180 ***	-0.0188 ***	-0.0166 ***	-0.0190 ***	-0.0179 ***
Herfindahl Index	-0.1213 ***	-0.0814	-0.4077 ***	0.0151	0.2184
Population >65 (in 1000's)	0.0004 ***	0.0007 ***	-0.0001	-0.0001	0.0009
Certificate of Need (Yes=1)	-0.1133	-0.2181 **	-0.5628	(dropped)	
Constant	4.9314 ***	4.7557 ***	4.8964 ***	4.7089 ***	4.4234 ***
N (Pioneer Homes)	100	22	16	32	30
N (Non Pioneer Homes)	10368	2652	3101	2984	1631
Chi2	4907.67	1243.94	989.71	1210.48	1016.6
*p-value ≤ 0.1 **p-value ≤ 0.05 *** p-value ≤ 0.01					

Table 3.3 Negative Binomial Regression for All Homes in 2003 by Degree of State Regulatory Enforcement (Dependent Variable: Number of Health and Life Safety Citations)

	ALL STATES Negative Binomial	Most Stringent Negative Binomial	Strict Negative Binomial	Moderate Negative Binomial	Limited Negative Binomial
Variables	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Years In Pioneer Network	-0.0237 **	-0.0504 **	-0.0131	-0.0170	-0.0391
Type of ownership (For profit=1)	0.0336 **	0.0659 **	-0.0253	0.0622 ***	0.0202
Located in a Hospital (Yes=1)	0.1260 ***	0.2251 ***	0.1199 **	0.0923 **	0.0332
Chain Status (Yes=1)	-0.0144	-0.0770 ***	0.0267	-0.0112	-0.0096
Number of beds	0.0000	0.0004 **	0.0001	0.0002	-0.0004 **
Census Medicare	0.0032 ***	0.0030 ***	0.0033 ***	0.0043 ***	0.0024 **
ADL Index	0.0043 ***	0.0043 ***	0.0037 ***	0.0045 ***	0.0045 ***
High Medicaid	-0.1380 ***	-0.0848 *	-0.1898 ***	-0.1500 ***	-0.1472 **
Average Hourly Wage Rate	-0.0046 ***	-0.0067 *	-0.0060 *	-0.0059	0.0005
Total Staff Hours Per Resident Per Day	0.0422 ***	0.0540 ***	0.0354 **	0.0217	0.0469 **
Occupancy Percentage	-0.0025 ***	-0.0025 ***	-0.0017 **	-0.0025 ***	-0.0048 ***
Herfindahl Index	0.0233	-0.0856	0.1133 **	-0.0359	0.0909
Population >65 (in 1000's)	0.0003	0.0000	0.0007	0.0004	0.0003
Certificate of Need (Yes=1)	-0.0999	0.1469 **	0.2416	(dropped)	(dropped)
Constant	3.0892 ***	3.1675 ***	3.0631 ***	2.9644 ***	3.2010 ***
N (Pioneer Homes)	100	22	16	32	30
N (Non Pioneer Homes)	10368	2652	3101	2984	1631
Chi2	3338.88	725.6	638.68	1092.76	309.13

*p-value ≤ 0.1 **p-value ≤ 0.05 *** p-value ≤ 0.01

Table 3.4 Negative Binomial Regression for All Homes in 2003 by Degree of State Regulatory Enforcement (Dependent Variable: Dependence Index)

3.6 Matched Sample Analysis

3.6.1 Matched Sample Method

To further examine quality of care differentials for homes participating in the Pioneer Network, the following analysis examines this data utilizing a matched sample model. Since a nursing home's participation in the Pioneer Network is a choice, the possibility of random assignment is eliminated as an option for this quantitative analysis. This is unfortunate, because a true experiment with of its defining characteristic, random assignment, helps to eliminate the danger of treatment variables being correlated with

exogenous variables that affect process and outcomes (Chen and Rossi, 1983). In other words, random assignment affords the best opportunity for identifying the impact of the intervention and addressing the counterfactual. Without random assignment, this quantitative analysis is quasi-experimental because the assignment of nursing homes to Pioneer Network or control groups is not random. However, this quasi-experimental multiple group design does compare Pioneer Network homes with a group of analogous control homes. One of the key internal validity issues with this type of design is the extent to which groups are comparable before the study. Control homes for comparison should be counterparts of homes in the network based on matched observable characteristics that impact the likelihood of Pioneer Network participation and potential resulting outcomes (Bryson et al., 2002). In response to this limitation, propensity score statistical matching (Rosenbaum and Rubin, 1984) allows for the creation of a control group of homes that closely resembles Pioneer Network homes on observable characteristics that affect both the likelihood of network participation and improved quality of care outcomes. Rosenbaum and Rubin (1983) showed that this method of matching on a single index (which summarizes all of the matching characteristics and reflects probability and participation) could achieve consistent estimates of the treatment effect in the same way as matching on all covariates.

The propensity score for this analysis is derived from the equation in Chapter 2 used for the study of significant organizational and market structures of homes participating in the Pioneer Network. To review, the regression model for this portion of the analysis is represented by the following logit equation:

$$P_{ij} = \beta_0 + \beta_1 E_{ij} + \beta_2 C_{ij} + \beta_3 M_{ij} + \varepsilon_{ij} \quad (3.2)$$

where for nursing home i in state j

- P is a dummy variable indicating network participation (participating in the Pioneer Network = 1, non-participants = 0)
- E is the vector of organizational characteristics (Type of ownership, Chain status)
- C is the vector of internal organizational characteristics (Number of beds, Staffing ratios, Occupancy rate, Private Pay Census)
- M is market concentration measured by the Herfindahl Index

The predictors in Equation 3.2 equate to the estimation of the probability of joining the Pioneer Network. This probability estimation is also considered the propensity score. Pioneer Network homes are matched to control homes with the closest propensity score through a method of "nearest-neighbor" matching. Matching is made with replacement indicating that a control home can be matched to multiple treatment homes. Reasons for utilizing propensity score specification in this type of investigation are due primarily to the potential interaction of covariates in the model as well as difficulty with the specification of functional form. It is a strength of propensity score matching that it does not rely on the correct specification of covariates in the outcome regression (Zanutto, 2004) and is particularly robust to multicollinearity issues (Conniffe, Gash & O'Connell, 2000). Thus, it controls for the potential multicollinearity of Equation 3.1. Arguably, the principal weakness with propensity scores is the potential for the "common support problem" which alludes to the detriment of being unable to find a suitable match for the treatment home in the control population (Smith, 2003). Fortunately, in this dissertation, the government datasets contain all of the Medicare certified homes in the country

allowing for a wide range of potential matches (see Appendix D for a more detailed explanation of propensity scores).

While there are an abundance of potential control homes for propensity score matching, another primary limitation of this study is the small number of Pioneer Network homes in certain states. To control for regulatory differences, multiple regressions are estimated so that homes participating in the network are matched to homes in the same state. However, in states where there are fewer than four homes, it is problematic to estimate a statistically viable logit model with Pioneer Network participation as the dependent variable. For these states, a form of matching that matches homes on a complete list of multi-dimensional variables is more appropriate. Thus, in addition to propensity score matching, states with fewer than four homes use matching that provides "optimal matches" over a set of designated independent variables (Abadie, Leber Herr, Imbens & Drukker, 2004). This form of matching is a logical specification since there are a large number of available matches for the single or few Pioneer Network homes in each state.[12]

Homes are matched based on characteristics of homes from the pre-participation timeframe with data from 1996. Determining the appropriate observable characteristics is based, in large part, on knowledge of theoretical literature and prior empirical research (Bryson et al., 2002). Because the logit from the analysis of network participation is the

[12] NNMatch is a STATA module created by Abadie, Leber Herr, Imbens and Drukker (2006) designed to compute nearest-neighbor bias-corrected estimators. This program matches to the nearest neighbor over a list of independent variables and allows for exact matching for a subset of those variables. As with propensity score estimation, this program allows for matching with replacement. The difference between propensity score matching and this method is predominantly that this method matches variables as one-to-one exact matches while propensity score matching defines relative weights over a set of co-variates through the propensity score.

source of the propensity score, hypothesized relevant pre-designated characteristics are discussed in Chapter 2

To summarize, characteristics and primary explanations for use in this model are outlined in the following explanations.

- Organizational Characteristics
    - Type of ownership - Matching on type of ownership allows for profit/non-profit motivational differences.
    - Chain status - Matching on chain status allows for dissimilarities in economies of scale.
- Internal Organizational Characteristics
    - Number of beds - Matching on number of beds allows for an approximation of size of facility and a measurement of capital.
    - Staffing ratios (RN, LPN, CNA) - Matching on average hours per day controls for differences due to more attentive care and acuity.
    - Occupancy rate - Matching by occupancy rate accounts for potential benefits or detriments due to economies of scale or overcrowding.
    - Percent Medicare - Matching by the percent of Medicare residents controls for resident acuity and case mix as well as reimbursement.
    - Percent Medicaid - Matching by the percent of Medicaid resident controls for resident acuity and case mix as well as reimbursement.
    - Percent Private Pay - Matching by the percent of private paying residents controls for reimbursement.

- ADL index - Matching by ADL index controls for case mix and resident acuity.

- Market Characteristics
  - Herfindahl index (sum of square market shares of all facilities in a county) - Matching on Herfindahl index allows for differences in competitive environments.

After Pioneer Network homes are matched to control homes, a difference-in-difference approach is employed to test for statistically significant changes in quality of care pre- to post-Pioneer Network participation contrasted with control homes during the same timeframe. Data in these analyses are for homes in the Pioneer Network from 1996 (pre-participation in the network timeframe) and 2003 (participating in the network for at least one year). Negative binomial regressions examine quality of care by network participation while controlling for other variables. Next, a difference-in-difference approach is employed to test for statistically significant changes in quality of care from the pre- to post-timeframe for homes participating in the network and matched control homes.

By matching on the propensity score prior to network participation, the DID estimator can take into account "unobserved variables that may affect outcomes" (e.g. state or federal regulatory policies that alter operations in nursing homes) (Bryson, 2002, p. 8). The use of the DID estimator in conjunction with matching aids in a research model "very analogous to common practice in randomized experiments" (Conniffe, Gash & O'Connell, 2000, p. 292). As stated earlier, the pre-timeframe is defined as calendar year

1996 and the post-timeframe is defined as calendar year 2003 (see Appendix B for a discussion of extraction from data files and decision rules).

To ascertain the extent to which pre-to-post quality of care outcomes are significantly different between Pioneer Network and control homes, the negative binomial regression model is approximated as the following:

$$O_{it} = \delta_0 + \delta_1 NONPIO_{it} + \delta_2 PIOPRE_{it} + \delta_3 PIOPOST_{it} + \varepsilon_{it} \qquad (3.3)$$

where O_{it} is the quality of care outcome for home *i* in year *t*, *NONPIO* is a dummy variable equal to 1 if the outcome is for a comparison home in the post-timeframe and equal to 0 otherwise, *PIOPRE* is a dummy variable equal to one if the outcome is for a network home in the pre-timeframe and equal to 0 otherwise, and *PIOPOST* is a dummy variable equal to one if the outcome is for a network home in the post-timeframe and equal to 0 otherwise. Since the omitted variable equates to outcomes for control homes in the pre-timeframe, the coefficient on $NONPIO_{it}$, δ_1, corresponds to the difference in outcomes for control homes from 1996 to 2003. Similarly, the change in outcomes for Pioneer Network homes can be calculated from (δ_3-δ_2). Finally, the difference-in-difference estimate is calculated as the change in quality outcomes for Pioneer homes minus the change in quality outcome for control homes or (δ_3-δ_2) - δ_1. Since the dependence index is represented as an index ranging from zero to 500, a negative final difference-in-difference estimation indicates that Pioneer Network homes achieved greater improvement (reduced dependency) or less of an increase in this outcome when compared to control homes from 1996 to 2003. Since the number of citations can range

from zero to infinity, a negative final difference-in-difference estimation for this outcome measure also indicates that Pioneer Network homes reduced the number of citations more than control homes during the same timeframe. A limitation of this study is that it only includes observations for 1996 and 2003. Thus, it only measures the change in outcomes and not longitudinal growth from the pre- to the post-timeframe.

3.6.2 Propensity Score Estimation

A detailed discussion regarding the logit employed in propensity estimation is discussed in Chapter 2. To summarize, variables chosen for this model represent characteristics that theoretically influence network participation and potentially affect quality of care outcomes. A stepwise logit is an appropriate method, because the purpose of the logit "is to generate a set of good predictors to be used for matching rather than to test hypotheses regarding individual coefficients" (Greenbaum and Tita, 2004, p. 11). In other words, the independent variables are the best predictors for network participation as well as outcome measures and are utilized in propensity score estimation. The result is that the control group of homes closely resembles homes participating in the Pioneer Network on observable characteristics that affect both the likelihood of network participation and quality of care outcomes. Following logic suggested by Dehejia and Wahba (1999), homes with very high and very low predicted probabilities for network participation are not likely to have a suitable match. Thus, homes that fell within the upper and lower one-percent tails of the propensity score distribution were dropped from the analysis and the best matches for each state were utilized.

Figure 3.1 reflects the match quality for all homes based on the independent variables hypothesized to affect network participation and quality of care outcomes. Again, the similar value of control and treatment means is an indication of the strength of match quality. For example, there were no significant differences between the Medicaid and Medicare censuses of homes participating in the Pioneer Network and non-participating homes. The figure also illustrates that these homes shared similar sizes as well as chain and profit statuses. Finally, the propensity score matching produced homes with comparable competitive levels and total staff hours per resident day.

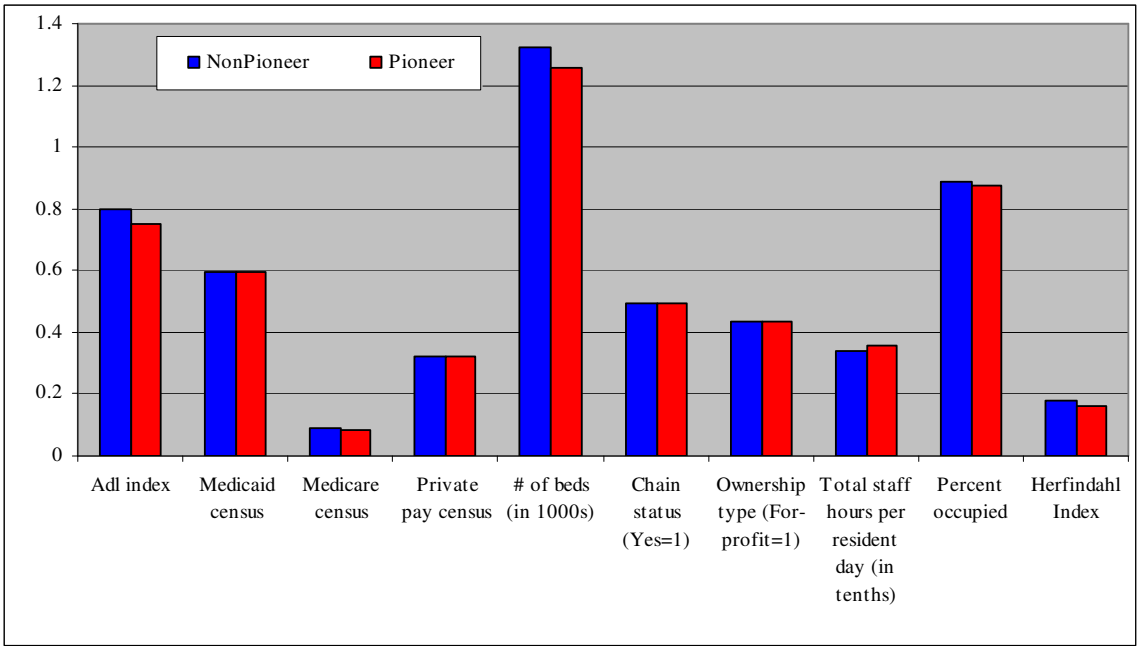

Figure 3.1 Means of Key Quality Indicators of Matched Homes by Network Participation

3.6.3 Matched Sample Findings

Table 3.5 displays the results of the negative binomial regressions measuring quality of care outcomes from Equation 3.3. The difference-in-difference estimations for each of the outcome measures (number of citations and the dependence index) are also reported. Overall and for each regulatory cluster, the coefficients on the negative binomial regressions for the citations and the dependence index represent the percent change in each outcome from 1996 to 2003. A Wald test is employed to determine whether the differences by network participation are significantly different from zero

Overall, changes in quality of care as measured by citations per 100 residents varied for the analyses of all homes and by regulatory cluster. In the analysis of all homes in the Pioneer sample versus control homes, the 0.3 coefficient for control homes indicates that these homes actually increased deficiencies from 1996 to 2003, and homes participating in the Pioneer Network experienced a negligible change. The difference in differences estimation (-0.4) is significant at the .1 level. For the "most stringent" degree of regulatory enforcement, the coefficient of -0.4 denotes that homes participating in the Pioneer Network decreased deficiencies. However, controls only slightly increased (.1) resulting in an insignificant difference. In a more noteworthy finding, the difference in difference estimation is significant at the (.01) level for the strict cluster. In these states, homes participating in the Pioneer Network reduced deficiencies (-1.1) from 1996 to 2003 whereas control homes experienced a negligible change. Citations in the moderate and limited regulatory clusters actually increased over the timeframe; however, homes

participating in the Pioneer Network increased less than control homes creating all but zero difference-in-difference estimations.

Table 3.5 also details the results of the matched sample analysis of the dependence index. In Table 3.5, it is important to first note that both Pioneer Network and control homes experienced a reduction in the occurrence of dependence measures from 1996 to 2003. This general reduction could be attributed to governmental programs targeting quality of care improvement (e.g. the Nursing Home Quality Improvement Initiative) during this timeframe. Overall and in each cluster, Pioneer Network homes are more improved from 1996 to 2003 when compared to controls; however, some of the effects are virtually equal and none of the difference in difference estimations are significant at the .1 level. Thus, the matched sample analysis is most supportive of the effect of network participation on citations. As the final component of four investigations, these findings again bolster the theory that an outcome of network participation is fewer citations.

3.7 Discussion

For decades, improving the quality of care provided in nursing homes has been a focus of concern for stakeholders at all levels of involvement including the government, providers, consumers and their families. The Omnibus Budget Reconciliation Act of 1987 highlighted this focus by shifting evaluations of health care quality from structure and process criteria to clinical outcomes, resident satisfaction, and quality of life (Lowe et. al, 2003). In the late nineties the concentration on improving quality of care intensified

as federal and state initiatives endeavored to view quality improvement through the internal and external systems that influence nursing homes and to further define quality through the development of outcome measurements. Despite these efforts, policymakers and researchers still struggle with a definitive understanding of external and internal adaptations or processes that improve quality of care for consumers in nursing homes. A number of suggestions for improvement involve external modifications such as the intensification of the regulatory process or increasing quality monitoring (Wiener, 2003). Other proposals center on various voluntary and internal methods such as "changing the culture of nursing facilities" (Weiner, 2003, p. 25).

This research evaluates a method that encompasses both external and voluntary internal developments through a study of an inter-organizational network of nursing homes. While it is the assertion of the Pioneer Network that it communicates process adaptation and techniques among members, this exchange of ideas is not the focal point for analysis. Instead, this investigation employs participation in the network as the treatment variable used in assessing quality of care outcomes. As the first empirical analysis of the Pioneer Network's effects on quality of care for consumers, attempts were made to substantiate findings through the use of multiple outcomes and methods. For example, this study builds upon earlier studies of quality of care by employing two types of outcome measures that address evaluations of quality from internal and external perspectives.

Degree of Regulatory Enforcement	Deficiencies	Dependence Index
Pioneer (All homes)	0.0	-1.3
NonPioneer (All homes)	0.3	-1.2
Difference	***-0.4 **	***-0.1***
Pioneer (Most stringent)	-0.4	-1.3
NonPioneer (Most stringent)	0.1	-1.3
Difference	***-0.5***	***0.0***
Pioneer (Strict)	-1.1	-1.2
NonPioneer (Strict)	-0.1	-1.0
Difference	***-0.9 ***	***-0.2***
Pioneer (Moderate)	0.7	-1.3
NonPioneer (Moderate)	0.9	-1.3
Difference	***-0.2***	***0.0***
Pioneer (Limited)	0.4	-1.4
NonPioneer (Limited)	0.4	-1.1
Difference	***-0.1***	***-0.3***

*p-value ≤ 0.1 **p-value ≤ 0.05 *** p-value ≤ 0.01
Table entries for Non Pioneer and Pioneer represent the coefficients δ_1 and $(\delta_3-\delta_2)$ from the analysis of outcome measures of the quality of care index and deficiency scores regressed on dummy variables measuring pre and post network participation timing:
$O_{it} = \delta_0 + \delta_1 NONPIO_{it} + \delta_2 PIOPRE_{it} + \delta_3 PIOPOST_{it} + \varepsilon_{it}$
"Difference" is the difference between the change in Pioneer and non-Pioneer outcomes:$(\delta 3-\delta 2) - \delta 1$
Significance levels are the results of a Wald test testing that differences in outcomes for Pioneer and non-Pioneer = 0.

Table 3.5 Regression Results of Change by Outcome Measure: 1996 to 2003

The first is the number of facility citations from state regulatory agencies. Again, this outcome is often employed as a dependent variable in research on quality in nursing homes. As stated in a previous section, network branding could result in an improved relationship with external stakeholders such as regulators. As a result, this outcome is representative of theoretical frameworks of network branding and explanations involving the dissemination of information from the network to participating homes. The second quality measure is a summative "dependence index" of outcomes that are theoretically

associated with internal facility processes. As stated previously, while it could be argued that this index reflects resident acuity, the outcome measures in the index are a composite of current measures utilized by the Nursing Home Quality Initiative to evaluate elements of care in which facility processes result in a reduction of autonomy for residents.

Another approach for utilizing multiple techniques for verification and confirmation of findings was through methods. The first method employed a matched sample analysis with a difference-in-difference estimation of improvements in the dependence index and number of citations from 1996 to 2003. The second method utilized in this analysis is a negative binomial cross-sectional study for the year 2003 with data for all of the 31 states in which there was Pioneer participation. The explanatory variable in this model specification represented the number of years that a home has participated in the network. In addition, the model included organizational, market and state-level independent variables.

The use of multiple outcome measures and methods produced the following cogent evidence that there is a less than random effect on quality of care acquired through network participation:

- For both outcome measures, overall difference-in-difference estimates in the matched sample were negative (indicating greater improvement for each outcome in Pioneer Network homes).
- For both outcome measures, overall coefficient estimates of Pioneer Network participation in the negative binomial regressions were negative (indicating that, for the 2003 cross-section, length of time in the network is positively associated with each outcome in Pioneer Network homes).

- In three of the four analyses, the overall findings of positive effects resulting from participation in the Pioneer Network were statistically significant. This finding is most persuasive in the cross-sectional study where the sample of Pioneer Network homes comprises less than one percent of all nursing homes.

Accordingly, this evidence corroborates previous research in several fields of academic inquiry. For example, these findings support network research concluding that the length of time in a network results in improved outcomes for network nodes (Juenke et. al, 2005). Also, these results substantiate prior studies concluding that networking scaffolds innovation (Ahuja, 2000; Owen-Smith & Powell, 2004). Most importantly, this investigation indicates that participation in the Pioneer Network increases the chance that residents (consumers of this network) will receive superior quality of care. This type of analysis of outcomes for consumers in a network is one that is rare, yet often discussed as an essential element to furthering the theoretical foundations of network research (Provan and Milward, 2001).

