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Determinants Of Hospital Affiliation With Health Care Networks

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DETERMINANTS OF HOSPITAL AFFILIATION WITH HEALTH CARE NETWORKS

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ABSTRACT

Since the 1990s, integrated health care delivery systems have proliferated rapidly in the U.S., but little research has been devoted to studying why hospitals decide to join such systems (e.g., health care networks or systems). The aim of this study was to identify environmental and organizational factors that encourage freestanding hospitals to affiliate with health care networks. Specifically, the relationships of hospital affiliation choice to environmental munificence, environmental uncertainty and organizational resources were examined. Additionally, the moderating effects of hospital setting on these relationships were also investigated.

A nonexperimental, longitudinal design was used, with the individual hospital as the unit of analysis. Data for this study were merged from three principle sources: (1) the 1993-1997 American Hospital Association (AHA) Annual Survey of Hospitals; (2) the 1993-1997 Area Resource File (ARF); and (3) the 1993-1997 Online Survey, Certification, and Reporting System (OSCAR). The sample population included 1,129 nongovernment, general acute care, community hospitals that were freestanding hospitals in 1993 and traced from 1993 to 1997.

According to study findings, the proposed model was acceptable, which explained 17.1% of hospital affiliation choice and had 52.2% correct predictions. The number of hospital beds, occupancy rate, community orientation, nursing competition, and health maintenance organization (HMO) penetration rate were demonstrated to be significant

predictors that can successfully separate network-affiliated hospitals from freestanding hospitals. Additionally, hospital setting had moderating effects on the prediction of health care network affiliation through variables of hospital competition and occupancy rate. Unfortunately, few significant factors separated network-affiliated from system-affiliated hospitals in this study.

Generally, hospitals located in counties with moderate levels of environmental munificence were more likely to affiliate with health care networks. Additionally, hospitals with more organizational resources were more likely to join health care networks or systems. Finally, future research could focus on improving the generalizability, applicability, and predictability of the model (e.g., enhancing the sample representativeness, applying the model to other industries and/or countries, and including more valid indicators and data), and on expanding the depth (e.g., exploring the degree and amount of relations) and width (e.g., the impact of structural changes on organizational performance) of the model.

DEDICATION

To my loving and benevolent parents who are the most important persons in my life. You are to whom I owe the most in the world. You always provide me with tremendous supports to pursue my dreams. To my wonderful and loving wife, Yi-Chen Chiu, and my pretty daughter, Tiffany Chang, who are the best and invaluable treasures in my life. You are what make life worth living to me. Your existence and love gave me the great inspiration and motivation to complete this dissertation. I have truly been blessed.

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LIST OF ABBREVIATIONS

AHA	American Hospital Association
ANCOVA	analysis of covariance
ANOVA	analysis of variance
ARF	Area Resource File
BBA	Balanced Budget Act
HHI	Hirschman-Herfindahl index
HMO	health maintenance organization
IOR	interorganizational relationship
MSA	metropolitan statistical area
MVA	missing values analysis
OSCAR	Online Survey, Certification, and Reporting System
RBV	resource-based view
RN	registered nurse

CHAPTER 1

INTRODUCTION

The purpose of this dissertation was to identify the factors that encourage free-standing hospitals to affiliate with health care networks. The study of network partnerships is increasingly important to researchers, practitioners, and policymakers since the late 1980s, because of the rapid proliferation of applying the network concept in the restructuring of organizations in many industries (Sydow & Windeler, 1998). Networks have not only been viewed as the new, distinctive organizational form in the postindustrial era (Grandori, 1997; Miles & Snow, 1986, 1992), but have also been conceptualized to delineate a wide range of interorganizational relationships (IORs) between market and hierarchy (Inkpen & Tsang, 2005; Koza & Lewin, 1999; Powell, 1990; Thorelli, 1986).

In the past 10 years, many studies related to the "networks" concept have been conducted, and several popular organizational models have been developed in the management literature, such as strategic networks (Gulati, 1998; Gulati & Gargiulo, 1999; Gulati, Nohria, & Zaheer, 2000). Similarly, numerous studies explored the popularity of facilities and providers joining together to form health care networks in the 1990s (Burns & Pauly, 2002; Gregg & Moscovice, 2003; Grim, 1986; Robinson & Casalino, 1996; Schumaker, 2002/2003). Based on their developed taxonomy, Bazzoli, Shortell, Dubbs, Chan, and Kralovec (1999) revealed that the numbers of health care networks and their hospital members had grown rapidly during the 1990s; specifically, there were 2,467

hospitals belonging to one of 306 health care networks in 1995. The American Hospital Association (AHA) annual reports also indicated that the number of community hospitals affiliating with health care networks accelerated from 987 in 1994 to 1,492 in 1997.

In this dissertation, relationships among environmental munificence, environmental uncertainty, organizational resources, and affiliation choice were examined for those freestanding hospitals in 1993. It was hypothesized in this dissertation that environmental and organizational factors have great impacts on a hospital's strategic choice of affiliating with health care networks. Through analysis of secondary data, this study will reveal what predictors of those three concepts can significantly influence a hospital's decision of affiliating with a health care network under certain circumstances. The results of this study may help researchers understand the influential determinants of health care networks formation, assist policymakers in supporting intended hospitals to form health care networks, and help health care networks efficiently locate potential hospital partners.

Theoretical Framework

The conceptual framework developed in this dissertation to explain a hospital's strategic choice of affiliating with a health care network integrated multiple organization theories. Multiple theories were used, rather than a single theory, because of the unique features of the relationships among network participants; namely, no one theory could adequately explain all aspects of the formation of interorganizational networks. Beginning with the work of Ulrich and Barney (1984), many researchers have advocated the development of integrated network theories, and the use of multiple theories in exploring

network arrangements is becoming prevalent in the business and health care literature (Luke & Walston, 2003; Osborn & Hagedoorn, 1997).

This study applied three theories to develop the conceptual framework and delineate the strategic behaviors of freestanding hospitals that decided to affiliate with health care networks. The first fundamental theory is resource dependence theory, which is built upon the power-dependence mechanism of social exchange theory (Blau, 1964; Emerson, 1962; Levine & White, 1961). Resource dependence theory (Pfeffer & Salancik, 1978) focuses mainly on the importance of developing useful external relations to maintain stable and certain flows of critical resources (Sofaer & Myrtle, 1991), and then to keep firms, like hospitals, more viable in highly turbulent and competitive environments. However, resource dependence theory explains little about the influence of internal resources on developing cooperative relations among organizations.

The second theory used in the study is the resource-based view (RBV), which emphasizes the significance of developing and possessing valuable resources (e.g., reputation and specialization) in becoming potential cooperative partners (Barney, 1991, 2001). This is very important in explaining why health care networks tend to select certain hospitals as cooperative members, and fits with the idea of value-adding partnerships ("The virtual corporation," 1993; Foreman & Roberts, 1991; Johnston & Lawrence, 1988; Young, Pinakiewicz, McCarthy, Barrett, & Kenagy, 2001). Contrary to resource dependence theory, the RBV asserts that firm resource heterogeneity motivates organizations to cooperate, but says nothing about the effects of environmental forces on the need of inter-firm cooperation.

The third applied theory is transaction cost theory (or transaction cost economics). Although both resource dependence theory and the RBV demonstrate the necessity of developing IORs, they provide no rationale for making a choice between different inter-organizational arrangements (i.e., networks versus systems). In contrast, transaction cost theory is useful specifically in helping hospitals to make an affiliation choice; that is, it is used to explain why hospitals choose to affiliate with health care networks rather than health care systems, and vice versa.

Program of Study

This section lists the questions this study attempted to answer, the hypotheses proposed in the conceptual framework, the sample analyzed in the research, and the definitions of terminologies applied in this study.

Research Questions

To accomplish the purposes of this study, the following specific research questions were addressed:

1. What are the influential environmental and organizational determinants of hospitals' choice of health care network affiliation?

2. Does environmental munificence motivate freestanding hospitals to affiliate with health care networks?

3. Does environmental uncertainty enhance the likelihood of freestanding hospitals to affiliate with health care networks?

4. Do organizational resources make freestanding hospitals more likely to affiliate with health care networks?

5. Does hospital setting have moderating effects on the relationship between a hospital's choice of health care network affiliation and environmental munificence, environmental uncertainty, and organizational resources?

Proposed Hypotheses

This study proposed six groups of hypotheses that were derived from theoretical and empirical considerations (Figure 1). In addition, these proposed hypotheses were expressed with freestanding hospitals as the reference group and while controlling for hospital setting, which was referred to the urban or rural areas where hospitals were located.

H1: There is an overall negative relationship between environmental munificence and the probability of hospital affiliation with health care networks.

H1a: The unemployment rate is positively related to the odds of affiliating with health care networks.
H1b: The number of specialists is positively related to the odds of affiliating with health care networks.
H1c: The percentage of aged population is positively related to the odds of affiliating with health care networks.

H2: There is an overall negative relationship between environmental munificence and the probability of hospital affiliation with health care systems.

H2a: The unemployment rate is positively related to the odds of affiliating with health care systems.
H2b: The number of specialists is positively related to the odds of affiliating with health care systems.
H2c: The percentage of aged population is negatively related to the odds of affiliating with health care systems.