As the first extensive empirical investigation of quality of care outcomes resulting from Pioneer Network participation, this research is not without limitations and affords a wide range of possibilities for future inquiries. For example, while the results of this study suggest that participation in the network improves quality of care in nursing homes, there are at least two strong theoretical explanations for these findings. The first is that network participation resulted in the dissemination of information to homes and that subsequent activities lead to quality improvements. A second theoretical framework is that participation in the network lead to a product branding that signaled to external stakeholders that the home was voluntarily engaging in quality improvement efforts.

Thus, the finding of fewer citations could be due to external stakeholders (such as regulators) respecting the network brand. While the study in this chapter employed two quality measures in an attempt to uncouple this effect, the methodology of future studies could focus on further elucidating network participation's effects from a product branding or information dissemination standpoint.

In addition, based on the number of participants at Pioneer Network conferences, the number of homes participating in the network for at least one year in 2006 has increased exponentially from 2003 (Pioneer Network Conference, 2006). Thus, there are legitimate opportunities to build upon this research with a more substantial treatment group from a larger geographical area. Another area worthy of further examination is the study of potential interactions between regulatory enforcement and network participation. From an inter-organizational perspective of network theory, this could include charting the flow of communications from the nodes in this network to regulatory enforcement agencies and to assess the strength of ties between organizations (Ahuja, 2000). As discussed by Milward and Provan (1998), this type of research is essential to unraveling the concept of organizational learning in the network environment. In addition, an investigation of this nature could further the understanding of successful implementation in varying regulatory environments. Findings may assist in identifying whether future policy for the nursing home industry should focus on punishing poor performers or rewarding excellence in the provision of quality of care (Walshe, 2001).

Finally, studies that substantiate the actual and "best practices" of the most successful adaptations occurring in homes in the network would be beneficial to policymakers. Identifying these types of practices has been a focus of research for the

past several years (Meiners, et al., 2002; Weiner, 2003; Kane, 2003; Kane, Flood, Bershadky, Keckhafer, 2004). The Centers for Medicare and Medicaid Services' recognition of the Pioneer Network further enhances anticipation for this type of study (Centers for Medicare and Medicaid, 2006). The following chapter asks the question of at what cost quality improvements occur through an exploration of profitability outcomes associated with network participation.

CHAPTER 4

4 EFFECTS OF NETWORK PARTICIPATION ON PROFITABILITY

4.1 Introduction

In Chapter 3, an investigation of quality of care outcomes for early adopter homes of the Pioneer Network concluded that participation in the network increases the chance that consumers (residents) of these homes receive superior quality of care when compared to analogous control homes. However, improving care for residents of nursing homes could also generate the additional concern of managing the costs associated with employing resources to enhance quality. Cost escalation and financial decline are ongoing threats to nursing homes given the structure of payment for this type of care. In effect, 80 percent of the payment for services in skilled nursing facilities is received from public sources, with Medicaid absorbing the majority of public financing (AARP, 2005).[13] Yet, current proposals in the U.S. House and Senate call for extensive cuts to Medicaid that threaten to reduce operating provisions for nursing homes around the country. Since financing and quality of care are both areas of policy concern, it is not

[13] Skilled nursing facilities represented the largest category of Medicaid expenditures in 2003 by comprising 16.8 percent of total Medicaid dollars (AARP, 2005).

unexpected that legislation such as the Long-Term Care Quality Improvement Act (H.R. 1166) introduces a proposal to link quality improvement to Medicaid payment.

With this inexorable relationship between cost and quality, nursing homes are increasingly required to maintain a complex balance between the varying domains of nursing home operations. For example, costs associated with quality improvements are further constrained by adjustments to Medicaid payment structures and the restructuring of Medicare to a prospective payment system. In this unstable environment, financial solvency is one potential indicator of organizational success. According to Weech-Maldonado, Neff and Mor (2003), "The financial performance of nursing homes is primarily affected by two things: the ability to generate revenues and the ability to control costs" (p. 201). Although this is an apparent observation, it also provokes more complicated questions regarding the type of service necessary to optimize revenue while containing costs. For instance, employing resources to improve quality of care has the potential to escalate costs. However, evidence shows that poor quality of care also has negative repercussions for cost and profitability. For example, poor quality of care is a predictor of litigation (Johnson et al, 2004). Also, in more competitive markets, poor quality of care could result in a loss of revenue if residents opt for a competitor's services. In fact, according to Weech-Maldonado, Shea & Mor (2006) "…facilities with better quality may be able to capture a higher market share and as a result experience lower costs due to economies of scale" (p. 46).

If there is veracity in the supposition that higher quality homes have more revenue generating opportunities than lower quality homes, the positive quality outcomes of

Pioneer Network homes discussed in Chapter 3 could also have implications for profitability. In fact, several recent studies corroborate the link between high quality and financial performance (Hicks, Rantz, Petroski & Mukamel, 2004; Mukamel and Spector, 2000; Weech-Maldonado, Neff & Mor, 2003). One common theme of these studies is the use of innovation or product differentiation to reduce costs while increasing quality and revenue. According to Hicks, Rantz, Petroski and Mukamel (2004) "… nursing homes that successfully focus on providing quality of care through innovative protocols and care management strategies can have a positive impact on the costs of the home (p. 191). In addition, Mukamel and Spector (2000) affirm that "some nursing homes use innovative care protocols or management strategies that are both quality enhancing and cost reducing" (p. 86). As with the quality of care analysis, these prior studies suggest that positive profitability outcomes are associated with the type of innovation that the Pioneer Network purports to advocate.

As outlined in Chapter 1, the idea that positive outcomes could disseminate through the Pioneer Network is based on the theory that participation in inter-organizational networks could result in many possible benefits including dissemination of resources, product branding and/or adaptive techniques that aid in process changes. Thus, the existence of inter-organizational networks in the nursing home industry coupled with a complex financial environment affords a unique opportunity for further investigation of profitability outcomes of nodes of an inter-organizational network. This analysis addresses this opportunity through a study of the Pioneer Network, an inter-organizational network that asserts profitability outcomes are associated with the network's adaptive techniques and process changes occurring in network homes. A quasi-

experimental methodology matches Pioneer Network homes with control homes and then utilizes a difference-in-difference approach to measure pre- to post- network participation profitability outcomes contrasted with profitability outcomes for control homes during the same timeframe. The dependent variable in this chapter is net income (or loss) as collected by the Centers for Medicare and Medicaid Services in 1996 and 2003. In this way, this research investigates whether this outcome measure for Pioneer Network homes differed from 1996 to 2003 when compared to control homes.

The subsequent sections of this chapter include the following: Section 4.2 presents an overview of factors affecting profitability in the nursing home market from 1996 to 2003, Section 4.3 reviews the relevant literature including empirical work on cost and profitability in nursing homes, Section 4.4 outlines the methodology for the matched sample and difference-in-difference estimation, Section 4.5 reports descriptive statistics, Section 4.6 presents findings, and 4.7 provides a discussion with recommendations for future research.

From a policy perspective, this research is the first to provide an evaluation of claims resulting from prior studies of the Pioneer Network using national panel data. These findings also contribute to the network literature by adding to the relatively few studies that employ the network as the treatment variable in the empirical design. Finally, this investigation coupled with the analysis on quality of care contributes to the understanding of the effects of quality of care on profitability in this network setting. While this profitability inquiry is separate from the examination of quality of care in Pioneer Network homes, it is interesting to posit that quality improvements could be achieved without detrimental effects to profits. Because the majority of nursing homes in

the country have not engaged in network participation, this evidence could provide powerful support to evaluate policy to introduce adaptations associated with network participation into a larger population of homes.

4.2 Overview of Changes Affecting Profitability in the Nursing Home Industry

The primary focus of this chapter is an analysis of nursing home profitability from the pre- to post-timeframe of 1996 to 2003. The foundation of the propensity score methodology employed in this chapter relies on the success of matching homes participating in the Pioneer Network with comparable control homes based on characteristics theorized to affect a home's participation and profitability outcomes. The following section provides an industry overview of influential factors influencing a nursing home's fiscal success during this timeframe. It is important to note that homes participating in the Pioneer Network comprised less than 1 percent of the population of nursing homes certified by the Centers for Medicare and Medicaid Services 1996. Thus, given the complexities of the nursing home industry, it is not expected that the small sample of homes in the control or treatment groups will be representative of the industry as a whole during this timeframe. However, this background of variables critical to a nursing home's profitability supports the necessity of matching control homes based on these characteristics prior to network participation.

4.2.1 Medicare

One of the most influential variables affecting a nursing home's profitability is Medicare payment. Medicare skilled nursing facility coverage provides short-term skilled nursing care following hospitalization for an acute condition. In the mid-nineties, Medicare was cost-based, which is essentially defined as payment calculated based on a home's reported costs. During this timeframe, demand for skilled nursing intermediate care dramatically increased as hospitals exercised the option to discharge patients into nursing home care with more frequency (CMS, 2003). In 1997, to curb costs associated with escalating Medicare resident days, Congress re-structured skilled nursing facility reimbursement to a per diem rate (SNF Prospective Payment System). The initial effect of SNF PPS created an 18 percent reduction in Medicare spending by 1999 (CMS, 2003). In turn, the Balanced Budget Refinement Act of 1999 and the Benefit Improvement and Protection Act of 2000 created temporary add-on payment provisions that allowed homes to balance growth with decreased reimbursement during the transitional timeframe from cost-based to prospective payment (CMS, 2003). However, in 2002, these add-on provisional payments sunset, which further restricted Medicare resources for homes. Although these reductions were somewhat offset by a 2.6 percent inflationary increase in 2003 (CMS, 2005), Medicare resources decreased significantly.

Thus, by fiscal year 2003, homes were adjusting to the sunset of the add-on provisions as well as the per diem payment structure. While it is important to note that Medicare payment is far more likely to cover or exceed patient costs than Medicaid payment, according to CMS (2003), the sunset of add-on provisions resulted in a

dramatic 14 percent reduction in Medicare margins from 2000 (19 percent margin) to 2003 (5 percent margin) (CMS, 2003, p.10). For homes that were unable to absorb the loss of these additional margins due to organizational size or status (e.g. non-profit, small homes), this loss of net income had the potential to significantly impact a home's operating resources.

4.2.2 Medicaid

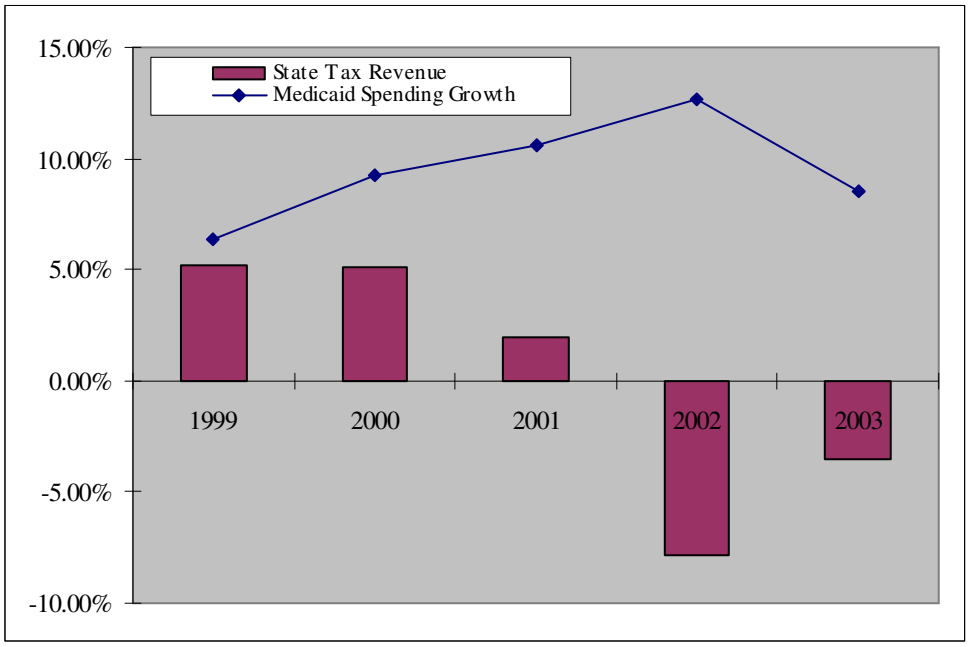

Figure 4.1 Underlying Growth in State Tax Revenue Compared with Average Medicaid Spending Growth, 1999-2003[14]

Medicaid is the largest revenue source of nursing homes providing payment for 65 to 70 percent of the nursing home population in 2003. However, in 2003, the ongoing

and pervasive reduction by most states to Medicaid reimbursement rates was a primary concern of Wall Street analysts evaluating the nursing home industry (CMS, 2003, p.2). These reductions were due in large part to The Balanced Budget Act of 1997, which "gave states greater latitude to set payment rates for nursing home care" (Grabowski, Feng, Intrator & Mor, 2004, p. W4-364). In 1997, most states structured Medicaid payments either prospectively (payment rates set in advance) or under a hybrid system of prospective and retrospective payment (prospective in some areas and based on actual costs in others) (Grabowski, Feng, Intrator & Mor, 2004, p. W4-365). Predominantly, Medicaid reimbursed at a higher rate by the severity of case mix (morbidity). Ultimately, this payment configuration provided a perverse incentive for a home to disregard improving a resident's health outcomes, because improvements could result in lower reimbursement. Since residents with advanced needs required additional resources, it is logical to posit that this payment structure potentially resulted in higher costs for states and a poorer quality of life for the resident.

By 2003, many states failed to cover a Medicaid resident's cost per day due in large part to a reduction in the state tax revenue providing the source of Medicaid funding. In 2002, tax revenue decreased by over five percent from the previous year (BDO Seidman, 2006, p. 6) (See Figure 4.1). In addition, Figure 4.1 illustrates that, despite the limited dollars designated by state governments for Medicaid, spending growth increased to over 10 percent in 2002 (BDO Seidman, 2006, p. 6). Although these changes were less volatile in 2003, the trends continued, and CMS (2003) acknowledged that a nursing home's profit margins decreased when a home maintained a higher

[14] Source BDO Seidman, 2006, p. 6

percentage of residents relying on Medicaid. This coupled with widespread fraudulent Medicaid claims resulted in severe impairments to many states' and homes' Medicaid operating resources.

Figure 4.2 exhibits that, by 2003, nursing home shortfalls averaged $14.60 per resident day, which created a deficit of $5,239 per year (BDO Seidman, 2006, p. 6). This statistic varied by state. For example, in New York, shortfalls were as high as $27.45 per resident day, which resulted in a loss of $10,000 a year (BDO Seidman, 2006, p. 6). In contrast, one private pay resident could gross as much as $25,000 over and above a home's costs in a year. As with the changes to Medicare payment, small or non-profit homes with a high percentage of Medicaid residents likely experienced the most difficulty adjusting to more limited resources.

4.2.2 Other Factors

Other factors affecting a nursing home's profitability from 1996 to 2003 include labor availability, liability insurance and access to capital. To begin, labor is the largest operating expense for a nursing home and comprises approximately 55 to 65 percent of costs (CMS, 2003, p. 12). Beginning in the late nineties, the nursing home industry endured an ongoing nursing shortage which promoted wage increases and decelerating financial performance for homes in those labor markets experiencing these labor constraints (CMS, 2003). Although there was a shortage in supply of these workers, demand for nursing staff increased into the 21st century. Explanations for this growth in nursing homes included a higher acuity level of resident and elevated regulated

thresholds of minimum staffing standards. According to Harrington, Carillo & Mercado-Scott (2005), total average nursing hours per resident day increased to three and one-half hours by 2003 (p. 62) (See Figure 4.3). This average increase translated to wages for an additional 7,300 hours per year for 100 residents. Although facilities could offset some of these costs through the substitution of certified nursing assistant (CNA) hours for registered nurse hours, elevated staffing levels maintained cost constraints for homes.

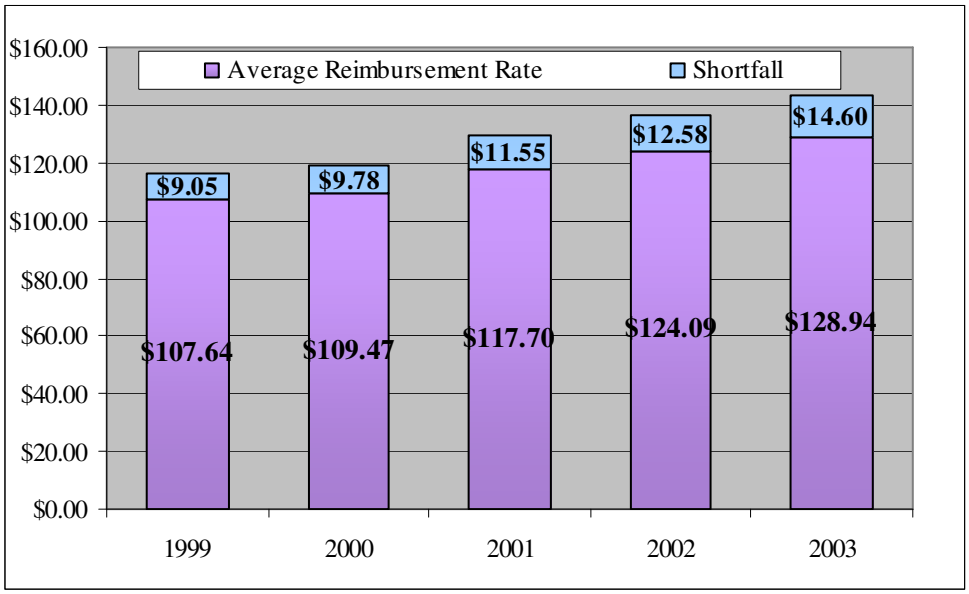

Figure 4.2 Shortfall per Medicaid Resident Day 1999-2003[15]

Another potential stressor to operating resources was liability insurance. The cost of liability insurance increased substantially from 1996 to 2003 due in large part to an increase in the number of claims against homes and a decrease in insurance companies

offering long-term care insurance (CMS, 2003, p. 12). According to a report by AON Risk Consultants (2005), liability costs increased 400 percent from $820 per occupied bed in 1996 to $2,270 in 2003 (See Figure 4.4). A home's response to liability expenditures depended on the potential to offset costs through debt financing or divesting beds in high cost areas. However, access to capital for nursing homes declined from 1996 to 2003 (CMS, 2003). Since capital is essential to a home's financial stability and operating provisions in areas such as financing liability costs, this reduction would have been particularly damaging for those homes unable to maintain capital investments.

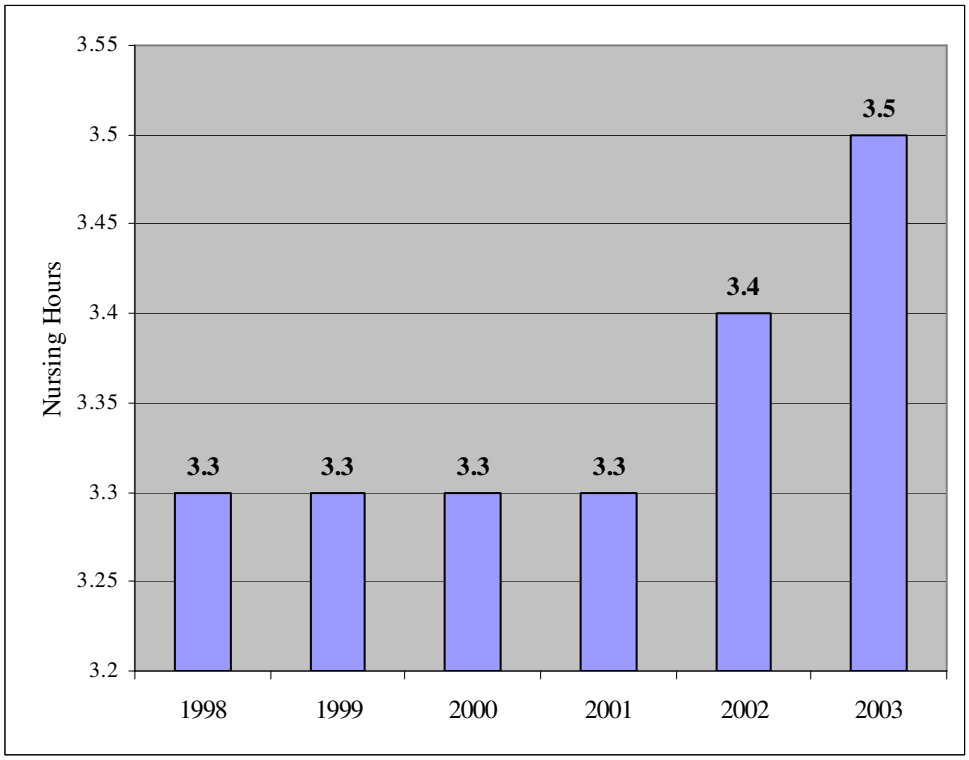

Figure 4.3 Total Nursing Hours per Resident Day in Facilities with Medicaid and Medicaid/Medicare Beds, 1999-2003[16]

[15] BDO Seidman, 2006, p. 6

[16] Harrington, Carillo & Mercado-Scott, 2005, p. 62

While the above discussion of major changes to influential components of profitability from 1996 to 2003 would generally indicate a decline in financial performance over this timeframe, it is important to note that not all of these factors affected homes with the same impact. For example, since many homes rely on Medicare and private pay resident days to subsidize Medicaid shortfalls, a high percentage of private paying or Medicare residents could positively influence a home's operating resources in those states where Medicaid fails to cover resident costs. In addition, access to capital or the ability to "exit" from states due to low reimbursement or high liability costs (often easiest for homes that are a part of a chain) could assist in a home's response and adaptation to ongoing industry changes and pressures.

By 2003, chains had divested 17.9 percent of beds compared to 2.1 percent nationally (CMS, 2003, p. 5). However, even the response of the largest and most lucrative chains was varied. Although five of the top eight nursing home chains declared bankruptcy after the advent of the Prospective Payment System and extensive Medicaid cutbacks, other chains continued to maintain profitability. For example, corporations such as Manor Care Healthcare (which reports two-thirds of revenues from Medicare and Medicaid) doubled net income from $59.4 million in 1996 to $119 million in 2003. Figure 4.5 highlights the performance of four of the major chains from 1996 to 2003 including the successful example of Manor Care as well as less successful corporations such as Kindred Healthcare which declared bankruptcy in 1998 (Mergent Online, 2006). The varying outcomes for these chains most likely resulted from product diversification and strategic analysis of successful nursing home markets.