H3: There is an overall positive relationship between environmental uncertainty and the probability of hospital affiliation with health care networks.

H3a: The health maintenance organization (HMO) penetration rate is positively related to the odds of affiliating with health care networks.
H3b: The hospital competition is positively related to the odds of affiliating with health care networks.

H3c: The nursing home competition is negatively related to the odds of affiliating with health care networks.

H4: There is an overall positive relationship between environmental uncertainty and the probability of hospital affiliation with health care systems.

H4a: The HMO penetration rate is positively related to the odds of affiliating with health care systems.
H4b: The hospital competition is positively related to the odds of affiliating with health care systems.
H4c: The nursing home competition is negatively related to the odds of affiliating with health care systems.

H5: There is an overall positive relationship between organizational resources and the probability of hospital affiliation with health care networks.

H5a: The number of hospital beds is positively related to the odds of affiliating with health care networks.
H5b: The number of registered nurses (RNs) per bed is positively related to the odds of affiliating with health care networks.
H5c: The occupancy rate is negatively related to the odds of affiliating with health care networks.
H5d: The level of community orientation is positively related to the odds of affiliating with health care networks.

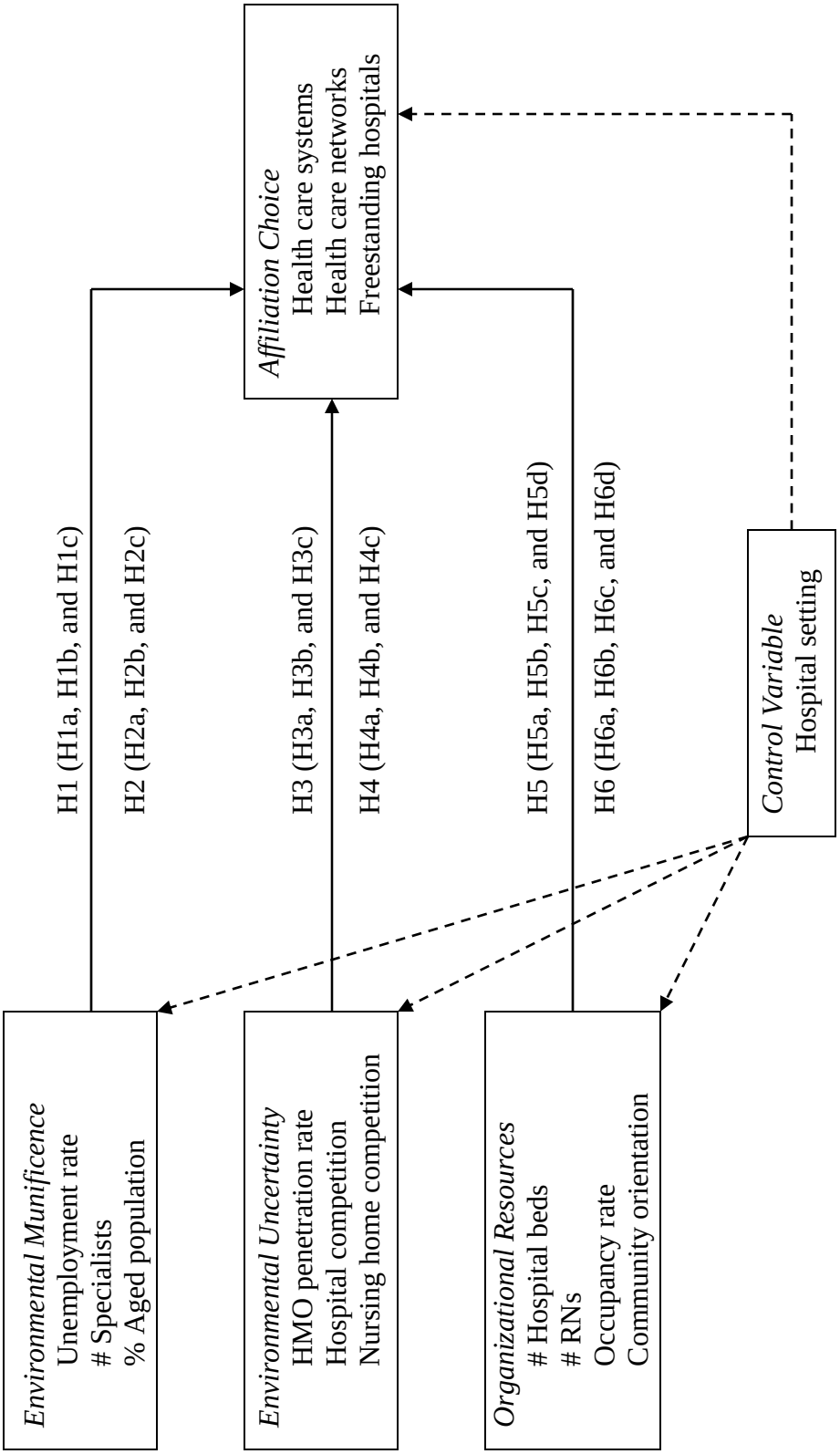
H6: There is an overall positive relationship between organizational resources and the probability of hospital affiliation with health care systems.