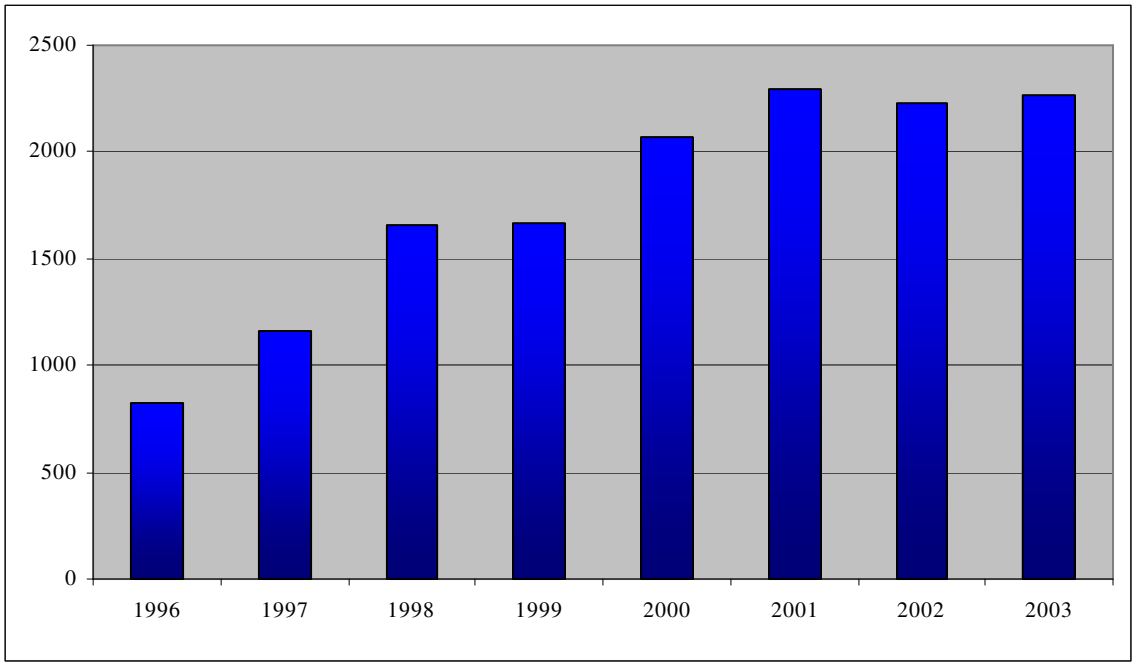

Figure 4.4 Average General Liability and Professional Liability Costs per Occupied Long-term Care Bed[17]

Thus, multiple complex variables affected nursing home profitability during the timeframe employed as the focus of this investigation. Given the complexities of the industry during this time, the small sample of homes participating in the Pioneer Network are more representative of early network participants, and are not representative of the industry as a whole. However, this background illustrates the imperative that participating homes be matched with control homes based on variables such as chain status (which influenced a home's ability to divest or diversify) or Medicaid census

[17] Source: AON Risk Consultants (2005)

(which translated to potential shortfalls in cost) in order to control for variations in profitability and to contribute to the veracity of regression results. In Section 4.6.1, a discussion will outline how methods such as those prescribed by the Pioneer Network could also result in improved profitability.

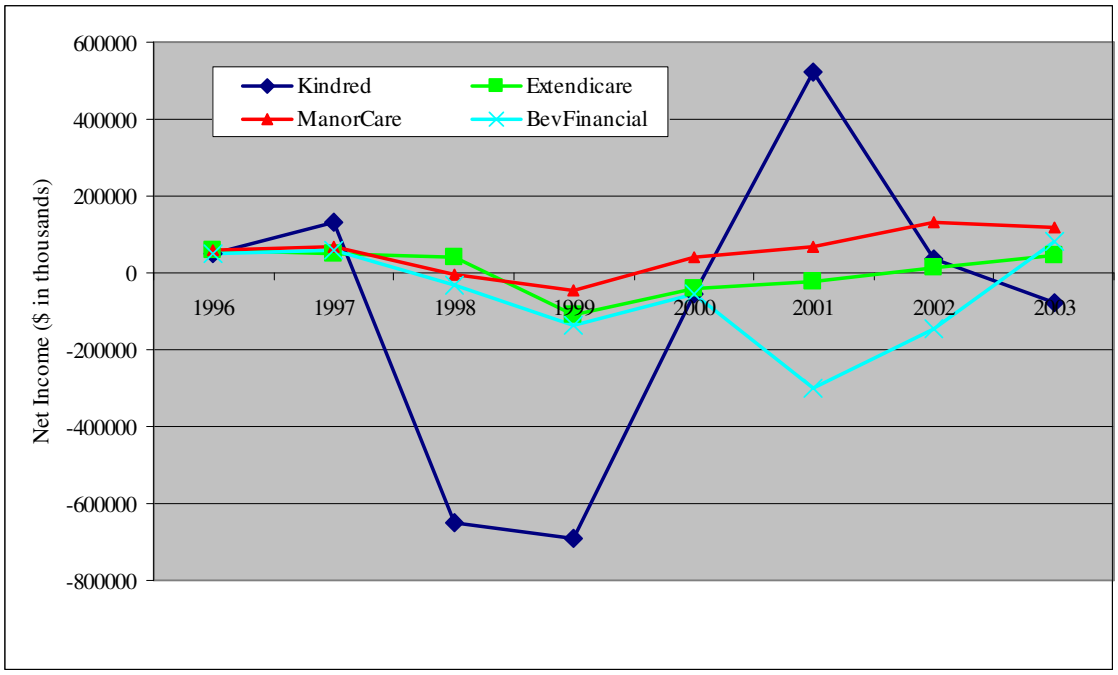

Figure 4.5 Net Income of Major Chains, 1996-2003[18]

4.3 Previous Research

In order to fully explore the pertinent profitability research, a comprehensive literature review must explore two significant themes:

[18] Source AHCA Health Services Research and Evaluation

- Networks –Relevant network literature is discussed in Chapter 3.
- Efficiency outcomes in nursing homes - Previous qualitative and quantitative findings will be reviewed in order to outline the results and conclusions of earlier studies.

Efficiency Outcomes in Nursing Homes

Profit Type - Prior empirical research endeavored to understand how marketplace and organizational factors influence the efficiency and profitability of nursing facilities. One focus of these studies is the effect of organizational type (for-profit, non-profit, government) on efficiency outcomes. The hypothesis in this research is that for-profit homes are more likely to attempt to maximize profits through cost minimization. Agency theory is one theoretical explanation for the differences in profit outcomes between these two organizational types. As agents, it is a logical supposition that for-profit nursing homes choose to prioritize cost minimization and profit maximization over resident care (while non-profits lack this motivation). In turn, it is often problematic for a resident (the principal) to monitor nursing home operations to confirm that resources are employed correctly. Also, a resident may lack information regarding quality expectations. As Barney and Hesterly (1999) suggest, the goal divergence between the principal and the agent leads to this difficulty in monitoring the agent's behavior (moral hazard) and problems of information (adverse selection).

Several studies relating to the effect of profit status on a home's profitability outcomes are discussed in Section 2.3.1. In addition, many investigations utilized DEA analysis to examine nursing home efficiency. For example, Nyman and Bricker (1990)

employed a DEA method to conclude that for-profit homes were more efficient. The sample for this study consisted of Wisconsin nursing homes in 1979. Although their research appeared sound and controlled for theoretically relevant variables including occupancy rate and wage index, the historic nature of the sample lacks relevance for the current environment, because homes were reimbursed under a retrospective cost basis in 1979. Contrastingly, in the current environment, homes are reimbursed based on an acuity case mix formula which would alter the cost variable in the analysis.

In a more recent inquiry, Street et al. (2003) investigated changes in revenue streams and resident characteristics in Florida and argued that for-profits were more likely to maximize revenues by limiting the number of Medicaid residents. This was dynamic research in that it was longitudinal and examined the effects of policy and reimbursement changes on a nursing home's decision of case mix. One limitation of their investigation was that it only concluded that the case-mix changed in response to Medicaid policy but did not examine the ultimate efficiency or profitability outcomes. In another area affecting a home's profitability, Johnson et al. (2004) utilized regressions to study lawsuits in Florida nursing homes and found for-profit homes were more likely to be sued for extensive damages. However, the authors were not able to ascertain specific operational variations associated with these homes and speculated that individuals targeted these larger, for-profit homes due to their substantial financial resources. Thus, the general conclusions of the inquiries into the effects of organizational type on efficiency and profitability were that for-profit homes are more cost efficient and more likely to respond to changes in reimbursement but could be susceptible to extraneous costs associated with liability claims.

Market Environment - In addition to organizational type, variables such as market environment have been considered in this type of empirical research. For example, Nyman (1988a) analyzed the effect of market competition on facility costs and found costs to be lower in markets with excess demand (measured by empty beds). One hypothesis of Nyman's inquiry was that homes will not invest (or spend more dollars for quality of care) in market environments where competition for residents is not a factor. A potential critique of Nyman's investigation is that the link between quality of care and cost (as discussed in the hypothesis) was not fully confirmed due to the choice of an empirical design that measured costs instead of quality (with the assumption that lower costs resulted in lower quality). In support of Nyman's conclusions, Mukamel, Spector and Bajorska (2005) utilized cost equations and found that excess competition increased costs in New York nursing homes during the nineties. However, the scope of their investigation did not include a detailed examination of outcomes associated with these higher costs. For example, it did not determine whether the additional expenditures resulted in a higher level of care.

Other Organizational Factors – Often, organizational factors affect a home's potential for cost reduction and profitability through the ability to achieve economies of scope or scale. For example, modifications to a home's case mix allow the home to possibly maximize economies of scope in care provision (e.g. post-acute, residential) Ubokudom, et al. (2002) examined case mix in Ohio nursing homes and concluded that nursing homes responded to case-mix in cost allocation more than to any other variable (i.e. limiting Medicaid residents when Medicaid reimbursement is lowered). While his

model provided interesting conclusions, it was only generalizable to Ohio and would benefit from verification in other states.

In addition to economies of scope, scale economies have the potential to improve efficiency. This phenomenon is often associated with chains or merged firms, because these homes "…can achieve economies of scale producing output at a more efficient level, which lowers its average total cost per unit of output" (Chen & Shea, 2004, p. 39). Chen and Shea (2004) estimated costs in nursing homes and did not find economies of scale in homes that were part of a chain or economies of scope in care provision. One limitation of their study was that it focused on short-term efficiency and did not control for capital (thus eliminating the long-term element). In addition, the study did not draw any significant conclusions regarding the effect of size. Crivelli, Fillippini and Lunati (2002) found that size was a factor in economies of scale, but economies were exhausted at 88 beds in Swiss nursing homes. Although there are similarities between the nursing home industries in Switzerland and the United States, the limitation of their study is the lack of generalizability to U.S. payment structures.

Process Adaptations - In addition to the empirical research, qualitative methods are often employed to study efficiency and profitability. Often, the limitation of these findings was the conclusion that occurrences observed in case studies (such as lower turnover or reduced absenteeism) translated to reduced costs. Without empirical verification of these claims, these hypotheses are difficult to substantiate. For example, Rantz, et al. (2004) utilized an observational study to link quality improvement techniques to lower costs. While their inquiry observed a correlation between higher costs and homes with lower quality of care, the study provided no hypotheses or

explanations for the elevated costs in these homes. Yeatts, et al. (2004) also engaged in observational methods to conclude that self-managed work teams resulted in lower turnover, lower absenteeism and higher employee satisfaction. While their qualitative analysis established that this phenomenon occurred in five nursing homes, it again lacked any empirical evidence of resulting reductions in cost. Other qualitative findings are associated with consumer-directed care and include dramatic reductions in hiring costs for a Washington Eden Home (Doughton, 2003), lower absenteeism in Texas Eden homes (Time, 2000), and a decrease of nursing staff turnover by 25 percent (Gold, 2001). Again, these case studies are associated with one home and thus lack statistical strength and empirical quantitative links between these occurrences and profitability.

Of the outcomes associated with process adaptations, turnover is particularly complicated to evaluate. For example, Anderson, Corrazzini and McDaniel (2004) utilized surveys of staff to link a positive culture to reduced turnover. However, the underlying question with these types of studies is the use of "turnover" as a comparative term in the literature. In an effort to understand the use of this variable in prior research, Castle (2006) estimated that differences in the measurement of turnover of various studies resulted in variations of as much as 47 percent (p. 210). Castle (2006) argued that, "As a result of measurement error, turnover rates may be misrepresented in prior studies" (p. 210).

Thus, the research regarding cost efficiency and profitability in nursing homes is supported by varying hypotheses and conclusions. Suppositions regarding profit motivations appear to be corroborated by empirical findings; however, there is not a complete understanding of the way in which other organizational factors contribute to an

organization's decision for cost allocation or maximization of profit. In addition, qualitative findings argue that process adaptations result in outcomes that affect profitability (e.g., lower turnover and absenteeism); however, these findings are plagued by discrepancies in definitions, measurement errors and minimal quantification of outcomes.

This dissertation contributes to the literature on efficiency and profitability in nursing homes by employing a quantitative longitudinal analysis that evaluates the profitability outcomes of homes in the Pioneer Network versus comparable organizational counterparts. In order to fully implement this investigation, prior research regarding networks and efficiency provide guidelines to additional variables utilized in the matching process. Again, it should be noted that while this study does not attempt to identify specific practices within organizations in this inter-organizational network, it does evaluate the claims that participation in the Pioneer Network results in superior outcomes for participants.

4.4 Methodology

4.4.1 Outcome Measure

Financial ratios such as net and operating margins are one aid in assessing a firm's performance. However, financial advisory firms are more likely to utilize ratios for the analysis of trends (as opposed to final outcome measurement) (Ziegler, 2005). For example, operating margins do not represent sources of income outside of resident

revenues (such as investment income, donations or assets). Since non-profit homes depend on outside sources of income for fiscal stability (CMS, 2003), net income provides a more inclusive, steady outcome for nursing homes. Net income in the CMS Skilled Nursing Facility Cost Reports (CMS, 2005) is defined in the following manner:

> Patient Revenues + Total Other Income - Total Operating Expenses - Total Other Expenses.

4.4.2 Empirical Specification

The dependent variable of net income is utilized in a propensity score analysis to compare the profitability outcomes of Pioneer Network homes with a group of analogous control homes. Data in this analysis are from 1996 (pre-participation in the network timeframe) and 2003 (participating in the network for at least one year). A difference-in-difference approach then examines if the change in profitability outcomes for Pioneer homes from 1996 to 2003 is different than the change for comparable control homes during the same timeframe.

4.4.3 Matched Sample Analysis

As in Chapter 3, this investigation employs a propensity score analysis in a quasi-experimental multiple group design that compares Pioneer Network homes with a group of analogous control homes. This method is discussed in detail in Chapter 3; however, some of the key advantages include the following:

- Propensity score statistical matching (Rosenbaum and Rubin, 1984) allows for the creation of a control group of homes that closely resembles Pioneer Network homes on observable characteristics that affect both the likelihood of network participation and improved quality of care outcomes.[19]
- Propensity score matching minimizes potential interaction of covariates in the model as well as difficulty with the specification of functional form. It is a strength of propensity score matching that it does not rely on the correct specification of covariates (Zanutto, 2004) and is particularly robust to multicollinearity issues (Conniffe, Gash & O'Connell, 2000).

Moreover, given the limitations of the data available for this investigation and the interactions occurring between many of the independent variables, propensity score analysis is the preferred methodology for this investigation. Specifically, this empirical design controls for many of the complex factors posited to affect profitability. Thus, this method allows this investigation to focus more fully on differences in profitability between Pioneer Network and control homes.[20] The matched sample of homes in this chapter is a subset (fewer homes were represented in the Cost Reports) of the control homes identified by the analysis in Chapter 3. This method is detailed in Section 3.3.2.[21]

[19] Rosenbaum and Rubin (1983) showed that this method of matching on a single index (which summarizes all of the matching characteristics and reflects probability and participation) could achieve consistent estimates of the treatment effect in the same way as matching on all covariates.

[20] Unfortunately, a cost function analysis is outside of the scope of the non-identifiable data available in the Cost Reports. OLS was attempted; however, the propensity score methodology provided the superior model.

[21] It is also important to note that there is no research to indicate that profitability in homes is affected by regulatory regimes. Thus, this analysis does not group by the clusters utilized for the study in Chapter 3.

To ascertain the extent to which pre-to-post profitability outcomes are significantly different between Pioneer Network and control homes, the following OLS regression model is approximated:

$$O_{it} = \delta_0 + \delta_1 NONPIO_{it} + \delta_2 PIOPRE_{it} + \delta_3 PIOPOST_{it} + \varepsilon_{it} \qquad (4.1)$$

Finally, the difference-in-difference estimate is calculated as the change in net income for Pioneer homes minus the change in net income for control homes or $(\delta_3-\delta_2) - \delta_1$. A positive final difference-in-difference estimation indicates that Pioneer Network homes achieved greater profitability compared to control homes from 1996 to 2003.[22]

4.5 Descriptive Statistics

Data for this analysis are discussed in Section 2.2.3, and overall descriptive statistics are outlined in Section 2.2.4. The relevance of the overall descriptive statistics for Pioneer Network homes prior to network participation highlights the importance of controlling for these variables in the analysis. For example, statistically significant differences in ownership type could indicate that these homes have a disadvantage in profitability prior to network participation. However, the significant differences in occupancy rate and private pay census suggest that Pioneer Network homes would have an advantage in profitability. Again, as stated in the literature review, cost efficiency and profitability are complex factors that rely strongly on a home's organizational

[22] The regression and DiD estimations are detailed in Section 3.3.2.

characteristics and response to environmental constraints. In this multi-faceted framework, organizational variables such as profit type and market environment interact in determining a home's response to environmental constraints and choices regarding profit maximization.

4.5.1 Financial Indicators

Since the outcome measure of this investigation is net income, it is useful to discuss the financial indicators of homes participating in the Pioneer Network versus the industry as a whole. However, descriptive financial data are limited for benchmarking use in the nursing home industry. In addition, while financial indicators are one form of analysis for a firm, these statistics in nursing homes are most likely skewed towards chains and for-profit homes. The primary reason for this bias is rooted in the entities collecting data. For example, publicly traded firms are often required to provide financial statistics to shareholders and the Securities Exchange Commission. Figure 4.5 outlined the performance of four of the largest publicly traded chains from 1996 to 2003 (Mergent Online, 2006). As stated previously, this figure shows that disparate performance occurs even among the firms with the greatest size and resources. Other potential data sources are financial advisory firms that create reports based on their clients' data. However, as with publicly traded firms, these reports are for a small sample and do not provide an industry standard. Thus, the available financial data are for a fraction of the industry and over represent larger, for-profit firms and chains.

Given these limitations, comparisons between these indicators and Pioneer Network homes are made for descriptive purposes only. For example, one potential financial indicator is net margin ratio. This ratio is representative of an organization's total fiscal viability and is defined as net income (loss) divided by total revenue. In a study by Larson, Allen, Weishair & Co (2006), this average ratio was -1.4 percent for Larson Allen clients in the Midwest and -2.0 percent for clients in the Southeast (p. 9). In contrast, homes participating in the Pioneer Network averaged a .02 percent net margin ratio indicating that these homes achieved a higher net margin than the homes in the Larson Allen sample. A second indicator often employed in financial analyses is operating margin. Operating margin is representative of a home's internal resources and is defined as income (loss) from operations divided by total operating revenue. In a study by Ziegler Capital Markets Group (2004), the median for this ratio was -.77 percent for single-site clients and -1.03 percent for multi-site providers in 2003 (p. 13). Homes participating in the Pioneer Network achieved a -1.3 percent median operating margin which is lower but relatively similar to the Ziegler sample. Again, the propensity score methodology requires that homes participating in the Pioneer Network be matched to control homes on independent variables. Since there are no data available to positively state the levels of these variables in the LarsonAllen, Ziegler or Mergent Online samples, it is difficult to establish relative similarities between these homes and homes participating in the Pioneer Network.

4.6 Results

4.6.1 Matched-Sample Results

A detailed discussion regarding the implementation of propensity score matching for homes participating in the Pioneer Network to control homes is discussed in Chapter 3. To summarize, the average propensity score for homes participating in the Pioneer Network was .31. Comparably, the average propensity score of homes identified as matches was also .31. This indicates that the control group of homes closely resembled homes participating in the Pioneer Network on observable characteristics that affect both the likelihood of network participation and improved net income. As discussed in Chapter 3, homes in each state that fell within the upper and lower one-percent tails of the propensity score distribution were dropped from the analysis and the best matches for each state were utilized.

Figure 4.6 further illustrates the robustness of the matching process by displaying the means of key profit indicators discussed in Section 4.2 prior to network participation. For example, there were no significant differences between the Medicaid and Medicare censuses of homes participating in the Pioneer Network and non-participating homes. As discussed in Section 4.2, changes to the levels of payment of these government reimbursement structures likely impacted the net income of nursing homes from 1996 to 2003. Thus, it was essential to ensure that these variables were matched between participating and non-participating homes in the pre-participation timeframe. The figure also illustrates that these homes shared similar sizes as well as chain and profit statuses.

In this way, this analysis controlled for the potential effects of size and economies of scale on a home's net income. Finally, the propensity score matching produced homes with comparable competitive levels and total staff hours per resident day.

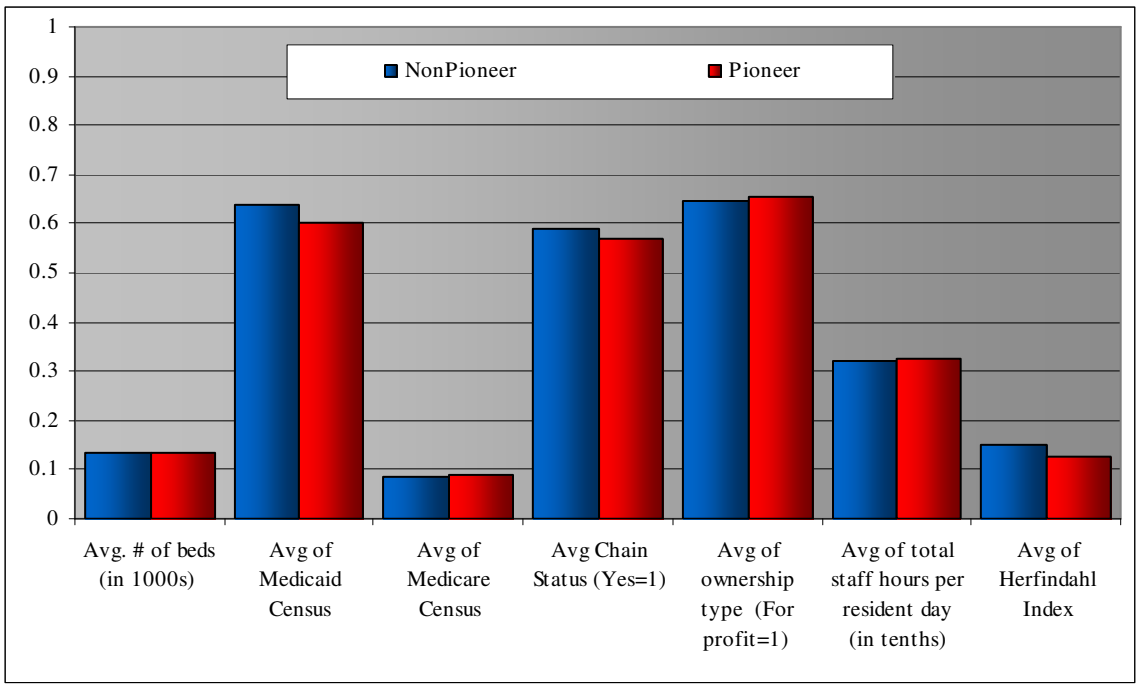

Figure 4.6 Means of Key Profit Indicators of Matched Homes by Network Participation

Table 4.1 outlines the results for the matched sample analysis that compares net income from the pre-network participation timeframe (1996) to a time when homes had been participating in the network for at least one year (2003). Overall, homes participating in the Pioneer Network displayed significant improved net income from 1996 to 2003 when compared to controls. To quantify the overall findings, homes in the Pioneer Network generated an average additional $2,093 dollars net income (per resident

bed) over analogous control homes from the pre- to the post-timeframe. Interestingly, per bed net income in homes participating in the Pioneer Network increased from $410 in 1996 to $521 in 2003. However, quite the opposite effect occurred for the group of analogous control homes that, on average, earned profits of $973 per resident bed in 1996 but incurred losses of $1,029 by 2003. In addition, both a Wald test and a t-test (used to examine whether the changes in net income are significantly different from zero) are significant at the .05 level.

The discussion of environmental pressures affecting the nursing home industry in Section 4.2 outlined several variables that potentially negatively impacted net income from 1996 to 2003. This general effect did occur for control homes in the matched sample during this timeframe. Of course, it is important to note that this is a small sample sensitive to outliers. In 1996, statistics of net income per bed were similar for homes participating in the Pioneer Network and control homes. Control homes displayed a slightly higher mean, median and maximum value of net income while homes participating in the Pioneer Network exhibited lower values in these statistics. Clearly, homes in the control sample experienced a negative shift in net income by 2003 while homes participating in the network shifted in a positive direction. However, given the limitations of this study, it would be a premature assertion that these findings resulted from participation in the Pioneer Network. Even if this investigation could claim a causal impact, it would not be clear whether the impact was due to process adaptations in the homes or to the network affiliation or branding. For example, since non-profit homes operate partially through donations, network branding could result in increased contributions. A small sample size is also a principal limitation of this investigation. To

address these concerns, a more detailed examination of a larger sample of nursing homes, a sensitivity analysis of the outlier outcomes of homes participating in the Pioneer Network, and a breakdown of donations, patient revenues and costs serve to further clarify findings.

The histograms of net income differences (from 1996 to 2003) in Figures 4.7, 4.8 and 4.9 highlight outcome distributions. As stated above, the examination of a larger sample of homes contributes to an understanding of net income changes of homes participating in the Pioneer Network. Figure 4.7 examines the per bed net income differences of homes in the Cost Report sample (n = 5,788 homes)[23]. While this sample is non-representative of all nursing homes in the country (only homes that completed cost reports for this timeframe), it does provide a more comprehensive assessment for comparison. Sensitivity analyses (including normal probability plots and goodness of fit tests) revealed outliers of change in per bed net income at a level greater than $25,000 and less than -$25,000. After the removal of outliers (including 2 homes participating in the Pioneer Network), the normal distribution produced positive (extending to $22,000) and negative differences (extending to -$22,000). The mean change to net income was negative $551 per bed. This assessment of the overall sample of homes provides the background for the more specific histograms of control homes and homes participating in the Pioneer Network.

In Figures 4.8 and 4.9, Pioneer participants experienced more zero or negligible net income differences than controls; however, the number of observations with net income differences from zero to $10,000 was similar for both sets of homes. The source

[23] The histogram only utilizes homes with observations for both 1996 and 2003. Outliers were removed from the sample.

of the variation is based on positive net income for Pioneer participants (extending to $20,000) and negative differences for controls (extending to -$20,000). Noticeably, not every home participating in the Pioneer Network improved per bed net income from 1996 to 2003. In fact, more homes decreased per bed net income from the pre- to post-timeframe than increased (see Figure 4.10). This was also true of the Cost Report sample where 58 percent of homes experienced negative outcomes. However, Figure 4.10 displays that a larger number of homes participating in the Pioneer Network increased net income from the pre- to post-timeframe versus controls. In addition, Figure 4.11 illustrates that homes in the Cost Report sample and control homes experienced a negative impact to net income from 1996 to 2003. As described in previous sections, it is not unexpected that homes facing certain constraints (such as a high Medicaid census) suffered fiscally during this timeframe. The propensity score methodology allowed homes to be matched on these factors, and these findings imply that homes participating in the Pioneer Network were not as negatively impacted as control homes facing the same constraints in the industry. However, it is still unclear based on this data and design that network participation is responsible for this effect.

In addition, although the differences in the change to net income between homes participating in the Pioneer Network and control homes are statistically significant, it could be stated that these results are relatively unremarkable. For example, it would be expected that large, for-profit corporate entities would have more variations in net income (of the type shown in Figure 4.5). Since access to debt financing or investment income for publicly traded firms is substantial, it would not be unusual for net income to exceed well over $100,000 per bed (Mergent Online, 2006). However, the chains

represented in the Pioneer sample were small (and in some cases non-profit chains) and not publicly traded. Thus, the similarity of pre-participation per resident net income could be another indication of the strength of the match between homes participating in the Pioneer Network and control homes.

As stated previously, in a small sample, the effect of outliers on the interpretation of results is a logical concern. It should also be noted that two homes participating in the Pioneer Network (as well as the two matched homes) were excluded from results based on outlier sensitivity analysis. If these homes had been included, the DiD estimate between homes participating in the Pioneer Network and control homes would have increased by an additional $1,000 (significant at the .001 level). Even with the removal of outliers, five homes participating in the Pioneer Network achieved per bed net income differences greater than $10,000, and further analysis of these "high performers" is also instructive in the clarification of findings. A within group investigation does not produce a common characteristic of these five homes that is not shared by other less successful homes in the Pioneer Network. For example, the five high-performing homes are affiliated with four separate chains (in Massachusetts, Wisconsin, Pennsylvania, and two homes in Colorado); however, homes in two of these chains actually decreased net income from 1996 to 2003. Thus, there is no evidence that a particular chain affiliation increased net income. In addition, these five homes increased occupancy rates from 1996 to 2003, but this finding is also true of other less successful homes participating in the Pioneer Network.

One indicator that explicates the performance of the five homes is a significant increase in operating margin. As stated previously, operating margin is representative of a

home's internal resources and is defined as income (loss) from operations divided by total operating revenue. These five homes experienced a substantial increase in operating margin indicating that modifications to operations provide a logical explanation for the significant improvement in per bed net income. Since network participation is one possible basis for these modifications, one hypothesis is that the five homes achieved profitability advantages due to implementation of network recommendations or network branding that proved more successful than the implementation efforts of network counterparts. However, based on data limitations, this hypothesis is speculative and definitive conclusions are beyond the scope of this study.

Year	Net Income Non Pioneer Homes N=69	Net Income Pioneer Homes N=75	***Difference-in-Difference Estimate***
1996	973	431	(542)
2003	(1,029)	521	1,550
Change	**(2,002)**	**90**	**2,093** **

*p-value ≤ 0.1 **p-value ≤ 0.05 *** p-value ≤ 0.001

[a] Table entries for Non Pioneer and Pioneer represent the coefficients δ_1 and $(\delta_3-\delta_2)$ from the analysis of outcome measures of net income regressed on dummy variables measuring pre and post network participation timing:

$O_{it} = \delta_0 + \delta_1 NONPIO_{it} + \delta_2 PIOPRE_{it} + \delta_3 PIOPOST_{it} + \varepsilon_{it}$

"Difference-in Difference" is the difference between the change in Pioneer and non-Pioneer outcomes:(δ3-δ2) - Significance levels are the results of a Wald test testing that differences in outcomes for Pioneer and non-Pioneer = 0.

Table 4.1 Propensity Score Analysis
Change in Net Income per Resident Bed

To address overall changes, further examination of available Cost Report data provides additional insight into cost and revenue changes for homes from 1996 to 2003. In terms of operating costs, the average per bed expenses of control homes and homes participating in the Pioneer Network were quite similar in 1996 (averaging $50,694 per bed for control homes and $50,158 for homes participating in the Pioneer Network). Each set of homes increased costs by 2003; however, homes participating in the Pioneer Network only increased operating expenses by $15,000 while control homes increased costs by over $22,000 per bed. The result is an increased operating margin for homes participating in the network with a reduced margin for control homes. Thus, it is possible that participation in the Pioneer Network resulted in decreases to operational expenses in areas such as the following:

- More efficient practices that allowed a home to employ fewer staff and diminish labor costs.
- Consistent staffing that decreased staff turnover and costs associated with recruitment and training.
- Changes to dining methods that lowered food costs.

If any of these examples of decreases to operational expenses occurred, each example impacted a home's net income. For instance, if a home cross-trained employees, it likely reduced full-time staff. A reduction of five employees with total compensation of $15,000 per year decreased compensation and benefit costs by over $75,000 which increased net income in excess of $750 per bed. Finally, food costs associated with dining tend to be a major component of a home's expenses (after labor costs). According to Dan Look (2005), homes implementing buffet dining options can decrease costs by as much

as $27,000 in the first six months of implementation. Therefore, there are multiple ways in which a home's participation in the Pioneer Network reduced costs from the pre- to post-timeframe.

In addition to costs, net income could also improve based on increases to revenue. For example, increasing occupancy or attaining private pay residents has the potential to increase net income by $25,000 per resident over and above costs (Killian, 2004). However, analysis of available Cost Report data does not suggest that these were the most relevant factors in increases to net income. As with the discussion of operating costs, control homes and homes participating in the Pioneer Network were operating with nearly identical average per bed resident revenues of approximately $50,000 per bed in 1996. By 2003, homes in the Pioneer Network increased patient revenues slightly more than control homes (homes participating in the network increased to $65,000 per bed while control homes increased to $63,400 per bed). Thus, there was an additional $1,500 increase per bed in homes participating in the Pioneer Network. Again, this coupled with reduced costs improved operating margins for homes participating in the network.

Of course, access to capital, donations, debt financing and government appropriations could also increase revenue. However, examination of the available Cost Report data intimates that this factor actually negatively affected homes participating in the Pioneer Network. Available data for "Other Income" indicates that homes participating in the Pioneer Network averaged only $2,556 dollars in per bed other income in 1996 compared to $4,730 per bed other income for control homes. By 2003, homes participating in the network experienced a negligible increase of less than $100 while control homes increased to $6,944 per bed. Even when broken down into non-

profit and for-profit categories (to assess potential changes to donations), non-profit homes participating in the Pioneer Network experienced an almost zero increase in per bed net income between the two timeframes while for-profit homes participating in the network actually decreased other income from 1996 to 2003.

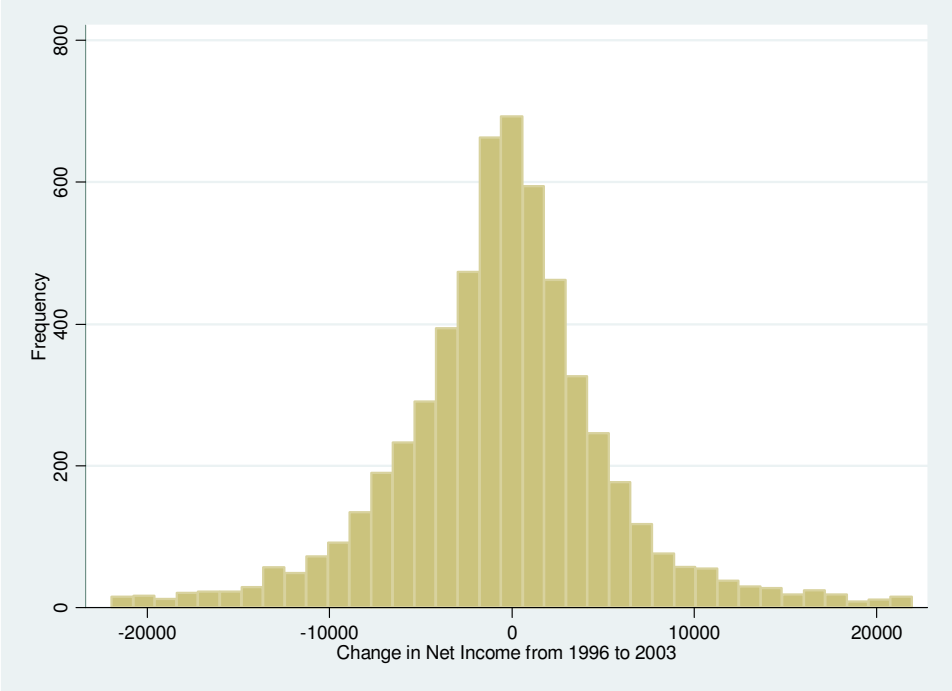

Figure 4.7 – Histogram of Change in Net Income from 1996 to 2003 for All Homes in Cost Report Sample (n=5790)

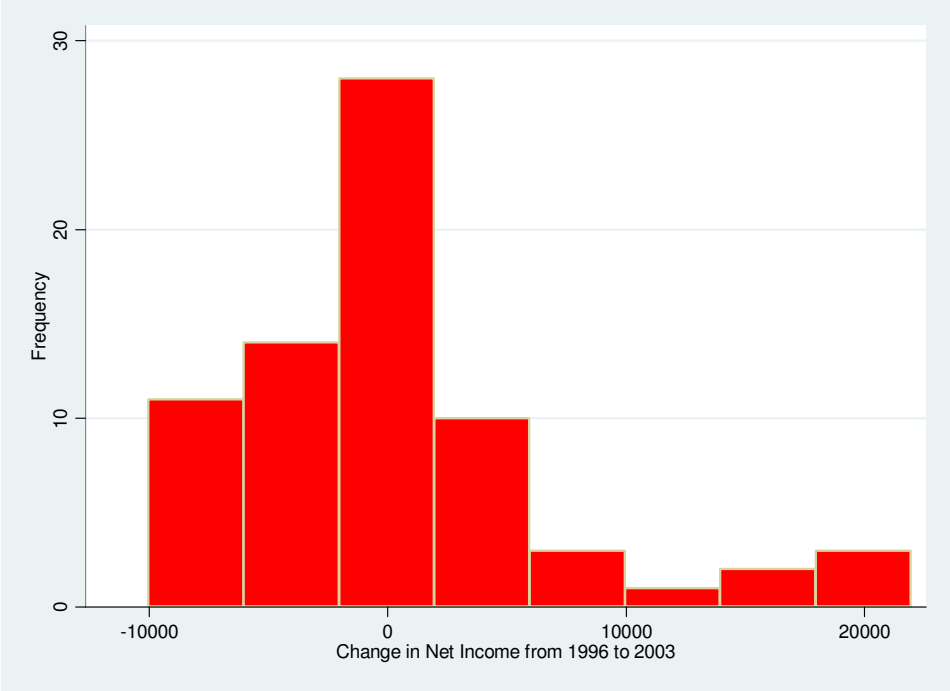

Figure 4.8 – Histogram of Change in Net Income from 1996 to 2003 for homes participating in the Pioneer Network (n=72)

Again, it is important to note that cost efficiency and profitability are extremely complex factors that rely strongly on a home's organizational characteristics and responses to environmental constraints. However, since the propensity score methods assure that each of the control homes is matched to a Pioneer home based on these organizational characteristics, it is expected that these homes will react similarly to environmental issues. Also, the small sample size is sensitive to outliers, and this analysis does not have the same benefit of verification through methods and outcomes as the quality of care analysis. Thus, it is imperative when interpreting results to not attribute income changes to network participation as the definitive causal factor. Despite this

limitation, the more convincing conclusions of the previous chapter's results on quality of care provoke inquiries regarding efficiency and profitability. Thus, the findings of this initial investigation provide a starting point for theories correlating network participation and profitability. The next section will incorporate the previous chapter's results on quality of care with profitability and provide a framework for future investigations.

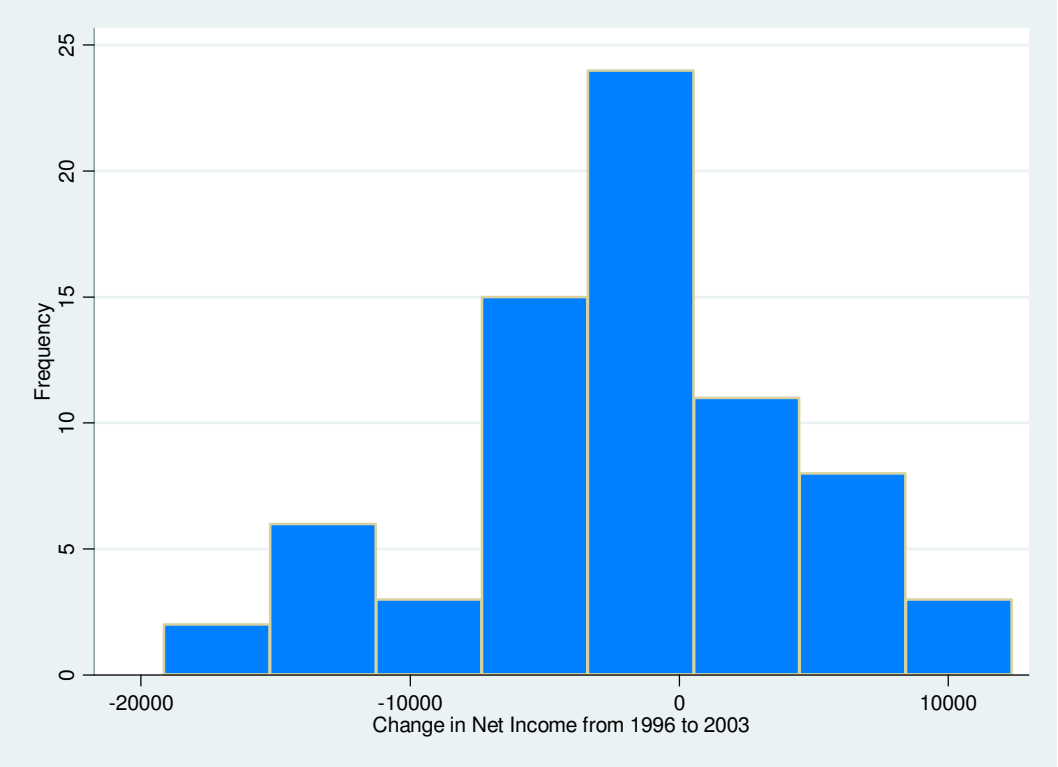

Figure 4.9 – Histogram of Change in Net Income from 1996 to 2003 for Control Homes (n=72)

4.7 Discussion

Financial solvency is a crucial element in any organization's ability to function and maintain long-run operations. For nursing homes, this is a particularly critical concern given that the majority of financing is in the form of Medicare and Medicaid reimbursement (a payment structure subject to governmental hegemony and frequent initiatives to restructure or reduce these payments). In light of these environmental constraints, it is not surprising that prior research endeavored to formulate hypotheses and draw conclusions regarding cost efficiency and profitability in nursing homes. Investigations of this type typically focused on one of several explanatory variables including profit motivation, economies of scope, or economies of scale. However, emerging lines of inquiry focus on the relationship between quality of care and profitability. Of particular interest are the potential disincentives created by the provision of regulated care coupled with governmental reimbursement (e.g. Medicaid reimbursement in many states is based on higher morbidity of residents). Thus, investigations into approaches that improve quality of care while maintaining cost efficiency are extremely valuable to government policy and the nursing home industry.

One potential method of maintaining profitability while enhancing quality is through innovation. In fact, several recent examinations concluded that innovation positively affected each of these outcomes (Hicks, Rantz, Petroski & Mukamel, 2004; Mukamel and Spector, 2000; Weech-Maldonado, Neff & Mor, 2003). This analysis builds upon these earlier investigations through a study of the Pioneer Network, an inter-

organizational network that asserts positive quality of care and profitability outcomes are associated with the network's adaptive techniques and process changes occurring in network homes. A quasi-experimental methodology matched Pioneer Network homes with control homes and then utilized a difference-in-difference approach to measure pre- to post- network participation profitability outcomes contrasted with profitability outcomes for control homes during the same timeframe.

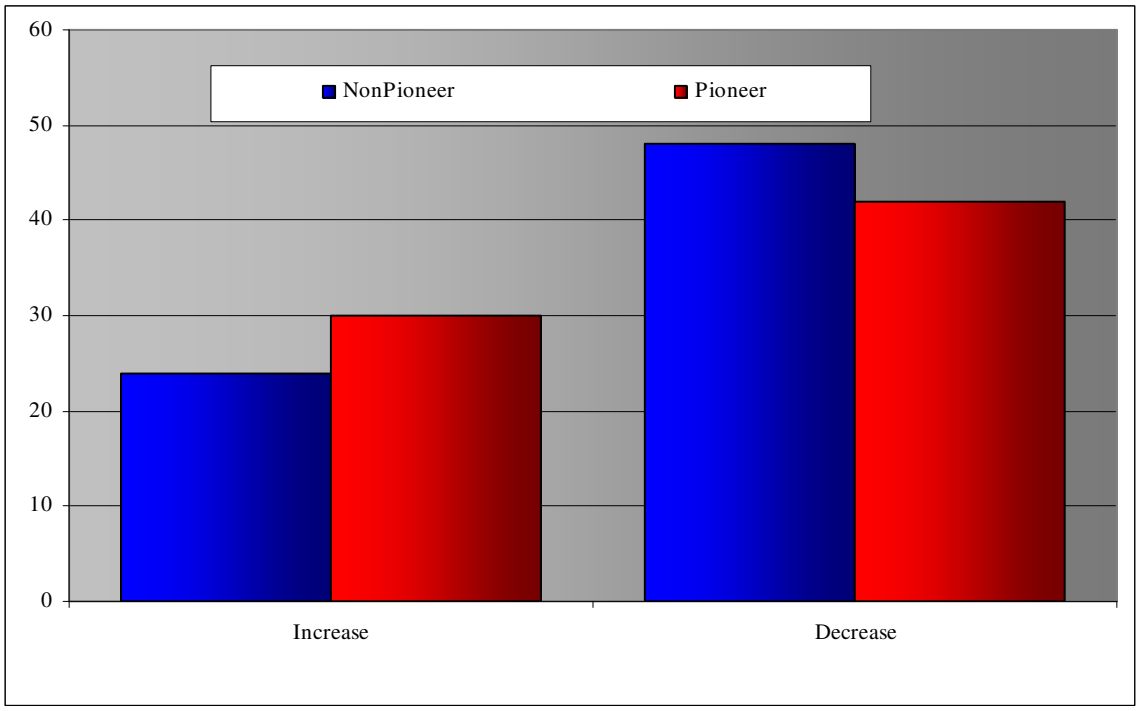

Figure 4.10 Count of Homes Increase or Decrease in Net Income from 1996 to 2003 by Network Participation

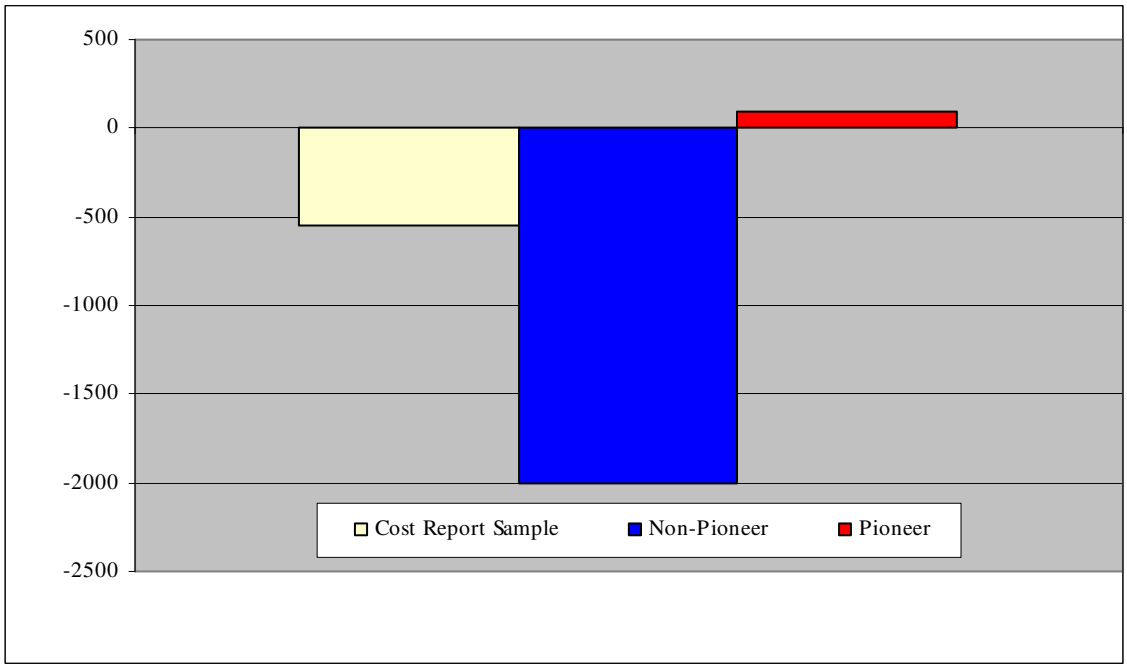

Figure 4.11 Average Differences in Per Bed Net Income from 1996 to 2003

The dependent variable in this study was net income (or loss) as collected by the Centers for Medicare and Medicaid Services in 1996 and 2003. In this way, this research investigated whether this outcome measure for homes participating in the Pioneer Network improved more, less or equally from 1996 to 2003 when compared to control homes. While it is the assertion of the Pioneer Network that it communicates process adaptation and techniques among members, this exchange of ideas is not the focal point for analysis. Instead, this investigation employed participation in the network as the treatment variable used in assessing profitability outcomes. Given the limitations of the data available for this investigation and the convoluted relationships of independent variables, propensity score matching was the preferred methodology for this

investigation. The findings of this examination concluded the following regarding network participation's effect on per bed net income:

- Overall, difference-in-difference estimates of per bed net income in the matched sample were significant and positive for homes participating in the Pioneer Network.