H6a: The number of hospital beds is positively related to the odds of affiliating with health care systems.
H6b: The number of RNs per bed is positively related to the odds of affiliating with health care systems.
H6c: The occupancy rate is negatively related to the odds of affiliating with health care systems.
H6d: The level of community orientation is negatively related to the odds of affiliating with health care systems.

Sample Description

Data for this study were merged from three principle sources: the AHA Annual Survey of Hospitals from 1993 to 1997, the 1993-1997 Area Resource File (ARF), and

Figure 1. Conceptual framework



Dr. David Grabowski's nursing home competition index data. Basically, the AHA and ARF datasets provided facility-level data and county-level information, respectively.

The sample for this investigation was composed of nongovernment, general acute care, community hospitals that were reported as freestanding in 1993 and traced from 1993 to 1997. The unit of analysis for this study was the individual hospital, and the hospital's market area was defined as the county in which the hospital was located. Hospitals with missing data in any variable during the study period 1993-1997 were excluded from the final sample. In addition, those freestanding hospitals reported as belonging to both health care systems and networks at the same year were also excluded. The rationales of sample selection were based on the suggestions of previous studies.

Definitions of Terms

Interorganizational relationships. Linkages among organizations vary greatly in certain ways (Reitan, 1998), such as the tightness of linkages, and include three categories of governance structure (from market governance structure with weakest relations, to cooperative governance structure with moderate relations, and to hierarchical governance structures with tightest relations).

Network. A formal cooperative arrangement among voluntarily autonomous organizations with recurring, enduring, and partner-specific exchanges of resources (e.g., capital, personnel, knowledge, and information).

Integrated health care organization. Shortell, Gillies, Anderson, Mitchell, and Morgan (1993) defined an integrated health care organization as "a group of organizations that provides or arranges to provide a coordinated continuum of services to a defined population and is willing to be held clinically and fiscally accountable for the outcomes and the health status of the population served."

Health care system. Through acquisition, merger, and consolidation, a corporate body that may own and/or manage a group of health-related or non-health-related organizations, including freestanding facilities and/or subsidiary corporations (American Hospital Association [AHA], 1997; Bazzoli, Chan, Shortell, & D'Aunno, 2000).

Health care network. An organizational arrangement among a group of health-related providers (including hospitals, physicians, other providers, insurers, and/or community agencies) that coordinate (vertically and/or horizontally) to deliver a broad spectrum of services to their community (AHA, 1997; Moscovice, Wellever, & Christianson, 1997; Zuckerman, Kaluzny, & Ricketts, 2002).

Hospital alliance. AHA (1997) defined a hospital alliance as "a formal organization that works on behalf of its individual members in the provision of services and products and in the promotion of activities and ventures."

Significance of the Study

The significance of this study depends in large part on several expected contributions of this study to the literature and to the practice. First, because there are few empirical studies examining the determinants of health care networks formation, the results of this study can provide important evidence as to why freestanding hospitals want to affiliate with health care networks at the price of their autonomy and why health care networks select certain hospitals to cooperate.

Second, examining health care systems and networks simultaneously in this study can clarify the relative importance of the factors that influence hospitals to develop tightly or loosely coupled relations.

The third important contribution is that the results of this study are more reliable than that of other studies, and this can be attributed to the study design. First, the present study traced those freestanding hospitals in 1993 and looked for changes in the affiliation choice for those hospitals. Therefore, the causal relationship between predictors and hospital affiliation choice could be established more reasonably and logically. In addition, the potential influence of hospital setting was investigated in this study, because the interaction terms were included in the final multinomial logistic regression to detect and understand those possibly moderating effects of hospital setting.

The final contribution is the provision of evidence on the necessity and appropriateness of integrating multiple complementary theories, especially combining resource dependence theory and the RBV, to examine complex IORs.

CHAPTER 2

LITERATURE REVIEW

This chapter reviews the literature on the emergence and formation of interorganizational networks, especially health care networks. The first part introduces the literature studying why inter-firm networks have been adopted by many organizations in various industries since the 1980s, with a focus on the health care industry. The second part reviews the rationale of applying network arrangements among organizations. The third part presents the literature on some important attributes of the formation of health care networks. This chapter concludes with a delineation of the conceptual framework and pertinent hypotheses of health care network affiliation (and health care system affiliation).