While this empirical design does not explicitly link quality of care and profitability, the matched sample of Pioneer and control homes in the profitability analysis is a subset of homes in the quality of care investigation. Given that the matched sample of homes was essentially the same in a cross-section at one point in time, the fact that Pioneer Network homes experienced improvements over control homes in both the quality of care and in the profitability examination is compelling. Certainly, improved quality of care in homes participating in the Pioneer Network provokes the question of, "At what cost?" However, since the methods and data in the quality of care analysis provided far more convincing conclusions than the investigation in this chapter, the question of profitability and efficiency advantages associated with network participation remain unanswered. Despite this limitation, findings do point to network participation as one possible explanation for improved profitability, and this initial investigation provides a first step in what will hopefully be a continued line of inquiry.

Accordingly, this evidence corroborates previous research in several fields of academic inquiry. For example, this research supports prior studies that concluded network participation resulted in positive outcomes for network nodes (O'Toole & Meier, 2004; Juenke et al., 2005). This research also supports studies that linked positive financial outcomes to network participation (Moskowitz, 2003). Most importantly, this

investigation complements earlier examinations of superior quality and efficiency outcomes in the same nursing home environment (Hicks, Rantz, Petroski & Mukamel, 2004; Mukamel and Spector, 2000; Weech-Maldonado, Neff & Mor, 2003). While these prior analyses hypothesized that innovation or product differentiation reduced costs while increasing quality and revenue, this research is unique in that it utilizes the network component as an explanatory factor in quality and profitability outcomes. Thus, this dissertation contributes to insight regarding outcomes for nodes and consumers in a network environment.

As the first extensive empirical investigation of profitability outcomes resulting from Pioneer Network participation, this research is not without limitations and affords a wide range of possibilities for future inquiries. Specifically, other authors speculated that causality in nursing homes flows from quality of care to profitability and efficiency. According to Weech-Maldonado, Neff and Mor (2003), "Producing high quality of care may allow nursing homes to become more efficient, or it may allow the nursing home to have higher revenues due to high levels of customer satisfaction" (p. 212). However, since this analysis did not address the actual changes occurring in homes participating in the network, it is unclear if there is causal flow from one of these elements to the other. Although this investigation did not link improved quality of care to increased efficiency, there are several plausible hypotheses for homes participating in the Pioneer Network including the following:

1. Improved quality of care reduces morbidity, which lowers costs and increases net income.

2. Higher quality increases the customer base or reputation in the community leading to additional residents (private paying) which increases net income.

3. More efficient practices result in improved quality of care.

4. The innovative techniques of the Pioneer Network are the cause of both outcomes

5. Innovative homes join the network, so the direction of causality is reversed.

To address these hypotheses, future research should attempt a more detailed analysis of the factors affecting quality and profitability in network homes. As discussed in Section 4.6, implementing more efficient processes could result in quantifiable cost-savings and tangible quality of care outcomes. Isolating particular cost centers (e.g. dining) along with quality of care components linked with those cost centers (e.g. weight loss) would further illuminate this relationship. In addition, one limitation of the non-identifiable data employed in this research was the inability to construct cost functions. Reliable yearly data were not available for this investigation. Certainly, the best design would employ yearly, identifiable data in a cost function with "length of time participating in the network" as an explanatory variable along with information regarding changes made in homes. Future research could utilize this identifiable data to elucidate concrete cost increases or reductions associated with network participation. In addition, this research could forecast and quantify potential cost-savings. Thus, there are legitimate opportunities to build upon this research with more detailed analyses of cost allocation.

Since current legislation proposes to link quality and reimbursement, the type of rigorous evidence provided by this future research is a powerful tool for policy. As stated

previously, Medicaid reimbursement in many states currently affords greater payment to homes with higher acuity. Thus, there exists a perverse incentive to maintain higher morbidity levels. Research that introduces data supporting the existence of quantified cost reductions and increased net income in homes with improved quality of care promotes policy (such as Medicaid waivers) to reward homes with higher acuity cases mixes that actively reduce morbidity through innovative practices. The final chapter of this dissertation further highlights these linkages between quality of care and profitability by summarizing the results of all three investigations into the Pioneer Network.

CHAPTER 5

5 CONCLUSION

This dissertation evaluated a method that encompasses both external and voluntary internal developments in nursing homes through a study of the Pioneer Network. To study the network, this research employed participation in the network as the treatment variable used in assessing outcomes among network participants and between network participants and comparable control homes. The second chapter in this dissertation investigated the characteristics of homes that join the network. While this analysis yielded only a few statistically significant results, these findings are still noteworthy in the context of network participation in the nursing home setting. Of particular interest is the most significant finding that non-profit homes are more likely to be early adopters of the Pioneer Network, all else equal. Since one of the goals of the Pioneer Network is to improve quality of care for residents in nursing homes, this supported the idea that non-profits are more likely to invest in innovation with the hope of improving quality of care for clients.

As with the decision to join the network, non-profit status was also the predominant characteristic in the analyses of quality of care and net income outcomes of network participants. In fact, significant improvement occurred in all three of the outcome measures for non-profit homes. These homes reduced the dependence index and citations more than for-profits from 1996 to 2003. In addition, non-profit homes were more able to substantially increase net income during the same timeframe. This finding supported that successful participants in the Pioneer Network are potentially motivated by improvements in quality of care but may also be motivated by and experience a supplementary outcome of increased net income due to the enhanced efficiencies associated with network participation.

The second investigation was the first empirical analysis of the Pioneer Network's effects on quality of care for consumers. Attempts were made to substantiate findings through the use of multiple outcomes and methods. The first analysis utilized a cross-sectional study analyzing outcomes in 2003 and found that length of time participating in the network was associated with positive outcomes over all other homes monitored by the Centers for Medicare and Medicaid Services in the country. In addition, a second model employed propensity score matching to match homes participating in the Pioneer Network with comparable control homes and found that network participation resulted in better quality of care outcomes from the pre- to post- timeframe. Thus, the use of multiple outcome measures and methods produced evidence that participation in the Pioneer Network resulted in better quality of care outcomes and that years of participation in the network increased this effect.

In the third analysis, a quasi-experimental methodology matched Pioneer Network homes with control homes and then utilized a difference-in-difference approach to measure pre- to post- network participation profitability outcomes contrasted with profitability outcomes for control homes during the same timeframe. The dependent variable in this study was net income (or loss) as collected by the Centers for Medicare and Medicaid Services in 1996 and 2003. In this way, this research investigated whether this outcome measure for homes participating in the Pioneer Network improved from 1996 to 2003 when compared to the means of control homes. Given the limitations of the data available for this investigation and the convoluted relationships of independent variables, propensity score matching was the preferred methodology for this investigation. The findings of this examination concluded that the difference-in-difference estimate of per bed net income in the matched sample was significant at the .05 level and positive for homes participating in the Pioneer Network. A more detailed examination of the Cost Report data indicated complexities with this finding but confirmed that, overall, homes participating in the network outperformed comparable control homes in per bed net income.

Although the investigations into quality of care and profitability were separate, there were nearly identical homes in the matched sample for both chapters. Thus, there is evidence that Pioneer Network homes experienced improvements over control homes in both quality of care and in profitability. Given the lack of research into quality of care and efficiency as dual outcomes, these findings support a potential link between network participation, quality for residents and profitability for homes. Therefore, this research provides a first step to the promising future studies discussed in 5.3

5.1 Theoretical Implications

Accordingly, this evidence corroborates previous research in several fields of academic inquiry, and the overall findings of this investigation were instructive and supplemented the relatively few studies of network participation in this setting. For example, these results contributed to the insight regarding "why" homes undertake this type of innovation by revealing that non-profits are more likely to join the network. Although there is an established tradition of research that has focused on innovation in diverse organizational settings, few studies have investigated this phenomenon in nursing homes. In addition, most of these prior investigations related to the adoption of capital intensive adaptations such as sub-acute units. An interesting component of this study was the juxtaposition of these hypotheses with the results of the analysis of the process-oriented adaptations associated with participation in the Pioneer Network.

In addition, these findings support network research concluding that the length of time in a network results in improved outcomes for network nodes (Juenke et. al, 2005). Also, these results substantiate prior studies concluding that networking scaffolds innovation (Ahuja, 2000; Owen-Smith & Powell, 2004). Most importantly, this investigation indicates that participation in the Pioneer Network increases the chance that residents (consumers of this network) will receive superior quality of care. This type of analysis of outcomes for consumers in a network is one that is rare, yet often discussed as an essential element to furthering the theoretical foundations of network research (Provan and Milward, 2001). This research also supports studies that linked positive financial

outcomes to network participation (Moskowitz, 2003). Most importantly, this investigation complements earlier examinations of superior quality and efficiency outcomes in the same nursing home environment (Hicks, Rantz, Petroski & Mukamel, 2004; Mukamel and Spector, 2000; Weech-Maldonado, Neff & Mor, 2003). While these prior analyses hypothesized that innovation or product differentiation reduced costs while increasing quality and revenue, this research is unique in that it utilizes the network component as an explanatory factor in quality and profitability outcomes. Thus, this dissertation contributes to insight regarding outcomes for nodes and consumers in a network environment, with particular emphasis for networks of nursing homes.

5.2 Future Research

Chapter 1 outlined several alternative explanations and theoretical frameworks for positive outcomes associated with the Pioneer Network. These explanations included participation with the Pioneer Network, general network participation, process adaptations and/or organizational culture change. Each of these areas presents opportunities for future research. As the first extensive empirical investigation of the internal characteristics of homes in the Pioneer Network, this research affords a wide range of possibilities for future inquiries with participation in the Pioneer Network as the theoretical framework. While this research contributes to an understanding of the "innovation decision" in the nursing home setting, it is limited in that it only studies the early adopters of the Pioneer Network. With so few homes, inferences from these findings lack statistical influence and authority. Since the network has expanded over the

past few years, there are legitimate opportunities to build upon this research with a more substantial treatment group from a larger geographical area. In addition, findings from this investigation suggest that organizational profit status could influence the choice between process-oriented adaptations and more capital intensive innovation. Thus, the type of innovation as it relates to organizational profit status should be more fully explored.

As one of the first studies to link the characteristics of a nursing home network with outcomes, findings from this analysis suggested that certain homes benefit in all three of these areas from Pioneer Network participation. One limitation of this research is that network participation is a proxy for innovation. Future research could uncouple the effects of participation and process adaptations associated with network participation. Also, since this research employed methods that separated organizational characteristics and outcomes, further explorations could employ methods that scrutinize the interactions of these characteristics on outcomes. For example, do small non-profits benefit more than large non-profits?

As the first extensive empirical investigation of quality of care outcomes resulting from Pioneer Network participation, the results of this dissertation suggest that homes that participate in the network have higher quality of care outcomes. From a general perspective of networks in the nursing home industry, additional research could further evaluate this finding by exploring other identifiable networks in the nursing home industry with similar agendas of disseminating knowledge and encouraging changes in nursing home practice. These future studies could also focus on further elucidating

network participation's effects from a product branding or information dissemination standpoint. Another area worthy of further examination is the study of potential interactions between regulatory enforcement and network participation. From an inter-organizational perspective of network theory, this could include charting the flow of communications from the nodes in this network to regulatory enforcement agencies and to assess the strength of ties between organizations (Ahuja, 2000). As discussed by Milward and Provan (1998), this type of research is essential to unraveling the concept of organizational learning in the network environment.

In addition, an investigation of this nature could further the understanding of successful implementation in varying regulatory environments. Findings may assist in identifying whether future policy for the nursing home industry should focus on punishing poor performers or rewarding excellence in the provision of quality of care (Walshe, 2001). In addition, studies that substantiate the actual and "best practices" of the most successful adaptations occurring in nursing homes would be beneficial to policymakers. Identifying these types of practices has been a focus of research for the past several years (Meiners, et al., 2002; Weiner, 2003; Kane, 2003; Kane, Flood, Bershadky, Keckhafer, 2004). The Centers for Medicare and Medicaid Services' recognition of the Pioneer Network further enhances anticipation for this type of study (Centers for Medicare and Medicaid, 2006).

Future research should also attempt a more detailed analysis of the manner in which process adaptations affect quality and profitability in nursing homes. Implementing more efficient processes in dining or toileting could result in quantifiable cost-savings and tangible quality of care outcomes. Isolating particular cost centers (e.g.

dining) along with quality of care components linked with those cost centers (e.g. weight loss) would further illuminate this relationship. In addition, one limitation of the non-identifiable data employed in this research was the inability to construct cost functions. Reliable yearly data were not available for this investigation. Certainly, the best design would employ yearly, identifiable data in a cost. Future research could utilize this identifiable data to elucidate concrete cost increases or reductions associated with process adaptations, network participation and/or culture change. In addition, this research could forecast and quantify potential cost-savings. Thus, there are legitimate opportunities to build upon this research with more detailed analyses of cost allocation.

5.3 Policy implications

For decades, improving the quality of care provided in nursing homes has been a focus of concern for stakeholders at all levels of involvement including the government, providers, consumers and their families. Policymakers and researchers still struggle with a definitive understanding of external and internal adaptations or processes that improve quality of care for consumers in nursing homes. As stated previously, both the National Commission for Quality Long-Term Care and the Centers for Medicare and Medicaid Services included the promotion of organizational "culture change" in their strategic recommendations for nursing homes. While this type of adaptation is possible without network participation or with non-Pioneer networks, both organizations recognized the Pioneer Network as a primary leader in the successful implementation of culture change.

While the research in this dissertation does not attempt to understand the actual systemic changes occurring in homes participating in the Pioneer Network, it does assist policymakers in a further understanding of any potential collaborative advantage due to network participation.

In addition, financial solvency is a crucial element in any organization's ability to function and maintain long-run operations. For nursing homes, this is a particularly critical concern given that the majority of financing is in the form of Medicare and Medicaid reimbursement (a payment structure subject to governmental hegemony and frequent initiatives to restructure or reduce these payments). Since current legislation proposes to link quality and reimbursement, the type of rigorous evidence provided by this dissertation is a powerful tool for policy. As stated previously, Medicaid reimbursement in many states currently affords greater payment to homes with higher acuity. Thus, there exists a perverse incentive to maintain higher morbidity levels. This dissertation introduces data supporting the existence of quantified cost reductions and increased net income in homes with improved quality of care. Thus, it promotes policy (such as Medicaid waivers) to reward homes that actively reduce morbidity through innovative practices.

In an industry that rarely engages in the ideas of efficiency and quality in the same conversation, this dissertation bridges the gap by viewing both outcomes as interconnected and not divergent lines of inquiry. Ultimately, the most altruistic organization cannot continue to operate if it forgoes efficiency and financial solvency only to concentrate on quality. Conversely, an organization that focuses only on costs and efficiency will likely suffer from quality issues that will lessen the organization's

potential by limiting the customer base. Nursing homes as organizations are hampered by a complicated framework that enforces a litany of dichotomous quality and financial mandates that result in incongruent outcomes between the home and the resident. This relationship is further complicated by the government's dual roles as the regulator charged with maintaining quality as well as the primary payer of the services concerned with lowering costs. This dissertation advanced this discussion through the study of homes participating in the Pioneer Network. The findings intimate to policymakers that network participation is not counter-intuitive and potentially affects quality without a detrimental effect on cost.

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APPENDIX A

PIONEER NETWORK

A.01 ***Pioneer Network as an inter-organizational network***

Specific features of inter-organizational networks include:

- Nodes – network members that act as channels for the transfer and flow of resources (Rowley, 1997).
- Linkages – relational ties used to gather and diffuse resources (Rowley, 1997).
- Network administrative organization – leads and governs network growth (Provan and Milward, 2001).

Figure A.1 represents a sample graphical representation of a network. Points A through G are "nodes" that can represent individuals, groups or corporations. Lines connecting the nodes are used to represent the flow of resources between nodes. This graphical representation includes a "focal organization" which is also known as a network administrative organization (NAO) used as an administrative decision-making hub in inter-organizational networks (Milward, 1982).

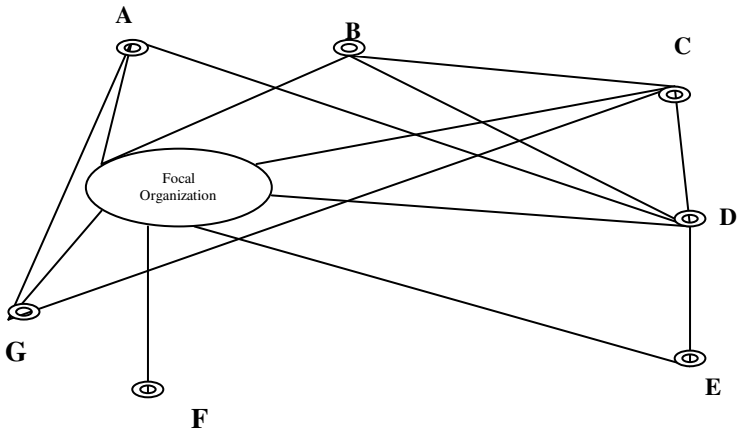

Figure A.1 Network Representation

The common interest of members of the network is the transformation of the culture of aging in America. The incentive for active participation in the network includes the "selective benefits" (Olson, 1965) associated with access to the other nodes. These advantages can be simply stated as *contacts* and *knowledge*. The incentive of expanded knowledge includes the ability to learn about process or product advancement in areas such as innovation or quality improvement. The incentive of productive contacts includes the potential for funding opportunities or coalition building (a helpful instrument in dealing with regulators). Figure A.2 represents an illustration of the Pioneer Network.

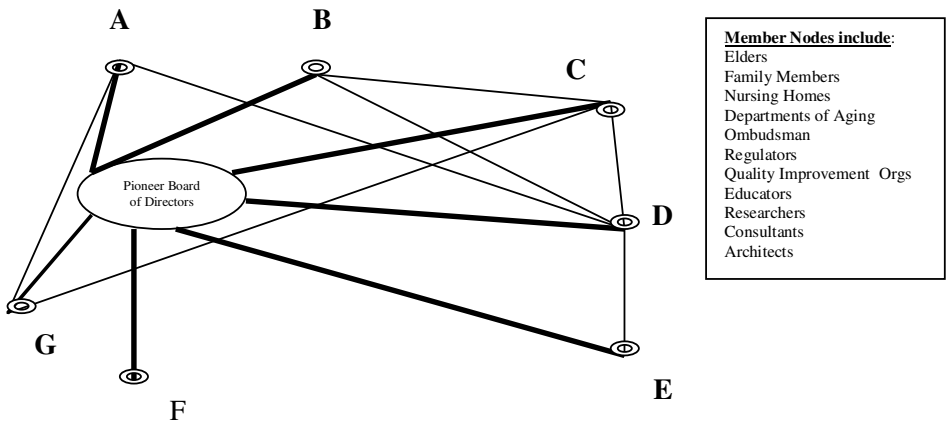

Figure A.2 Pioneer Network Representation

Contacts

Nodes - Typically, an inter-organizational network includes a "collection of organizations operating in the same domain, as identified by the similarity of their services, products or functions" (Rowley, 1997). Nursing homes are an example of this collection of organizations within the network. Also, successful networks "expand to include both

critical and peripheral services" (Provan and Milward, 2001). Nodes in the Pioneer Network that represent some of the critical peripheral services to the skilled nursing facility include Departments of Aging, Quality Improvement Organizations or Ombudsman. These peripheral organizations enhance the scope and diversity of resources available within the network. Homes that are a part of the Pioneer Network benefit from the Network's relationships and reputation with peripheral organizations. These beneficial relationships lead to support and even funding for further innovation. For instance, Kansas homes in the Pioneer Network were granted PEAK (Promoting Excellent Alternatives in Kansas nursing homes) funding from the Kansas Department of Aging based on Pioneer Network affiliation. These homes have been recognized statewide for their accomplishments.

Knowledge

NAO - In this depiction, the network administrative organization (NAO) is represented by the Pioneer Board of Directors. This Board communicates with homes, gathers critical resources, sifts through information and communicates innovations or successes to the rest of the network via linkages and channels. The Pioneer Network has created a new position, the "Director of Networking and Development." This individual will further foster the collaborative relationships of the network.

Linkages - Channels of communication are essential in any network. Links between members of a network can be direct channels such as newsletters and conferences or more indirect modes of communication (websites or listservs) (Brown and Duguid, 2000). In Figure A.2, the lines that are bold might represent the more direct channels of

communication from the Board of Directors to the various nodes in the network. These linkages include forms of communication such as the following:

- Quarterly newsletters – Newsletters inform members of the Pioneer Network of current or newly developed relationships with peripheral organizations in each state. In addition, the newsletter details the manner in which culture change is occurring in various homes. For example, an article in the Spring 2004 edition details the innovative person-centered measures of Friendly Acres in Kansas.
- Yearly conferences – The 2004 Pioneer Network Conference brought together 840 people from 44 states to discuss culture change. Forty-five sessions were offered with topics such as "Bathing Without a Battle," "Innovation in Long-term Care," "Person-Centered Approaches to the End-of Life Experience" and "Care Plans that Know Each Person." Through these sessions, member organizations are able to learn from and share with other member organizations.
- Workshops & Conferences – Process transformations and Pioneering approaches have been presented at major national conferences, including the American Association of Homes and Services for the Aging (AAHSA), the American Healthcare Association (AHCA), the American College of Health Care Administrators (ACHCA), the Gerontological Society of America (GSA), the National Citizen's Coalition for Nursing Home Reform (NCCNHR) and the American Society on Aging (ASA). Workshops have also produced advantageous results for members. For example, in 2002, a Pioneer Network workshop led to the development of the Colorado Culture Change Coalition in which Pinon Homes are a founding member. This workshop brought these homes together with

the Denver ombudsman program, state ombudsman program, the Colorado Health Care Association and the Colorado Association of Homes and Service for the Aging to further expand the network's domain.

- Web-site – www.pioneernetwork.net is a direct channel of communication in that it provides members with key resources regarding the network's missions, objectives and activities. It also provides new members the ability to "plug into" the network and to contact the focal organization.
- Products – The Pioneer Network currently offers twenty informational items for purchase. These items include "Getting Started: A Pioneering Approach to Culture Change in Long-term Care Organizations" which is a 300 page, $259.00 publication offering process engagement instructions and learning modules to assist in organizational change and assessment. Also available is an informational video co-produced with the Centers for Medicare and Medicaid Services.

In Figure A.2, the lines that are not bold represent the more indirect channels of communication between the various nodes in the network. These linkages include forms of communication such as the following:

- Listservs – The Network includes listservs in areas such as organizational practice, research and public policy. Through the listservs, members share resources and thoughts on relevant items and events.
- Web-site – www.pioneernetwork.net is also an indirect channel of communication in that it provides members an opportunity to post messages on the message board or to chat online with one another.

APPENDIX B

DATA

B.01 ***Technical Notes***

Source data for are research is provided by The Centers for Medicaid and Medicare Services. Data are reflective of internal in-house longitudinal storing of Oscar and Minimum Dataset data in SAS data files. Data are compiled at the facility level and are considered non-identifiable. Datasets utilized for this portion of the analysis as provided by CMS are:

- prov1996_ nodupkits.sas7bdat: files providing home level detail for 1996
- prov2003_ nodupkits.sas7bdat: files providing home level detail for 2003
- defs1996_nodupkits.sas7bdat: files providing deficiency and citation detail for 1996
- defs2003_nodupkits.sas7bdat: files providing deficiency and citation detail for 2003

Deficiency files were cleansed for duplicate records for each of the calendar years. In the event that multiple deficiency records existed for a home in a single calendar year, the most recent survey was selected. As per CMS, in the event that a record and a survey date existed for a home in the provider file for a calendar year but no deficiencies were recorded in the deficiency files, the provider had zero deficiencies for the calendar year.

Provider and deficiency files were merged by provider number by calendar year. For the matched sample analysis, only those providers with a valid record for 1996 and 2003 were utilized in the propensity score estimating process. Data cleaning processes were adapted from an earlier study by Harrington, Carillo and Mercado-Scott (2005). These methods included deleting providers that recorded greater than 24 hours per total

staff hours per resident per day as this indicates an error in the data record. In addition, the top two percent and the bottom one percent for each staffing variable were eliminated separately for Medicaid only and for dually certified homes.

Several variables in the analysis required calculated transformations. Most notably, CMS provided the formulas to calculate staff hours per resident day. Calculations as directed by CMS were to "take the FTE sum and multiply it by 5 (1 FTE=70 hours per 14 day period and hence 5 hours per day) and then divide it by the resident total (i.e. staff worked this many hours on a given day (on average) and given n residents spent this much time with this resident (on average)" (List of Variables in Annual Extract Provider File, CMS, 2006). Calculations for each type of staff were as follows:

RN resident hours per day = (RN FTE + Nurses with Admin Duties FTE+RN Director of Nursing FTE)*5)/Resident Total

LPN resident hours per day = (Licensed Practitioner Nurse FTE*5)/Resident Total

AID resident hours per day = (Certified Nurse Aides FTE + Nurses Aides in Training FTE + Medication Aides/Techs FTE *5)/Resident Total

B.02 ***Data Collection of Pioneer Network Homes***

In order to obtain a listing of these homes, an e-mail was sent to all members of the Board of Directors and regional leaders in the Pioneer Network requesting assistance in identifying nursing facilities in the network for two or more years. The documentation employed in this data collection effort was prepared in consultation with Joanne Radar (a member of the Pioneer Board of Directors). Responses to this request were returned via

e-mail. In order to assure an exhaustive data collection effort, a draft of the initial list of homes in the network was sent out for review to the Board of Directors. Respondents to the first request were asked to verify homes on the list. In addition, any individuals not responding to the first request were asked to either return additional names of homes or to verify that they had no additional homes to add to the list. This was repeated with a final response rate of 81.8 percent (27 out of 33 individuals responded). Since the Skilled Nursing Facility Cost Reports and Nursing Home Compare only contain data for homes that are Medicare and Medicaid certified, homes without this classification were excluded from the final list (approximately eight homes were excluded)[24]. The resulting list contained 115 Pioneer Network homes.

[24] These eight homes were assisted living or independent living facilities. Thus, skilled services that typically receive Medicare and Medicaid payment were not provided in these homes.

APPENDIX C

DESCRIPTIVE STATISTICS

C.01 *DESCRIPTIVE STATISTICS BY STATE*

	Non-Pioneer Network Homes		Pioneer Network Homes		Total	
Variables	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**
Number of beds (in hundreds)	0.493	0.524	0.890	0.000	0.518	0.516
Type of ownership (For profit=1)	0.067	0.258	0.000	0.000	0.063	0.250
Chain Status (Yes=1)	0.267	0.458	1.000	0.000	0.313	0.479
Located in a Hospital (Yes=1)	0.667	0.488	0.000	0.000	0.625	0.500
Herfindahl Index	0.772	0.260	0.432	0.000	0.751	0.265
Average Wage Rate	13.250	0.957	15.000	0.000	13.600	1.140
RN Hours Per Resident Per Day	2.980	5.537	0.760	0.000	2.842	5.378
LPN Hours Per Resident Per Day	0.642	0.387	0.502	0.000	0.633	0.375
CNA Hours Per Resident Per Day	4.702	5.284	2.942	0.000	4.592	5.124
Total Hours Per Resident Per Day	8.324	10.575	4.204	0.000	8.067	10.268
Occupancy Rate	0.611	0.303	1.000	0.000	0.635	0.309
Number of residents (in hundreds)*	0.358	0.532	0.890	0.000	0.391	0.531
Average Length of Stay (days in hundreds)	2.103	1.445	1.460	0.000	1.974	1.284
Family Group (Yes=1)	0.067	0.258	0.000	0.000	0.063	0.250
Resident Council (Yes=1)	0.267	0.458	1.000	0.000	0.313	0.479
Medicare or Medicaid Certified Beds (in hundreds)	0.429	0.555	0.890	0.000	0.458	0.548
Census Medicaid	0.794	0.242	0.921	0.000	0.802	0.236
Census Medicare	0.064	0.089	0.056	0.000	0.064	0.086
Census not Medicaid or Medicare	0.141	0.247	0.022	0.000	0.134	0.241

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 15 facilities
Pioneer=1 facility

Table C.1. Descriptive Statistics for Alaska in 1996

	Non-Pioneer Network Homes		Pioneer Network Homes		Total	
Variables	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**
Number of beds (in hundreds)	1.174	0.795	1.080	0.000	1.173	0.794
Type of ownership (For profit=1)	0.822	0.383	0.000	0.000	0.819	0.386
Chain Status (Yes=1)	0.556	0.498	0.000	0.000	0.554	0.498
Located in a Hospital (Yes=1)	0.102	0.303	0.000	0.000	0.101	0.302
Herfindahl Index	0.296	0.220	0.203	0.000	0.296	0.219
Average Wage Rate	7.109	1.303	7.000	0.000	7.108	1.299
RN Hours Per Resident Per Day	0.492	0.998	0.208	0.000	0.491	0.996
LPN Hours Per Resident Per Day	0.884	0.983	0.419	0.000	0.883	0.981
CNA Hours Per Resident Per Day	2.031	1.219	2.078	0.000	2.031	1.217
Total Hours Per Resident Per Day	3.407	2.688	2.705	0.000	3.405	2.684
Occupancy Rate	0.765	0.262	0.963	0.000	0.766	0.262
Number of residents (in hundreds)*	0.794	0.396	1.040	0.000	0.795	0.396
Average Length of Stay (days in hundreds)	0.689	0.849	8.240	0.000	0.737	1.040
Family Group (Yes=1)	0.549	0.498	1.000	0.000	0.551	0.498
Resident Council (Yes=1)	0.913	0.283	1.000	0.000	0.913	0.282
Medicare or Medicaid Certified Beds (in hundreds)	0.947	0.444	1.080	0.000	0.948	0.443
Census Medicaid	0.702	0.260	0.654	0.000	0.702	0.260
Census Medicare	0.128	0.265	0.010	0.000	0.128	0.265
Census not Medicaid or Medicare	0.169	0.144	0.337	0.000	0.170	0.144

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 275 facilities
Pioneer=1 facility

Table C.2. Descriptive Statistics for Arkansas in 1996

Variables	Non-Pioneer Network Homes Mean	Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	1.085	0.620	1.290	0.000	1.086	0.618
Type of ownership (For profit=1)	0.622	0.487	1.000	0.000	0.624	0.486
Chain Status (Yes=1)	0.686	0.466	0.000	0.000	0.682	0.467
Located in a Hospital (Yes=1)	0.224	0.419	0.000	0.000	0.223	0.418
Herfindahl Index	0.101	0.165	0.015	0.000	0.100	0.165
Average Wage Rate	10.142	3.287	11.000	0.000	10.149	3.273
RN Hours Per Resident Per Day	1.396	2.160	0.399	0.000	1.390	2.155
LPN Hours Per Resident Per Day	0.894	0.885	0.821	0.000	0.893	0.882
CNA Hours Per Resident Per Day	2.486	2.148	2.380	0.000	2.486	2.141
Total Hours Per Resident Per Day	4.776	4.121	3.601	0.000	4.769	4.109
Occupancy Rate	0.765	0.263	0.884	0.000	0.765	0.262
Number of residents (in hundreds)*	0.859	0.596	1.140	0.000	0.860	0.594
Average Length of Stay (days in hundreds)	0.558	0.517	0.280	0.000	0.555	51.558
Family Group (Yes=1)	0.481	0.501	1.000	0.000	0.484	0.501
Resident Council (Yes=1)	0.859	0.349	1.000	0.000	0.860	0.348
Medicare or Medicaid Certified Beds (in hundreds)	1.031	0.645	1.290	0.000	1.033	0.643
Census Medicaid	0.458	0.339	0.535	0.000	0.459	0.338
Census Medicare	0.214	0.308	0.035	0.000	0.213	0.308
Census not Medicaid or Medicare	0.328	0.279	0.430	0.000	0.329	0.278

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 156 facilities
Pioneer=1 facility

Table C.3. Descriptive Statistics for Arizona in 1996

Variables	Non-Pioneer Network Homes Mean	Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	1.009	1.041	1.300	0.000	1.010	1.041
Type of ownership (For profit=1)	0.741	0.438	1.000	0.000	0.741	0.438
Chain Status (Yes=1)	0.593	0.491	0.000	0.000	0.592	0.492
Located in a Hospital (Yes=1)	0.183	0.387	0.000	0.000	0.183	0.387
Herfindahl Index	0.059	0.111	0.500	0.000	0.059	0.112
Average Wage Rate	10.077	2.707	10.000	0.000	10.076	2.706
RN Hours Per Resident Per Day	1.039	1.909	0.283	0.000	1.038	1.908
LPN Hours Per Resident Per Day	0.796	1.013	0.554	0.000	0.795	1.012
CNA Hours Per Resident Per Day	2.411	1.791	1.997	0.000	2.411	1.790
Total Hours Per Resident Per Day	4.246	3.795	2.834	0.000	4.245	3.794
Occupancy Rate	0.807	0.223	0.869	0.000	0.807	0.223
Number of residents (in hundreds)*	0.767	0.584	1.130	0.000	0.767	0.584
Average Length of Stay (days in hundreds)	1.309	1.808	0.200	0.000	1.307	1.807
Family Group (Yes=1)	0.523	0.500	0.000	0.000	0.523	0.500
Resident Council (Yes=1)	0.914	0.280	1.000	0.000	0.914	0.280
Medicare or Medicaid Certified Beds (in hundreds)	0.898	0.661	1.300	0.000	0.898	0.660
Census Medicaid	0.575	0.322	0.743	0.000	0.575	0.322
Census Medicare	0.163	0.264	0.106	0.000	0.163	0.263
Census not Medicaid or Medicare	0.262	0.249	0.150	0.000	0.262	0.249

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 1319 facilities
Pioneer=1 facility

Table C.4. Descriptive Statistics for California in 1996

Variables	Non-Pioneer Network Homes Mean	Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	0.895	0.525	0.821	0.321	0.890	0.515
Type of ownership (For profit=1)	0.629	0.484	0.714	0.469	0.634	0.483
Chain Status (Yes=1)	0.653	0.477	0.643	0.497	0.652	0.477
Located in a Hospital (Yes=1)	0.178	0.384	0.000	0.000	0.167	0.374
Herfindahl Index	0.225	0.274	0.169	0.255	0.221	0.273
Average Wage Rate	10.399	3.296	11.000	1.732	10.444	3.204
RN Hours Per Resident Per Day	1.118	1.696	0.565	0.157	1.084	1.648
LPN Hours Per Resident Per Day	0.767	0.875	0.528	0.168	0.752	0.850
CNA Hours Per Resident Per Day	1.978	0.709	1.897	0.353	1.973	0.693
Total Hours Per Resident Per Day	3.863	2.559	2.990	0.422	3.809	2.490
Occupancy Rate	0.833	0.186	0.866	0.079	0.835	0.181
Number of residents (in hundreds)*	0.769	0.486	0.718	0.304	0.766	0.476
Average Length of Stay (days in hundreds)	1.115 *	2.126	2.482	2.766	1.245	2.220
Family Group (Yes=1)	0.549	0.499	0.571	0.514	0.551	0.499
Resident Council (Yes=1)	0.897	0.305	1.000	0.000	0.903	0.296
Medicare or Medicaid Certified Beds (in hundreds)	0.839	0.532	0.821	0.321	0.838	0.521
Census Medicaid	0.546	0.306	0.701	0.248	0.555	0.304
Census Medicare	0.161	0.280	0.045	0.039	0.153	0.273
Census not Medicaid or Medicare	0.294	0.228	0.255	0.228	0.291	0.228

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 213 facilities
Pioneer=14 facilities

Table C.5. Descriptive Statistics for Colorado in 1996

Variables	Non-Pioneer Network Homes Mean	Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	1.254 *	0.669	0.883	0.376	1.229	0.660
Type of ownership (For profit=1)	0.768 *	0.423	1.000	0.000	0.784	0.412
Chain Status (Yes=1)	0.411 *,	0.493	1.000	0.000	0.451	0.499
Located in a Hospital (Yes=1)	0.020	0.141	0.000	0.000	0.019	0.137
Herfindahl Index	0.036	0.035	0.041	0.024	0.036	0.034
Average Wage Rate	13.644	4.168	12.944	0.873	13.589	4.009
RN Hours Per Resident Per Day	0.823	1.089	0.716	0.254	0.816	1.054
LPN Hours Per Resident Per Day	0.487	0.398	0.323	0.175	0.476	0.389
CNA Hours Per Resident Per Day	2.059	0.872	1.835	0.444	2.044	0.851
Total Hours Per Resident Per Day	3.370	1.710	2.874	0.708	3.336	1.665
Occupancy Rate	0.939	0.086	0.952	0.069	0.940	0.085
Number of residents (in hundreds)*	1.169 *	0.588	0.854	0.384	1.147	0.581
Average Length of Stay (days in hundreds)	2.504	2.440	3.596	3.058	2.591	2.504
Family Group (Yes=1)	0.524	0.500	0.389	0.502	0.515	0.501
Resident Council (Yes=1)	0.984	0.127	1.000	0.000	0.985	0.122
Medicare or Medicaid Certified Beds (in hundreds)	1.225 *	0.624	0.883	0.376	1.202	0.616
Census Medicaid	0.673 *,	0.185	0.543	0.219	0.664	0.190
Census Medicare	0.112	0.094	0.142	0.072	0.114	0.093
Census not Medicaid or Medicare	0.216 *,	0.151	0.315	0.167	0.223	0.154

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 246 facilities
Pioneer=18 facilities

Table C.6. Descriptive Statistics for Connecticut in 1996

Variables	Non-Pioneer Network Homes Mean	Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	1.128	0.742	0.820	0.000	1.121	0.735
Type of ownership (For profit=1)	0.477	0.505	1.000	0.000	0.489	0.506
Chain Status (Yes=1)	0.568	0.501	1.000	0.000	0.578	0.499
Located in a Hospital (Yes=1)	0.068	0.255	0.000	0.000	0.067	0.252
Herfindahl Index	0.095	0.073	0.042	0.000	0.094	0.072
Average Wage Rate	10.091	2.951	10.000	0.000	10.088	2.906
RN Hours Per Resident Per Day	1.558	2.215	0.957	0.000	1.545	2.192
LPN Hours Per Resident Per Day	0.700	0.612	0.883	0.000	0.704	0.605
CNA Hours Per Resident Per Day	3.221	3.280	4.072	0.000	3.240	3.245
Total Hours Per Resident Per Day	5.479	5.368	5.911	0.000	5.489	5.307
Occupancy Rate	0.765	0.269	0.537	0.000	0.760	0.268
Number of residents (in hundreds)*	0.886	0.591	0.440	0.000	0.876	0.588
Average Length of Stay (days in hundreds)	2.547	2.993	0.510	0.000	2.487	2.968
Family Group (Yes=1)	0.409	0.497	1.000	0.000	0.422	0.499
Resident Council (Yes=1)	0.886	0.321	1.000	0.000	0.889	0.318
Medicare or Medicaid Certified Beds (in hundreds)	1.024	0.766	0.450	0.000	1.011	0.762
Census Medicaid	0.533	0.303	0.614	0.000	0.535	0.299
Census Medicare	0.133	0.193	0.227	0.000	0.135	0.191
Census not Medicaid or Medicare	0.334	0.285	0.159	0.000	0.331	0.283

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 44 facilities
Pioneer=1 facility

Table C.7. Descriptive Statistics for Delaware in 1996

Variables	Non-Pioneer Network Homes Mean	Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	1.103	0.573	1.248	0.438	1.104	0.572
Type of ownership (For profit=1)	0.771	0.421	0.800	0.447	0.771	0.420
Chain Status (Yes=1)	0.717	0.451	0.800	0.447	0.717	0.451
Located in a Hospital (Yes=1)	0.107	0.309	0.000	0.000	0.106	0.308
Herfindahl Index	0.105	0.160	0.153	0.198	0.105	0.160
Average Wage Rate	9.795	1.999	8.800	0.837	9.787	1.994
RN Hours Per Resident Per Day	1.278	2.269	1.426	1.641	1.279	2.265
LPN Hours Per Resident Per Day	1.081	1.217	0.650	0.250	1.078	1.213
CNA Hours Per Resident Per Day	2.589	2.363	2.378	0.861	2.588	2.356
Total Hours Per Resident Per Day	4.949	4.841	4.455	2.350	4.945	4.827
Occupancy Rate	0.807	0.240	0.793	0.341	0.807	0.240
Number of residents (in hundreds)*	0.915	0.553	1.088	0.594	0.916	0.553
Average Length of Stay (days in hundreds)	1.016	4.362	0.606	0.397	1.012	4.343
Family Group (Yes=1)	0.728	0.445	0.600	0.548	0.728	0.446
Resident Council (Yes=1)	0.912	0.283	0.800	0.447	0.912	0.284
Medicare or Medicaid Certified Beds (in hundreds)	1.032	0.586	1.240	0.425	1.033	0.585
Census Medicaid	0.540	0.305	0.591	0.342	0.540	0.305
Census Medicare	0.227	0.285	0.102	0.061	0.226	0.285
Census not Medicaid or Medicare	0.233	0.238	0.308	0.392	0.233	0.240

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 685 facilities
Pioneer=5 facilities

Table C.8. Descriptive Statistics for Florida in 1996

Variables	Non-Pioneer Network Homes Mean	Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	1.078	0.498	0.620	0.000	1.076	0.498
Type of ownership (For profit=1)	0.747	0.435	1.000	0.000	0.748	0.435
Chain Status (Yes=1)	0.718	0.451	1.000	0.000	0.718	0.450
Located in a Hospital (Yes=1)	0.172	0.378	0.000	0.000	0.172	0.378
Herfindahl Index	0.402	0.321	1.000	0.000	0.403	0.322
Average Wage Rate	8.314	2.172	8.000	0.000	8.313	2.167
RN Hours Per Resident Per Day	0.506	1.068	0.234	0.000	0.505	1.067
LPN Hours Per Resident Per Day	0.919	0.913	0.562	0.000	0.918	0.912
CNA Hours Per Resident Per Day	2.215	1.521	1.020	0.000	2.211	1.520
Total Hours Per Resident Per Day	3.640	3.136	1.816	0.000	3.635	3.133
Occupancy Rate	0.928	0.150	0.984	0.000	0.928	0.149
Number of residents (in hundreds)*	1.007	0.476	0.610	0.000	1.006	0.476
Average Length of Stay (days in hundreds)	2.801	5.756	1.230	0.000	2.795	5.745
Family Group (Yes=1)	0.522	0.500	0.000	0.000	0.520	0.500
Resident Council (Yes=1)	0.941	0.236	1.000	0.000	0.941	0.236
Medicare or Medicaid Certified Beds (in hundreds)	1.055	0.496	0.620	0.000	1.054	0.496
Census Medicaid	0.765	0.226	0.738	0.000	0.765	0.226
Census Medicare	0.092	0.165	0.131	0.000	0.092	0.165
Census not Medicaid or Medicare	0.143	0.150	0.131	0.000	0.143	0.149

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 372 facilities
Pioneer=1 facility

Table C.9. Descriptive Statistics for Georgia in 1996

Variables	Non-Pioneer Network Homes Mean	Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	0.958	0.796	0.693	0.266	0.955	0.793
Type of ownership (For profit=1)	0.572 *	0.495	0.167	0.408	0.567	0.496
Chain Status (Yes=1)	0.498	0.500	0.667	0.516	0.500	0.500
Located in a Hospital (Yes=1)	0.099	0.299	0.167	0.408	0.100	0.300
Herfindahl Index	0.222	0.130	0.172	0.058	0.221	0.130
Average Wage Rate	8.610	1.558	9.000	0.000	8.615	1.549
RN Hours Per Resident Per Day	0.705	1.131	0.644	0.121	0.704	1.124
LPN Hours Per Resident Per Day	0.499 *	0.476	0.894	0.696	0.504	0.480
CNA Hours Per Resident Per Day	1.956	1.260	2.635	0.718	1.964	1.256
Total Hours Per Resident Per Day	3.160	2.411	4.172	0.820	3.171	2.401
Occupancy Rate	0.795	0.236	0.744	0.212	0.795	0.235
Number of residents (in hundreds)*	0.656	0.368	0.518	0.264	0.654	0.368
Average Length of Stay (days in hundreds)	2.607	2.521	1.760	1.570	2.597	2.511
Family Group (Yes=1)	0.202	0.402	0.333	0.516	0.204	0.403
Resident Council (Yes=1)	0.807	0.395	0.667	0.516	0.806	0.396
Medicare or Medicaid Certified Beds (in hundreds)	0.740	0.403	0.545	0.295	0.738	0.402
Census Medicaid	0.487 *	0.193	0.285	0.345	0.485	0.196
Census Medicare	0.059	0.189	0.035	0.042	0.058	0.188
Census not Medicaid or Medicare	0.455 *	0.194	0.680	0.329	0.457	0.197