Background of the Topic and Problem

In response to great dynamism, hypercompetition, and increasing complexity in external environments, inter-firm networks have been advocated by researchers as better organizational governance forms than traditional forms of hierarchy and free market (Cravens, Piercy, & Shipp, 1996; Cravens, Shipp, & Cravens, 1994; Miles & Snow, 1986; Snow, Miles, & Coleman, 1992). The widening awareness and acceptance of interorganizational networks is demonstrated not only by numerous network-related research conducted over the past two decades, but also by the ubiquitous network arrangements

among corporations and institutions in many industries (Ebers, 1997; Sydow & Windeler, 1998). Similarly, the prevalence of the network paradigm is inevitable in the health care industries of many industrialized countries (Lega, 2005), and many more health care providers, insurers, and agencies have joined together to form health care networks since the 1980s, especially in the 1990s (Bazzoli et al., 1999, 2000).

The following sections focus on the important issues and features related to interorganizational (or inter-firm) networks and integrated health care organizations, especially health care networks.

Interorganizational Networks

Since the 1980s, we have witnessed a remarkable proliferation of a wide variety of cooperative arrangements among organizations around the world. The emergence and increasing importance of such cooperative forms of organization, generally referred to as interorganizational networks, are based on the belief that they are superior to hierarchical and market mechanisms in managing sophisticated transactional and collaborative interdependence among firms, especially when those firms face highly turbulent, complex, and competitive environments (Grandori & Soda, 1995). The paradigm of interorganizational networks has been widely applied in many industries (see examples in Ebers, 1997) and in various forms of cooperation, such as joint ventures, strategic alliances, franchising, outsourcing, consortia, and collaborations (Achrol, 1991; Brass et al., 2004; Cravens et al., 1993; Inkpen & Tsang, 2005). Consequently, a vast amount of research has been conducted in different disciplines to explore why, when, where, and how organizations engage in interorganizational networks (E. R. Alexander, 1995; Alter & Hage, 1993;

Contractor & Lorange, 1988; Cravens et al., 1996; Grandori & Soda, 1995; Gulati & Gargiulo, 1999; Jarillo, 1993; Madhavan, Koka, & Prescott, 1998).

The escalating growth of inter-firm networks can be attributed to several driving forces, including globalization, increasing customer diversity, rapid technology change and transfer, and resource requirements (Achrol, 1991; Cravens et al., 1993, 1994; Snow et al., 1992; Webster, 1992). First, due to technological advances and economic developments around the world, corporations are faced with many more competitors, customers, and potential partners, instead of being limited by domestic boundaries.

Second, both rapid technology changes and various customer sources reinforce the diversity of customer's demands and preferences, which in turn force companies to produce more diverse products and/or services in a short time. As a result, speedy product development and rapid response are crucial to the survival and success of firms, and increase the need for cooperation among organizations.

Third, faced with speedy technological changes and increased skill levels among competitors, it has become less efficient and more risky and impractical for companies to develop an entire technology or product by themselves. Thus, developing core competencies and assembling needed resources among value-adding partners have become more critical for organizations to achieve strategic goals and succeed in current environments.

Fourth, the costs of procuring needed resources, such as new technologies, new markets, and skilled professionals, are becoming more likely to exceed the capacity of a single company, even a large world-class corporation. The reality of the huge costs and risks of resource acquisition, coupled with the benefits of advanced information technology in reducing coordination costs (Ching, Holsapple, & Whinston, 1996; Kraut, Stein-

field, Chan, Butler, & Hoag, 1999; Malone, Yates, & Benjamin, 1987), makes interorganizational networks more attractive to firms and institutions.

Although many studies classify the motives of organizations affiliating with networks in different ways (Ebers, 1997; Glaister & Buckley, 1996; Oliver, 1990), the underlying reasons for forming cooperative networks are to achieve the maximum of efficiency and effectiveness (Cravens et al., 1994). Compared to large, vertically integrated corporations, network participants can achieve the same goals, such as developing new technologies and entering new markets, with lower costs and risks. In addition to the cost reduction (or efficiency) advantage, autonomous network members can respond more quickly than hierarchical and free-market counterparts to rapid and complex environmental changes, including innovative opportunities, changed customer demands, and new market exploitation. Thus, in contrast to hierarchy and market mechanisms, interorganizational networking has the competitive advantages of cost reduction, goal achievement, responsiveness, and flexibility.

One of the most important problems for conducting "inter-firm networking" research is to appropriately define the network paradigm (Nohria & Eccles, 1992). The lack of a precise definition for the "network" concept will not only cause confusion due to a variety of names used to describe it (Ching et al., 1996; Gulati, 1998; Gulati et al., 2000; Jarillo, 1988; Moscovice et al., 1996), but also influence the generalizability and comparability of research findings of interorganizational networks. To date, there are two major competing characterizations of networks. Some researchers define an inter-firm network as an "intermediate" or "hybrid" organizational form with features from both markets and hierarchies (Thorelli, 1986; Williamson, 1991). This broad definition of networks results

in the inclusion of a wide variety of cooperative forms of organization, including joint ventures and strategic alliances. Other researchers contend that a network is a unique organizational arrangement, with its own attributes distinct from features of markets or firms (Powell, 1990).

According to the study of Grandori and Soda (1995) and the above competing definitions, a more pertinent definition of "networks" should be a formal cooperative arrangement among voluntarily autonomous organizations with recurring, enduring, and partner-specific exchanges of resources (e.g., capital, personnel, knowledge, and information). In sum, the features of networks will include voluntary participation, residual autonomy, member selection, enduring exchange, formal agreement, vertical and horizontal integration, partner cospecialization, and full-disclosure information systems (Miles & Snow, 1986).

Integrated Health Care Organizations

As in other industry sectors, health care since the 1980s has been faced with unprecedented turbulence, complexity, and competition, and has experienced a great reconfiguration, especially in the 1990s, among health care providers and related institutes. Many studies have investigated the factors driving such environmental changes (Dowling, 2002; Robinson & Casalino, 1996; Shortell, 1988; Shortell et al., 1993). Three well-known fundamental drivers include: 1) the advances and proliferation of medical and information technology; 2) the increased and changing demands on health services due to an aging population; and 3) changes in reimbursement mechanisms, especially the Medicare prospective payment system and resource-based relative value scale. The most im-

portant drivers are the increasing pressure to contain costs and the prevalence of managed care organizations (Brown, 1996a, 1996b; Burns, Bazzoli, Dynan, & Wholey, 1997; Morrisey, Alexander, Burns, & Johnson, 1996; Shortell, Gillies, & Anderson, 1994; Zinn, Mor, Castle, Intrator, & Brannon, 1999).

Although variant strategies have been developed to cope with rapidly changing environments (Lee & Alexander, 1999), health care practitioners and researchers have recognized integrated health care organizations as superior organizational forms in delivering low-cost, high-quality, and community-based health care (Coffey, Fenner, & Stogis, 1997; Gillies, Shortell, & Young, 1997; Robinson & Casalino, 1996) and as a vital response to rapidly changing and uncertain environments (Fottler, Ford, Roberts, & Ford, 2000; Shortell et al., 1993).

The integrated health care organizations emerging in the 1990s fall into the category of IORs (Longest, 1990) and encompass various arrangements of vertical and horizontal integration among healthcare related providers (Burns & Pauly, 2002; Clement, 1988; Conrad & Hoare, 1994). Although having various names in the literature (Moscovice et al., 1997), integrated health care organizations can be generally defined as "a network of organizations that provides or arranges to provide a coordinated continuum of services to a defined population and is willing to be held clinically and fiscally accountable for the outcomes and the health status of the population served" (Shortell et al., 1993). The increased importance and prevalence of such organizational forms lie in the integral functions of pooling resources and sharing risks to provide a wide range of health services to meet the various needs of their clients.

Therefore, the survival and success of health care organizations depend in large part on the choice of appropriate integrated delivery arrangements to develop and maintain effective interorganizational linkages for managing their organizations' interdependencies (Zuckerman, Kaluzny, & Ricketts, 1995). As the major element of health care providers, U.S. hospitals are faced with the need and pressure to restructure and have been more likely to become members of health care systems or networks since the 1990s (Bazzoli, Chan, Shortell, & D'Aunno, 2000; Bazzoli, Manheim, & Waters, 2003). Health care systems and networks are the most popular and important types of integrated health care organizations, and they are similar in most functions but have the fundamental difference in ownership status.

Health care systems. Mainly evolved from multihospital systems (Lee & Alexander, 1999), health care systems incorporate various healthcare-related institutes and persons under the same organizations with unified ownership, through acquisition, merger, and consolidation (Cuellar & Gertler, 2003). In the 1990s, more and more hospitals became members of or were contractually managed within this prevalent organizational form. The study of Bazzoli et al. (1999) reveals that 3,017 U.S. hospitals belonged to one of 297 health care systems in 1995, and AHA data also shows that U.S. community hospitals affiliating with health care systems increased from 1,956 in 1994 to 2,226 in 1997. Moreover, numerous studies have been conducted to explore the formation, types, and influence of health care systems (Alexander & Morrisey, 1989; Dubbs, Bazzoli, Shortell, & Kralovec, 2004; McCue, 1988; Shortell, Gillies, & Anderson, 2000; Sloan, Ostermann, & Conover, 2003).