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 514 facilities
Pioneer=6 facilities

Table C.10. Descriptive Statistics for Iowa in 1996

Variables	Non-Pioneer Network Homes Mean	Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	1.248	0.793	1.630	0.580	1.248	0.792
Type of ownership (For profit=1)	0.638	0.481	0.500	0.707	0.638	0.481
Chain Status (Yes=1)	0.410	0.492	0.000	0.000	0.409	0.492
Located in a Hospital (Yes=1)	0.121	0.326	0.000	0.000	0.120	0.326
Herfindahl Index	0.132	0.168	0.239	0.164	0.133	0.168
Average Wage Rate	9.112	2.412	8.000	0.000	9.110	2.410
RN Hours Per Resident Per Day	1.025	1.574	0.345	0.061	1.023	1.572
LPN Hours Per Resident Per Day	0.600	0.693	0.500	0.214	0.599	0.693
CNA Hours Per Resident Per Day	2.165	2.150	1.909	0.163	2.164	2.148
Total Hours Per Resident Per Day	3.789	3.724	2.755	0.437	3.787	3.720
Occupancy Rate	0.783	0.226	0.879	0.095	0.783	0.226
Number of residents (in hundreds)*	0.983	0.705	1.460	0.665	0.985	0.705
Average Length of Stay (days in hundreds)	0.781	1.358	0.480	0.000	0.780	1.357
Family Group (Yes=1)	0.372	0.484	0.500	0.707	0.372	0.484
Resident Council (Yes=1)	0.960	0.196	1.000	0.000	0.960	0.195
Medicare or Medicaid Certified Beds (in hundreds)	1.143	0.794	1.630	0.580	1.144	0.794
Census Medicaid	0.543	0.307	0.678	0.045	0.543	0.307
Census Medicare	0.153	0.288	0.016	0.022	0.153	0.288
Census not Medicaid or Medicare	0.304	0.239	0.306	0.067	0.304	0.238

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 879 facilities
Pioneer=2 facilities

Table C.11. Descriptive Statistics for Illinois in 1996

Variables	Non-Pioneer Network Homes Mean	Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	0.691 *	0.368	1.037	0.472	0.696	0.372
Type of ownership (For profit=1)	0.553 *	0.498	0.143	0.378	0.546	0.498
Chain Status (Yes=1)	0.518 *	0.500	0.143	0.378	0.512	0.500
Located in a Hospital (Yes=1)	0.164	0.371	0.000	0.000	0.162	0.369
Herfindahl Index	0.261	0.241	0.178	0.126	0.260	0.239
Average Wage Rate	8.205	1.582	9.000	1.414	8.233	1.580
RN Hours Per Resident Per Day	0.834	1.551	0.473	0.191	0.829	1.540
LPN Hours Per Resident Per Day	0.641	0.887	0.561	0.256	0.640	0.880
CNA Hours Per Resident Per Day	2.233	2.041	2.084	0.278	2.230	2.025
Total Hours Per Resident Per Day	3.709	3.891	3.118	0.455	3.699	3.861
Occupancy Rate	0.820	0.171	0.894	0.159	0.821	0.171
Number of residents (in hundreds)*	0.566 **	0.314	0.896	0.397	0.571	0.318
Average Length of Stay (days in hundreds)	1.643	3.626	2.257	2.096	1.664	3.583
Family Group (Yes=1)	0.368	0.483	0.429	0.535	0.369	0.483
Resident Council (Yes=1)	0.881	0.324	1.000	0.000	0.883	0.322
Medicare or Medicaid Certified Beds (in hundreds)	0.656 *	0.346	0.939	0.411	0.661	0.348
Census Medicaid	0.494	0.228	0.435	0.251	0.493	0.229
Census Medicare	0.103	0.253	0.036	0.024	0.102	0.251
Census not Medicaid or Medicare	0.403	0.203	0.529	0.247	0.405	0.204

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 438 facilities
Pioneer=7 facilities

Table C.12. Descriptive Statistics for Kansas in 1996

Variables	Non-Pioneer Network Homes Mean	Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	0.990	0.534	1.170	0.554	0.991	0.534
Type of ownership (For profit=1)	0.736 **	0.441	0.200	0.447	0.731	0.444
Chain Status (Yes=1)	0.469	0.499	0.400	0.548	0.468	0.499
Located in a Hospital (Yes=1)	0.078	0.269	0.000	0.000	0.077	0.268
Herfindahl Index	0.030	0.063	0.029	0.022	0.030	0.063
Average Wage Rate	12.252	2.205	12.250	3.202	12.252	2.210
RN Hours Per Resident Per Day	1.318	2.292	0.755	0.345	1.314	2.283
LPN Hours Per Resident Per Day	0.650	0.588	0.427	0.192	0.648	0.586
CNA Hours Per Resident Per Day	2.472	1.381	2.168	0.720	2.469	1.377
Total Hours Per Resident Per Day	4.440	3.781	3.350	1.066	4.431	3.767
Occupancy Rate	0.863	0.208	0.867	0.152	0.863	0.208
Number of residents (in hundreds)*	0.886	0.531	0.958	0.356	0.886	0.530
Average Length of Stay (days in hundreds)	1.902	2.254	3.018	2.637	1.912	2.257
Family Group (Yes=1)	0.392	0.489	0.400	0.548	0.392	0.489
Resident Council (Yes=1)	0.943	0.233	1.000	0.000	0.943	0.232
Medicare or Medicaid Certified Beds (in hundreds)	0.975	0.537	1.044	0.465	0.975	0.536
Census Medicaid	0.651	0.278	0.558	0.143	0.650	0.277
Census Medicare	0.151	0.233	0.074	0.049	0.150	0.232
Census not Medicaid or Medicare	0.199	0.200	0.368	0.186	0.200	0.200

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 576 facilities
Pioneer=5 facilities

Table C.13. Descriptive Statistics for Massachusetts in 1996

Variables	Non-Pioneer Network Homes Mean	Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	1.291	0.780	2.020	0.000	1.294	0.780
Type of ownership (For profit=1)	0.596	0.492	0.000	0.000	0.593	0.492
Chain Status (Yes=1)	0.438	0.497	0.000	0.000	0.436	0.497
Located in a Hospital (Yes=1)	0.085	0.280	1.000	0.000	0.089	0.285
Herfindahl Index	0.124	0.144	0.031	0.000	0.124	0.143
Average Wage Rate	10.682	2.507	.	0.000	10.682	2.507
RN Hours Per Resident Per Day	1.003	1.881	0.513	0.000	1.001	1.877
LPN Hours Per Resident Per Day	0.703	1.160	0.884	0.000	0.703	1.158
CNA Hours Per Resident Per Day	2.467	1.855	2.359	0.000	2.467	1.851
Total Hours Per Resident Per Day	4.173	4.369	3.756	0.000	4.172	4.360
Occupancy Rate	0.814	0.237	0.876	0.000	0.815	0.236
Number of residents (in hundreds)*	1.085	0.740	1.770	0.000	1.088	0.739
Average Length of Stay (days in hundreds)	2.471	2.981	.	0.000	2.471	2.981
Family Group (Yes=1)	0.489	0.501	0.000	0.000	0.487	0.501
Resident Council (Yes=1)	0.898	0.303	1.000	0.000	0.898	0.303
Medicare or Medicaid Certified Beds (in hundreds)	1.227	0.768	1.920	0.000	1.230	0.767
Census Medicaid	0.577	0.311	0.734	0.000	0.578	0.311
Census Medicare	0.135	0.228	0.102	0.000	0.135	0.228
Census not Medicaid or Medicare	0.288	0.269	0.164	0.000	0.287	0.268

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 235 facilities
Pioneer=1 facility

Table C.14. Descriptive Statistics for Maryland in 1996

Variables	Non-Pioneer Network Homes Mean		Standard Deviation	Pioneer Network Homes Mean		Standard Deviation	Total Mean	Standard Deviation
Number of beds (in hundreds)	1.154		0.591	1.268		0.514	1.155	0.590
Type of ownership (For profit=1)	0.633	*	0.482	0.167		0.408	0.627	0.484
Chain Status (Yes=1)	0.466		0.499	0.167		0.408	0.462	0.499
Located in a Hospital (Yes=1)	0.054	**	0.227	0.500		0.548	0.060	0.238
Herfindahl Index	0.204	*	0.222	0.407		0.188	0.207	0.223
Average Wage Rate	9.772		1.902	9.000		2.646	9.765	1.906
RN Hours Per Resident Per Day	0.635		0.640	0.510		0.179	0.634	0.637
LPN Hours Per Resident Per Day	0.617		0.323	0.707		0.230	0.618	0.322
CNA Hours Per Resident Per Day	2.365		0.888	2.441		0.341	2.366	0.883
Total Hours Per Resident Per Day	3.617		1.431	3.657		0.350	3.618	1.422
Occupancy Rate	0.877		0.159	0.915		0.061	0.877	0.158
Number of residents (in hundreds)*	0.989		0.497	1.155		0.450	0.991	0.496
Average Length of Stay (days in hundreds)	1.596	*	1.683	3.883		2.602	1.616	1.701
Family Group (Yes=1)	0.554		0.498	0.833		0.408	0.558	0.497
Resident Council (Yes=1)	0.991		0.095	1.000		0.000	0.991	0.094
Medicare or Medicaid Certified Beds (in hundreds)	1.086		0.586	1.268		0.514	1.088	0.585
Census Medicaid	0.654		0.218	0.705		0.055	0.655	0.217
Census Medicare	0.128		0.143	0.115		0.029	0.128	0.142
Census not Medicaid or Medicare	0.218		0.173	0.180		0.054	0.217	0.172

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 448 facilities
Pioneer=6 facilities

Table C.15. Descriptive Statistics for Michigan in 1996

Variables	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Number of beds (in hundreds)	1.009	0.622	1.627	1.109	1.013	0.626
Type of ownership (For profit=1)	0.335	0.472	0.000	0.000	0.333	0.472
Chain Status (Yes=1)	0.482	0.500	0.333	0.577	0.481	0.500
Located in a Hospital (Yes=1)	0.163	0.370	0.333	0.577	0.164	0.371
Herfindahl Index	0.216	0.189	0.103	0.134	0.215	0.189
Average Wage Rate	10.535	2.301	12.000	1.414	10.545	2.298
RN Hours Per Resident Per Day	0.561	0.531	0.482	0.181	0.561	0.529
LPN Hours Per Resident Per Day	0.671	0.331	0.611	0.499	0.671	0.332
CNA Hours Per Resident Per Day	2.021	1.217	2.395	0.485	2.024	1.213
Total Hours Per Resident Per Day	3.254	1.734	3.488	1.110	3.255	1.730
Occupancy Rate	0.926	0.106	0.980	0.021	0.926	0.106
Number of residents (in hundreds)*	0.931	0.584	1.583	1.078	0.935	0.589
Average Length of Stay (days in hundreds)	3.684	2.313	5.655	2.143	3.697	2.314
Family Group (Yes=1)	0.703	0.457	1.000	0.000	0.705	0.457
Resident Council (Yes=1)	0.987	0.115	1.000	0.000	0.987	0.115
Medicare or Medicaid Certified Beds (in hundreds)	0.997	0.624	1.627	1.109	1.001	0.629
Census Medicaid	0.637	0.179	0.610	0.125	0.636	0.179
Census Medicare	0.087	0.132	0.064	0.025	0.087	0.132
Census not Medicaid or Medicare	0.277	0.142	0.326	0.141	0.277	0.142

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 445 facilities
Pioneer=3 facilities

Table C.16. Descriptive Statistics for Minnesota in 1996

Variables	Non-Pioneer Network Homes Mean	Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	0.965	0.578	1.700	0.707	0.968	0.580
Type of ownership (For profit=1)	0.659	0.474	0.500	0.707	0.659	0.475
Chain Status (Yes=1)	0.478	0.500	0.500	0.707	0.478	0.500
Located in a Hospital (Yes=1)	0.135	0.342	0.000	0.000	0.134	0.341
Herfindahl Index	0.216	0.189	0.103	0.134	0.215	0.189
Average Wage Rate	8.337	2.745	10.000	.	8.342	2.742
RN Hours Per Resident Per Day	0.815	1.362	0.558	0.321	0.814	1.359
LPN Hours Per Resident Per Day	0.920	1.108	0.563	0.062	0.919	1.106
CNA Hours Per Resident Per Day	2.660	2.395	2.106	0.726	2.658	2.391
Total Hours Per Resident Per Day	4.396	4.129	3.226	0.342	4.392	4.122
Occupancy Rate	0.760	0.211	0.907	0.010	0.761	0.211
Number of residents (in hundreds)*	0.716 **	0.449	1.545	0.658	0.719	0.452
Average Length of Stay (days in hundreds)	0.701	0.882	0.670	.	0.701	0.880
Family Group (Yes=1)	0.363	0.481	1.000	0.000	0.366	0.482
Resident Council (Yes=1)	0.867	0.340	1.000	0.000	0.867	0.340
Medicare or Medicaid Certified Beds (in hundreds)	0.877 *	0.524	1.700	0.707	0.880	0.526
Census Medicaid	0.579	0.278	0.556	0.171	0.579	0.277
Census Medicare	0.167	0.295	0.047	0.067	0.167	0.294
Census not Medicaid or Medicare	0.253	0.194	0.397	0.238	0.254	0.194

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 578 facilities
Pioneer=2 facilities

Table C.17. Descriptive Statistics for Missouri in 1996

Variables	Non-Pioneer Network Homes Mean	Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	0.832	0.468	1.300	0.000	0.835	0.468
Type of ownership (For profit=1)	0.704	0.457	0.000	0.000	0.701	0.459
Chain Status (Yes=1)	0.537	0.500	1.000	0.000	0.539	0.500
Located in a Hospital (Yes=1)	0.286	0.453	0.000	0.000	0.284	0.452
Herfindahl Index	0.448	0.284	0.255	.	0.447	0.284
Average Wage Rate	7.849	1.725	.	0.000	7.849	1.725
RN Hours Per Resident Per Day	1.192	3.080	0.201	0.000	1.187	3.073
LPN Hours Per Resident Per Day	1.010	1.087	0.802	0.000	1.009	1.085
CNA Hours Per Resident Per Day	2.394	2.040	2.441	0.000	2.394	2.035
Total Hours Per Resident Per Day	4.596	5.531	3.443	0.000	4.590	5.518
Occupancy Rate	0.896	0.208	1.000	0.000	0.897	0.208
Number of residents (in hundreds)*	0.778	0.472	1.300	0.000	0.781	0.472
Average Length of Stay (days in hundreds)	118.837	95.934	.	0.000	118.837	95.934
Family Group (Yes=1)	0.507	0.501	0.000	0.000	0.505	0.501
Resident Council (Yes=1)	0.887	0.318	1.000	0.000	0.887	0.317
Medicare or Medicaid Certified Beds (in hundreds)	0.813	0.470	1.300	0.000	0.815	0.470
Census Medicaid	0.684	0.342	0.631	0.000	0.684	0.341
Census Medicare	0.187	0.341	0.000	0.000	0.186	0.340
Census not Medicaid or Medicare	0.129	0.189	0.369	0.000	0.130	0.189

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 203 facilities
Pioneer=1 facility

Table C.18. Descriptive Statistics for Mississippi in 1996

Variables	Non-Pioneer Network Homes Mean	Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	0.805	0.489	1.360	0.000	0.811	0.490
Type of ownership (For profit=1)	0.115	0.321	0.000	0.000	0.114	0.319
Chain Status (Yes=1)	0.460	0.501	1.000	0.000	0.466	0.502
Located in a Hospital (Yes=1)	0.241	0.430	0.000	0.000	0.239	0.429
Herfindahl Index	0.536	0.288	0.162	0.000	0.532	0.289
Average Wage Rate	8.278	0.461	9.000	0.000	8.316	0.478
RN Hours Per Resident Per Day	0.643	0.606	0.623	0.000	0.643	0.602
LPN Hours Per Resident Per Day	0.630	0.481	0.250	0.000	0.625	0.480
CNA Hours Per Resident Per Day	2.285	0.528	2.114	0.000	2.283	0.525
Total Hours Per Resident Per Day	3.558	1.182	2.987	0.000	3.552	1.177
Occupancy Rate	0.933	0.097	0.985	0.000	0.934	0.096
Number of residents (in hundreds)*	0.766	0.490	1.340	0.000	0.772	0.491
Average Length of Stay (days in hundreds)	4.517	2.522	4.050	0.000	4.493	2.454
Family Group (Yes=1)	0.241	0.430	1.000	0.000	0.250	0.435
Resident Council (Yes=1)	0.977	0.151	1.000	0.000	0.977	0.150
Medicare or Medicaid Certified Beds (in hundreds)	0.805	0.489	1.360	0.000	0.811	0.490
Census Medicaid	0.545	0.173	0.515	0.000	0.545	0.172
Census Medicare	0.087	0.223	0.007	0.000	0.086	0.222
Census not Medicaid or Medicare	0.368	0.137	0.478	0.000	0.369	0.137

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 87 facilities
Pioneer=1 facility

Table C.19. Descriptive Statistics for North Dakota in 1996

Variables	Non-Pioneer Network Mean	Non-Pioneer Network Standard Deviation	Pioneer Network Mean	Pioneer Network Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	0.982	0.641	1.005	0.785	0.982	0.639
Type of ownership (For profit=1)	0.536	0.502	0.500	0.707	0.535	0.502
Chain Status (Yes=1)	0.476	0.502	0.000	0.000	0.465	0.502
Located in a Hospital (Yes=1)	0.048	0.214	0.000	0.000	0.047	0.212
Herfindahl Index	0.148	0.086	0.135	0.037	0.148	0.085
Average Wage Rate	11.063	1.719	11.000	.	11.061	1.701
RN Hours Per Resident Per Day	0.852	0.583	0.843	0.245	0.851	0.577
LPN Hours Per Resident Per Day	0.513	0.329	0.244	0.234	0.507	0.329
CNA Hours Per Resident Per Day	2.405	1.286	2.357	0.196	2.404	1.271
Total Hours Per Resident Per Day	3.770	1.945	3.444	0.184	3.762	1.922
Occupancy Rate	0.911	0.131	0.963	0.021	0.912	0.130
Number of residents (in hundreds)*	0.898	0.604	0.960	0.735	0.900	0.602
Average Length of Stay (days in hundreds)	1.211	1.470	1.070	.	1.208	1.455
Family Group (Yes=1)	0.369	0.485	0.500	0.707	0.372	0.486
Resident Council (Yes=1)	0.976	0.153	1.000	0.000	0.977	0.152
Medicare or Medicaid Certified Beds (in hundreds)	0.954	0.609	1.005	0.785	0.956	0.607
Census Medicaid	0.645	0.249	0.782	0.083	0.648	0.247
Census Medicare	0.079	0.195	0.010	0.014	0.077	0.193
Census not Medicaid or Medicare	0.276	0.212	0.208	0.069	0.275	0.210

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 84 facilities
Pioneer=2 facilities

Table C.20. Descriptive Statistics for New Hampshire in 1996

Variables	Non-Pioneer Network Homes Mean	Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	0.850	0.554	0.510	0.000	0.846	0.552
Type of ownership (For profit=1)	0.588	0.495	0.000	0.000	0.581	0.496
Chain Status (Yes=1)	0.671	0.473	0.000	0.000	0.663	0.476
Located in a Hospital (Yes=1)	0.188	0.393	0.000	0.000	0.186	0.391
Herfindahl Index	0.350	0.288	1.000	0.000	0.358	0.295
Average Wage Rate	8.577	2.071	.		8.577	2.071
RN Hours Per Resident Per Day	1.410	3.232	0.684	0.000	1.401	3.214
LPN Hours Per Resident Per Day	0.798	1.453	0.798	0.000	0.798	1.444
CNA Hours Per Resident Per Day	2.564	1.790	3.900	0.000	2.580	1.785
Total Hours Per Resident Per Day	4.772	6.245	5.383	0.000	4.779	6.208
Occupancy Rate	0.827	0.203	0.627	0.000	0.825	0.203
Number of residents (in hundreds)*	0.729	0.512	0.320	0.000	0.725	0.511
Average Length of Stay (days in hundreds)	0.909	1.073	.		0.909	1.073
Family Group (Yes=1)	0.553	0.500	1.000	0.000	0.558	0.500
Resident Council (Yes=1)	0.835	0.373	1.000	0.000	0.837	0.371
Medicare or Medicaid Certified Beds (in hundreds)	0.830	0.541	0.510	0.000	0.827	0.539
Census Medicaid	0.606	0.309	0.875	0.000	0.609	0.308
Census Medicare	0.164	0.298	0.000	0.000	0.162	0.297
Census not Medicaid or Medicare	0.230	0.203	0.125	0.000	0.229	0.202

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 85 facilities
Pioneer=1 facility

Table C.21. Descriptive Statistics for New Mexico in 1996

Variables	Non-Pioneer Network Homes Mean	Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	1.748 **	1.207	3.602	1.305	1.762	1.218
Type of ownership (For profit=1)	0.484 *	0.500	0.000	0.000	0.480	0.500
Chain Status (Yes=1)	0.130	0.336	0.000	0.000	0.129	0.335
Located in a Hospital (Yes=1)	0.124	0.329	0.000	0.000	0.123	0.328
Herfindahl Index	0.115	0.134	0.056	0.023	0.115	0.134
Average Wage Rate	12.863	4.816	14.400	4.722	12.877	4.813
RN Hours Per Resident Per Day	0.613	0.800	0.658	0.213	0.614	0.797
LPN Hours Per Resident Per Day	0.648	0.372	0.605	0.163	0.647	0.371
CNA Hours Per Resident Per Day	2.022	0.919	1.997	0.348	2.022	0.916
Total Hours Per Resident Per Day	3.283	1.745	3.260	0.351	3.283	1.739
Occupancy Rate	0.953	0.110	0.973	0.021	0.953	0.110
Number of residents (in hundreds)*	1.671 **	1.180	3.492	1.229	1.685	1.190
Average Length of Stay (days in hundreds)	5.772	11.893	7.476	6.344	5.787	11.852
Family Group (Yes=1)	0.614	0.487	0.800	0.447	0.615	0.487
Resident Council (Yes=1)	0.981 **	0.135	0.800	0.447	0.980	0.140
Medicare or Medicaid Certified Beds (in hundreds)	1.743 **	1.205	3.602	1.305	1.758	1.216
Census Medicaid	0.737	0.174	0.741	0.081	0.737	0.173
Census Medicare	0.101	0.089	0.057	0.039	0.101	0.089
Census not Medicaid or Medicare	0.162	0.163	0.201	0.120	0.163	0.163

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 647 facilities
Pioneer=5 facilities