The prevalence of health care systems depends on the many advantages that independent hospitals believe that they will gain through affiliating with health care systems. In general, health care systems help member hospitals improve efficiency and productivity via economies of scale, shared services and personnel, and access to capital and management techniques (Ermann & Gabel, 1984; Zuckerman, 1979). As a result, affiliating with health care systems is viewed as a feasible approach to increasing revenues, reducing expenditures, and enhancing financial performance for freestanding hospitals (Bazzoli et al., 2003).

Compared to health care networks, health care systems have several distinct features. The first, and most apparent, is the unified ownership of health care systems; namely, member hospitals relinquish all internal autonomy and control to the system corporation, in exchange for needed resources and other assistance. The second distinct feature is that health care systems, through centralization, tend to have superior managerial effects; therefore, health care systems are more likely to allow poorly performing hospitals to join them, as long as the possibility of improving operations or management exists (Bazzoli et al., 2003).

Health care networks. The increasing importance of health care networks can be shown by several facts. The proliferation of hospitals affiliating with health care networks has been rapid and obvious since the 1990s. First, according to the AHA data, the number of network community hospitals grew over 50% (from 987 to 1,492) during the period 1994-1997. In addition, a study (Bazzoli et al., 1999) indicated that there were 306 health care networks in 1995 that included 2,467 hospitals. Second, the environment be-

came more supportive for collaborative partnerships due to the appearance of many inducements (Gregg & Moscovice, 2003), including more grants, reimbursement, incentives, and favorable regulations. Consequently, many studies have been conducted to evaluate the functions and effectiveness of funded research projects on health care networks. For instance, a series of recently published papers are related to the national demonstration program of community care networks (Alexander et al., 2003; Conrad et al., 2003; Hasnain-Wynia et al., 2003; Sofaer et al., 2003).

Health care networks have been identified by a variety of names (Moscovice et al., 1997) and encompass a number of similar but distinct cooperative arrangements (Wellever, 1996). Health care networks are described by Zuckerman and his colleagues (2002) as "integrative alliances" and defined as "various types of health organizations coming together for purposes largely related to market and strategic position and securing competitive advantages." Bazzoli and her colleagues (1999) define health networks as "those organizations that are strategic alliances or contractual arrangements among hospitals and other health organizations that provide an array of health services." In addition, Moscovice et al. (1996) provided a more comprehensive definition for a health care network:

> A formal organizational arrangement among health care providers (and possibly insurers and social service providers) that uses the resources of more than one existing organization and specifies the objectives and methods by which various collaborative functions will be achieved.

A health care network is defined in this study as "an organizational arrangement among a group of health-related providers (including hospitals, physicians, other providers, insurers, and/or community agencies) that coordinate (vertically and horizontally) to deliver a

broad spectrum of services to their community," and this definition is similar to that of the AHA.

Based on the literature (Moscovice et al., 1997) and this definition, a health care network has the following specific characteristics. The first feature is voluntary participation, which implies that all network members make their own decisions to affiliate with health care networks and are free to exit. The second is diversified ownership, which means that there are two or more owners for a health care network and that each independent network affiliate maintains its residential autonomy and control and is responsible for its own performance. Third, there are various types of organizations in a health care network; namely, a health care network includes at least one hospital and other types of organizations as members. The fourth feature is the enduring and symbiotic relationship (Pointer, Begun, & Luck, 1988) among network members, which indicates that network members are willing to maintain long-term cooperation and help each other achieve strategic goals and competitive advantages through collective efforts. The last one is the selective membership based on the value-adding principle, and it implies that institutions with more resources helpful to other network participants are more likely to affiliate with a health care network.

The significance of conducting this study is based on the lack of empirical research on identifying determinants of hospital affiliation with health care networks, especially as regards hospital setting. Thus far, the health care literature on network partnership can be divided into three categories. The first group explores other cooperative arrangements, rather than real health care networks, such as hospital alliances (Kaluzny & Zuckerman, 1992; McCue, Clement, & Luke, 1999; Zinn, Proenca, & Rosko, 1997;

Zuckerman et al., 1995), coalitions (Johnson, 1993), consortia (Moscovice, Johnson, Finch, Grogan, & Kralewski, 1991) and federations (D'Aunno & Zuckerman, 1987). The second set of studies focus on service-specific networks (Bolland & Wilson, 1994; Dill, 1994; Goldman et al., 1992; Guihan, Manheim, & Hughes, 1995; Iutcovich & Pratt, 2003; McKinney, Morrisey, & Kaluzny, 1993; Provan, Sebastian, & Milward, 1996) or on certain hospital settings, especially rural areas (Casey, 1997; Christianson & Moscovice, 1993; Moscovice, 1997; Moscovice et al., 1996, 1997; Schumaker, 2002/2003). The last group includes mainly descriptive research on exploring the characteristics and formation of health care networks or on classifying health care networks (Bazzoli et al., 1999; Dubbs et al., 2004; Shortell et al., 2000).