Table C.22. Descriptive Statistics for New York in 1996

Variables	Non-Pioneer Network Homes Mean	Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	1.185	0.924	1.080	0.000	1.184	0.924
Type of ownership (For profit=1)	0.728	0.445	0.000	0.000	0.727	0.445
Chain Status (Yes=1)	0.481	0.500	0.000	0.000	0.481	0.500
Located in a Hospital (Yes=1)	0.081	0.272	0.000	0.000	0.081	0.272
Herfindahl Index	0.108	0.103	0.130	0.000	0.108	0.103
Average Wage Rate	9.824	3.949	12.000	0.000	9.827	3.947
RN Hours Per Resident Per Day	1.142	2.228	0.468	0.000	1.141	2.227
LPN Hours Per Resident Per Day	0.956	1.163	1.049	0.000	0.956	1.163
CNA Hours Per Resident Per Day	2.443	1.891	2.337	0.000	2.443	1.890
Total Hours Per Resident Per Day	4.541	4.401	3.854	0.000	4.540	4.399
Occupancy Rate	0.769	0.279	0.972	0.000	0.770	0.279
Number of residents (in hundreds)*	0.808	0.538	1.050	0.000	0.808	0.538
Average Length of Stay (days in hundreds)	1.362	1.580	4.930	0.000	1.368	1.585
Family Group (Yes=1)	0.316	0.465	0.000	0.000	0.316	0.465
Resident Council (Yes=1)	0.950	0.218	1.000	0.000	0.950	0.218
Medicare or Medicaid Certified Beds (in hundreds)	0.903	0.567	1.000	0.000	0.903	0.567
Census Medicaid	0.625	0.284	0.686	0.000	0.625	0.284
Census Medicare	0.136	0.256	0.067	0.000	0.136	0.256
Census not Medicaid or Medicare	0.239	0.213	0.248	0.000	0.239	0.213

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 1041 facilities
Pioneer=1 facility

Table C.23. Descriptive Statistics for Ohio in 1996

Variables	Non-Pioneer Network Homes Mean	Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	0.843 **	0.381	1.500	0.545	0.855	0.392
Type of ownership (For profit=1)	0.750	0.434	0.667	0.577	0.748	0.435
Chain Status (Yes=1)	0.606 *	0.490	0.000	0.000	0.595	0.492
Located in a Hospital (Yes=1)	0.094	0.292	0.000	0.000	0.092	0.290
Herfindahl Index	0.223	0.252	0.180	0.081	0.222	0.250
Average Wage Rate	9.710	1.325	8.667	2.309	9.682	1.354
RN Hours Per Resident Per Day	0.834	0.671	0.537	0.036	0.829	0.666
LPN Hours Per Resident Per Day	0.412	0.303	0.309	0.138	0.410	0.301
CNA Hours Per Resident Per Day	2.492	0.886	2.739	0.471	2.496	0.880
Total Hours Per Resident Per Day	3.738	1.466	3.585	0.324	3.735	1.453
Occupancy Rate	0.807 *	0.138	0.974	0.023	0.810	0.139
Number of residents (in hundreds)*	0.681 **	0.335	1.460	0.536	0.695	0.353
Average Length of Stay (days in hundreds)	0.546	0.711	0.237	0.035	0.538	0.703
Family Group (Yes=1)	0.438	0.498	1.000	0.000	0.448	0.499
Resident Council (Yes=1)	0.925	0.264	1.000	0.000	0.926	0.262
Medicare or Medicaid Certified Beds (in hundreds)	0.831 **	0.388	1.473	0.546	0.843	0.399
Census Medicaid	0.604	0.237	0.602	0.092	0.604	0.235
Census Medicare	0.089	0.160	0.076	0.024	0.088	0.158
Census not Medicaid or Medicare	0.307	0.191	0.322	0.068	0.308	0.189

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 160 facilities
Pioneer=3 facilities

Table C.24. Descriptive Statistics for Oregon in 1996

Variables	Non-Pioneer Network Homes Mean		Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean		Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	1.210		1.004	1.142		0.645	1.209	1.002
Type of ownership (For profit=1)	0.422	*	0.494	0.000		0.000	0.419	0.494
Chain Status (Yes=1)	0.428		0.495	0.333		0.516	0.428	0.495
Located in a Hospital (Yes=1)	0.157		0.364	0.000		0.000	0.156	0.363
Herfindahl Index	0.118		0.128	0.119		0.103	0.118	0.128
Average Wage Rate	10.311		3.067	10.750		2.062	10.314	3.060
RN Hours Per Resident Per Day	1.625		3.393	2.112		3.308	1.628	3.391
LPN Hours Per Resident Per Day	0.966		1.621	0.517		0.280	0.963	1.616
CNA Hours Per Resident Per Day	2.514	*	2.170	4.446		5.240	2.529	2.208
Total Hours Per Resident Per Day	5.106		6.437	7.075		8.287	5.121	6.448
Occupancy Rate	0.853		0.212	0.714		0.342	0.852	0.214
Number of residents (in hundreds)*	1.088		0.971	0.843		0.739	1.087	0.969
Average Length of Stay (days in hundreds)	2.732		3.299	1.160		1.138	2.719	3.290
Family Group (Yes=1)	0.383		0.486	0.667		0.516	0.385	0.487
Resident Council (Yes=1)	0.896		0.305	0.833		0.408	0.896	0.306
Medicare or Medicaid Certified Beds (in hundreds)	1.197		1.004	1.142		0.645	1.197	1.001
Census Medicaid	0.497		0.309	0.447		0.324	0.496	0.309
Census Medicare	0.173		0.266	0.124		0.113	0.173	0.266
Census not Medicaid or Medicare	0.330		0.268	0.429		0.286	0.331	0.268

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 789 facilities
Pioneer=6 facilities

Table C.25. Descriptive Statistics for Pennsylvania in 1996

Variables	Non-Pioneer Network Homes Mean		Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean		Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	1.026		0.628	0.560		0.057	1.016	0.625
Type of ownership (For profit=1)	0.753		0.434	1.000		0.000	0.758	0.431
Chain Status (Yes=1)	0.103		0.306	0.500		0.707	0.111	0.316
Located in a Hospital (Yes=1)	0.031		0.174	0.000		0.000	0.030	0.172
Herfindahl Index	0.064		0.063	0.102		0.000	0.065	0.063
Average Wage Rate	10.862		1.263	10.000	.		10.847	1.257
RN Hours Per Resident Per Day	1.117	**	2.399	6.075		7.979	1.217	2.604
LPN Hours Per Resident Per Day	0.362		0.446	0.064		0.090	0.356	0.443
CNA Hours Per Resident Per Day	2.289	**	2.221	7.024		8.381	2.384	2.449
Total Hours Per Resident Per Day	3.768	**	4.514	13.162		16.270	3.958	4.942
Occupancy Rate	0.911	**	0.158	0.515		0.658	0.903	0.179
Number of residents (in hundreds)*	0.953		0.611	0.270		0.339	0.939	0.613
Average Length of Stay (days in hundreds)	1.502		1.142	0.150	.		1.479	1.146
Family Group (Yes=1)	0.278		0.451	0.500		0.707	0.283	0.453
Resident Council (Yes=1)	0.907		0.292	0.500		0.707	0.899	0.303
Medicare or Medicaid Certified Beds (in hundreds)	1.017		0.630	0.455		0.092	1.006	0.629
Census Medicaid	0.717	*	0.200	0.392		0.555	0.710	0.211
Census Medicare	0.096		0.158	0.020		0.028	0.095	0.157
Census not Medicaid or Medicare	0.187	**	0.143	0.588		0.582	0.195	0.163

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 97 facilities
Pioneer=2 facilities

Table C.26. Descriptive Statistics for Rhode Island in 1996

Variables	Non-Pioneer Network Homes Mean	Standard Deviation	Pioneer Network Homes Mean	Standard Deviation	Total Mean	Standard Deviation
Number of beds (in hundreds)	0.992	0.639	1.320	0.440	0.998	0.636
Type of ownership (For profit=1)	0.741 **	0.439	0.000	0.000	0.728	0.446
Chain Status (Yes=1)	0.635 *	0.483	0.000	0.000	0.624	0.486
Located in a Hospital (Yes=1)	0.135	0.343	0.000	0.000	0.133	0.341
Herfindahl Index	0.303	0.248	0.172	0.058	0.301	0.247
Average Wage Rate	8.653	1.969	9.000 .		8.656	1.961
RN Hours Per Resident Per Day	1.182	2.759	0.433	0.198	1.169	2.737
LPN Hours Per Resident Per Day	1.153	1.501	1.070	0.433	1.152	1.489
CNA Hours Per Resident Per Day	2.847	2.248	2.078	0.584	2.834	2.232
Total Hours Per Resident Per Day	5.182	5.810	3.581	0.822	5.155	5.764
Occupancy Rate	0.846	0.239	0.883	0.140	0.847	0.237
Number of residents (in hundreds)*	0.873	0.598	1.137	0.284	0.878	0.595
Average Length of Stay (days in hundreds)	2.311	2.645	0.290 .		2.294	2.640
Family Group (Yes=1)	0.565	0.497	0.333	0.577	0.561	0.498
Resident Council (Yes=1)	0.900	0.301	1.000	0.000	0.902	0.299
Medicare or Medicaid Certified Beds (in hundreds)	0.930	0.621	1.173	0.254	0.935	0.617
Census Medicaid	0.627	0.304	0.787	0.159	0.629	0.303
Census Medicare	0.204	0.284	0.088	0.067	0.202	0.282
Census not Medicaid or Medicare	0.169	0.191	0.125	0.096	0.169	0.190

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 170 facilities
Pioneer=3 facilities

Table C.27. Descriptive Statistics for South Carolina in 1996

Variables	Non-Pioneer Network Mean	Standard Deviation	Pioneer Network Mean	Standard Deviation	Total Mean	Standard Deviation
Number of beds (in hundreds)	0.726	0.331	0.810	0.000	0.726	0.330
Type of ownership (For profit=1)	0.345	0.477	0.000	0.000	0.342	0.476
Chain Status (Yes=1)	0.552	0.499	0.000	0.000	0.547	0.500
Located in a Hospital (Yes=1)	0.172	0.379	0.000	0.000	0.171	0.378
Herfindahl Index	0.471	0.300	0.338	0.000	0.470	0.298
Average Wage Rate	8.631	2.613	8.000	0.000	8.621	2.594
RN Hours Per Resident Per Day	0.690	0.371	0.843	0.000	0.692	0.370
LPN Hours Per Resident Per Day	0.318	0.186	0.100	0.000	0.316	0.186
CNA Hours Per Resident Per Day	2.008	0.507	1.737	0.000	2.005	0.505
Total Hours Per Resident Per Day	3.016	0.621	2.680	0.000	3.013	0.619
Occupancy Rate	0.935	0.061	0.988	0.000	0.936	0.061
Number of residents (in hundreds)*	0.679	0.314	0.800	0.000	0.680	0.312
Average Length of Stay (days in hundreds)	3.350	3.425	3.220	0.000	3.348	3.398
Family Group (Yes=1)	0.560	0.498	0.000	0.000	0.556	0.499
Resident Council (Yes=1)	0.983	0.131	1.000	0.000	0.983	0.130
Medicare or Medicaid Certified Beds (in hundreds)	0.725	0.331	0.810	0.000	0.726	0.330
Census Medicaid	0.588	0.129	0.338	0.000	0.586	0.131
Census Medicare	0.049	0.066	0.013	0.000	0.049	0.066
Census not Medicaid or Medicare	0.363	0.131	0.650	0.000	0.365	0.133

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 116 facilities
Pioneer=1 facility

Table C.28. Descriptive Statistics for South Dakota in 1996

Variables	Non-Pioneer Network Homes Mean	Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	0.964	0.522	0.590	0.000	0.963	0.522
Type of ownership (For profit=1)	0.823	0.382	1.000	0.000	0.823	0.381
Chain Status (Yes=1)	0.698	0.459	1.000	0.000	0.699	0.459
Located in a Hospital (Yes=1)	0.143	0.350	0.000	0.000	0.143	0.350
Herfindahl Index	0.193	0.226	0.155	0.000	0.193	0.225
Average Wage Rate	8.436	5.019	.	0.000	8.436	5.019
RN Hours Per Resident Per Day	0.981	2.030	0.264	0.000	0.981	2.029
LPN Hours Per Resident Per Day	1.063	1.578	0.399	0.000	1.063	1.577
CNA Hours Per Resident Per Day	2.392	2.100	1.356	0.000	2.391	2.099
Total Hours Per Resident Per Day	4.437	4.821	2.019	0.000	4.435	4.820
Occupancy Rate	0.706	0.216	0.932	0.000	0.706	0.216
Number of residents (in hundreds)*	0.684	0.422	0.550	0.000	0.684	0.422
Average Length of Stay (days in hundreds)	1.257	2.269	.	0.000	1.257	2.269
Family Group (Yes=1)	0.426	0.495	1.000	0.000	0.426	0.495
Resident Council (Yes=1)	0.847	0.360	1.000	0.000	0.847	0.360
Medicare or Medicaid Certified Beds (in hundreds)	0.886	0.490	0.590	0.000	0.886	0.490
Census Medicaid	0.637	0.314	0.673	0.000	0.637	0.313
Census Medicare	0.194	0.333	0.000	0.000	0.194	0.333
Census not Medicaid or Medicare	0.169	0.164	0.327	0.000	0.169	0.164

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 1353 facilities
Pioneer=1 facility

Table C.29. Descriptive Statistics for Texas in 1996

Variables	Non-Pioneer Network Homes Mean		Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Number of beds (in hundreds)	0.972		0.478	1.370	1.372	0.974	0.484
Type of ownership (For profit=1)	0.693	*	0.462	0.000	0.000	0.688	0.464
Chain Status (Yes=1)	0.643		0.480	0.500	0.707	0.642	0.480
Located in a Hospital (Yes=1)	0.088	*	0.284	0.500	0.707	0.091	0.288
Herfindahl Index	0.147	*	0.201	0.509	0.695	0.149	0.207
Average Wage Rate	10.485		1.553	13.000	.	10.496	1.558
RN Hours Per Resident Per Day	1.077		1.146	0.650	0.089	1.074	1.142
LPN Hours Per Resident Per Day	0.624		0.558	1.354	1.022	0.629	0.563
CNA Hours Per Resident Per Day	2.599		2.023	0.276	0.391	2.583	2.026
Total Hours Per Resident Per Day	4.300		3.045	2.280	0.720	4.286	3.039
Occupancy Rate	0.836		0.155	0.789	0.016	0.836	0.155
Number of residents (in hundreds)*	0.817		0.436	1.070	1.061	0.819	0.440
Average Length of Stay (days in hundreds)	0.755		0.955	0.200	.	0.753	0.953
Family Group (Yes=1)	0.544		0.499	0.000	0.000	0.540	0.499
Resident Council (Yes=1)	0.947		0.224	1.000	0.000	0.947	0.224
Medicare or Medicaid Certified Beds (in hundreds)	0.948		0.488	1.370	1.372	0.951	0.494
Census Medicaid	0.619		0.235	0.467	0.086	0.618	0.235
Census Medicare	0.123		0.180	0.036	0.051	0.122	0.179
Census not Medicaid or Medicare	0.258		0.185	0.497	0.136	0.260	0.186

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 283 facilities
Pioneer=2 facilities

Table C.30. Descriptive Statistics for Washington in 1996

Variables	Non-Pioneer Network Homes		Pioneer Network Homes		Total	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Number of beds (in hundreds)	1.123	0.741	0.970	0.000	1.122	0.740
Type of ownership (For profit=1)	0.478	0.500	0.000	0.000	0.477	0.500
Chain Status (Yes=1)	0.416	0.494	0.000	0.000	0.416	0.493
Located in a Hospital (Yes=1)	0.096	0.295	0.000	0.000	0.096	0.295
Herfindahl Index	0.194	0.164	0.126	0.000	0.194	0.163
Average Wage Rate	10.079	1.804	9.000	0.000	10.075	1.802
RN Hours Per Resident Per Day	0.778	1.017	0.596	0.000	0.777	1.016
LPN Hours Per Resident Per Day	0.472	0.580	0.437	0.000	0.472	0.580
CNA Hours Per Resident Per Day	2.161	0.605	2.451	0.000	2.162	0.605
Total Hours Per Resident Per Day	3.411	1.887	3.483	0.000	3.411	1.885
Occupancy Rate	0.889	0.142	0.959	0.000	0.889	0.142
Number of residents (in hundreds)*	1.005	0.682	0.930	0.000	1.005	0.681
Average Length of Stay (days in hundreds)	2.202	2.217	4.230	0.000	2.209	2.217
Family Group (Yes=1)	0.419	0.494	1.000	0.000	0.420	0.494
Resident Council (Yes=1)	0.947	0.224	1.000	0.000	0.947	0.223
Medicare or Medicaid Certified Beds (in hundreds)	1.123	0.741	0.970	0.000	1.122	0.740
Census Medicaid	0.633	0.208	0.602	0.000	0.633	0.207
Census Medicare	0.097	0.164	0.043	0.000	0.097	0.164
Census not Medicaid or Medicare	0.269	0.160	0.355	0.000	0.270	0.160

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 437 facilities
Pioneer=1 facility

Table C.31. Descriptive Statistics for Wisconsin in 1996

C.02 *Dependence Measure Descriptive Statistics*

Variables	Non-Pioneer Network Homes Mean	Non-Pioneer Network Homes Standard Deviation	Pioneer Network Homes Mean	Pioneer Network Homes Standard Deviation	Total Mean	Total Standard Deviation
Dependence Index (per 100 residents)	31.14	20.11	24.91	16.18	31.08	20.08
Num ber of Health and Life Citations (per 100 residents)	12.49	13.03	8.78	10.86	12.45	13.02

*Statistically significant at the 5% level
**Statistically significant at the 1% level
Non Pioneer = 10368 facilities
Pioneer=100 facilities

Table C.32 Means of Dependence Measures (2003)

APPENDIX D

METHODS

D.01 ***Propensity Score Analysis***

Propensity score analysis is the method of choice to estimate the effect of Pioneer Network participation on profitability and quality outcomes in this dissertation. While there is considerable discussion among scholars regarding whether PSA is in any way a "superior" method to linear regression in the analyses of causal inferences, there is a general "agreement about the desirability of balancing covariate distributions through matching" (Conniffe, Gash & O'Connell, 2000, p. 292). Matching as a choice of methods does provide one possible solution to the "evaluation problem" (Smith, 2003, p.4). However, as additional covariates are added into a model the possibility of a perfect match becomes less feasible. Yet, previous studies have shown that "perfect matching is unnecessary" as propensity score analysis also provides sound results and conclusions (Conniffe, Gash & 'Connell, 2000, p. 288). In fact, "PSA can be seen as providing support for causal inferences in observational studies, support that can be nearly as strong as that of a corresponding true experiment" (Pruzek & Helmreich, 2004, p. 8). Since the propensity score is a function of covariate values, a Pioneer Network home matched with a control home with the same propensity score models a random allocation to control and treatment groups (Conniffe, Gash & O'Connell, 2000, p. 289).[25] This type of model

[25] The nearest neighbor method of propensity score matching will be used to identify the control group of nursing homes (Bryson et al., 2002). The three primary choices of matching methods are nearest neighbor (utilizes the closest propensity score to match between controls and treatment homes), kernel (weights the contribution of each comparison group member) and caliper matching (nearest neighbor but assigns a range over which matching is acceptable) (Bryson, et al, 2002, p. 27). Nearest neighbor is the preliminary matching method chosen for this study. However, previous studies have shown that in large datasets the choice of matching method has little relevance (Bryson et al., 2002, p. 28). Also, performance of different matching estimators varies case-by-case so it is suggested that each method is attempted and assessed by the researcher (Bryson et al, 2002, p. 27). Thus, although nearest neighbor is the preliminary choice of method, the other methods will be attempted to assess estimator performance.

specification is also desirable for difference-in-difference analysis as it is "very analogous to common practice in randomized experiments" (Conniffe, Gash & O'Connell, 2000, p. 292).

If the model in this study could be exactly specified (and the primary concern of this research was to study the interaction of covariates with outcome measures), standard regression would be the best approach for this dissertation (Conniffe, Gash & O'Connell, 2000, p. 291). However, current theories regarding the outcomes of multiple covariates on nursing home quality and profitability are still quite complex and not fully understood. Thus, it is unlikely that past research could provide guidance to exact specification of this model. Therefore, reasons for utilizing the propensity score specification in this type of investigation include:

- PSA maintains covariate distributions across control and treatment homes and does not rely on the correct specification of the functional form (Zanutto, 2004). In terms of covariate distributions, "the consequences of misspecifications on the estimate of the treatment effect are far more serious when the distributions of covariate values differ greatly between groups than when they do not" (Conniffe, Gash & O'Connell, 2000, p. 287). In addition, a regression model does make the assumption that "covariates are linear and do not exhibit increasing or decreasing returns to scale" (Conniffe, Gash & O'Connell, 2000, p. 287). Also, regression assumes that covariates do not interact and "operate identically in the two groups" (Conniffe, Gash & O'Connell, 2000, p. 287). In this study, it is expected that some of the key covariates including type of ownership and chain status will exhibit increasing returns to scale

and will not be linear. In addition, it is also expected that the interaction of covariates will likely result in overall effects on the outcome measures. By matching, the process of working with these covariates is simplified and it seems "plausible to suppose that the difference between the responses of two such matched individuals, one receiving the treatment and the other the control, is the treatment plus the random element" (Conniffe, Gash & O'Connell, 2000, p. 288).

- Testing for balance of covariates is easier than regression and "enables the researcher to easily determine the range over which comparisons can be supported" (Zanutto, 2004, p. 24). Essentially, matching on the propensity score allows that covariates are balanced which is another reason that "multicollinearity is not the difficulty it can be in regression analysis" (Conniffe, Gash & O'Connell, 2000, p. 287). Although ANCOVA could be utilized to test for the distribution of covariates in a regression based analysis, this method relies on assumptions of no existing relationships between treatments and covariates, and ANCOVA is more likely to fail as additional covariates are added to the model (Pruzek & Helmreich, 2004, p. 13). In contrast, PSA eliminates specification of the likely interaction between network participation and covariates included in the model, and PSA is even more robust as additional covariates are added (Pruzek & Helmreich, 2004).
- Finally, PSA is a model that is easier to explain to a non-technical audience (Pruzek & Helmreich, 2004). Since the majority of studies in this area have been qualitative in nature, future presentations of research results are likely to include audiences unfamiliar with quantitative methodology. The idea of matching based on factors that audiences will recognize as affecting the outcomes of profitability and quality will be

simpler for audiences to comprehend. In addition, "The reduction from multidimensional covariates to a uni-dimensional propensity score makes results much easier to interpret and summarize" (Conniffe, Gash & O'Connell, 2000, p. 291). These aspects will allow this research to be presented to audiences with a greater understanding of ultimate conclusions.

Although the reasons for using PSA in this dissertation are compelling, it is also essential to discuss possible weaknesses with this choice of method. Arguably, the principal limitation with PSA is the potential for the "common support problem" which alludes to the detriment of being unable to find a suitable match for the treatment home in the control population (Smith, 2003). Fortunately, in this dissertation, the government datasets contain all of the Medicare certified homes in the country and preliminary analysis indicates that matches are available for treatment homes. Another potential issue for PSA is that it relies on the supposition that all relevant variables that affect outcome measures can be observed and analyzed (Smith, 2003). This assumption is known as the conditional independence assumption (CIA) and requires the researcher to have "rich data on observable characteristics" as well as extensive research findings that explore relevant variables to the outcome measures (Smith, 2003, 11). Again, previous literature has outlined the covariates of interest in this study, and the government datasets provide extensive data for the variables utilized for matching.