Therefore, it is necessary to conduct a more comprehensive study of the reasons for hospital affiliation with health care networks, in order to increase our understanding of why hospitals can and should affiliate with health care networks, and to provide information for practitioners and researchers.

Theoretical Background

An integral principle of strategic management emphasizes the importance of matching an organization's external environmental changes with its internal resources and capabilities. In contrast to market and hierarchy governance mechanisms, health care networks are composed of complex, multidimensional, flexible, integrated relationships among participants for achieving mutually beneficial objectives. Such a collaborative organization form is believed to have a greater ability to cope with both the highly turbulent, uncertain health care environments of the 1990s and the idiosyncratic features (such as

repetition, complexity, and cooperation) that are inherent in providing health services (Banaszak-Holl, Elms, & Grazman, 2003).

Due to the unique characteristics of cooperative networks, none of the traditional organizational theories can fully explain the determinants of organizations' (here hospitals) strategic choice of network affiliation; therefore, it is more appropriate to integrate multiple theories for exploring such network arrangements (Combs, J.G. & Ketchen, D.J., 1999; Gray & Wood, 1991; Ireland, Hitt, & Vaidyanath, 2002; Luke & Walston, 2003; Osborn & Hagedoorn, 1997; Ulrich & Barney, 1984). As a result, the conceptual framework of this dissertation is derived from multiple theories. Specifically, this research is based primarily on both resource dependence theory and RBV, which provide reasons for why freestanding hospitals need to develop IORs (i.e., health care networks and systems). In addition, transaction cost theory is incorporated to provide complementary explanations for how freestanding hospitals make affiliation choices between health care networks and systems.

Resource Dependence Theory

Resource dependence theory is one of the most common approaches to the study of organizations in general (Casciaro & Piskorski, 2005) and interorganizational relations in particular (Sofaer & Myrtle, 1991). This theory is built upon the concepts of social exchange theory, which asserts that resource scarcity fosters the need of specialization and exchanges among cooperative organizations (Emerson, 1962; Levine & White, 1961) and results in organizational interdependence. The central concept of social exchange theory is the power-dependence assertion. It mainly assumes that organizational power is a func-

tion of dependence on resource suppliers (Jacobs, 1974), and that the degree of dependence is based on the importance and necessity of resources for organizational survival, as well as the availability of and control over external resource sources (Aldrich, 1979; Benson, 1975; Blau, 1964; Cook, 1977).

Consequently, the central proposition of resource dependence theory is that organizational survival is contingent on how successfully and efficiently an organization can acquire and maintain critical (both scarce and valued) resources from its external environments (Pfeffer & Salancik, 1978). More specifically, to achieve the fundamental goal of survival, organizations have to manage their environmental demands effectively for reducing uncertainty in the flows of needed resources.

The resource dependence perspective is firmly built on several assumptions (Auster, 1994; Reitan, 1998; Ulrich & Barney, 1984). The first assumption is that no one organization can possess all needed resources by itself, so organizations need to engage in exchange relations with resource suppliers in their task environments (Fennell, Ross, & Warnecke, 1987). Consequently, interorganizational exchanges are necessary to acquire needed resources, both material and sociopolitical, and are critical to organizational success and even survival. Such interdependence is evident in a service context such as health care, because health care organizations are usually dependent on each other to provide complementary services for their clients (Sofaer & Myrtle, 1991).

The second assumption is that the environment of organizations controls critical resources essential to organizational survival (Pfeffer & Salancik, 1978), but the supply of such resources is uncertain for organizations. According to the study of Levine & White (1961), a focal organization needs to depend on other organizations for the pro-

curement of scarce and valued resources, both economic (such as funds, raw materials, and clients) and noneconomic (i.e., information, legitimacy, and political support). To reduce uncertainty in the flows of resource supply, organizations are willing to engage in cooperative activities to develop interdependence with those influential organizations, at the price of reducing some degree of autonomy. These interdependent relationships can be symbiotic, competitive, or a mixture of both (Raak & Paulus, 2001).

The third assumption is that although the external environment constrains the strategic choices for organizations, administrators of organizations tend to manipulate the environment to their own advantage (Fennell et al., 1987; Reitan, 1998). In other words, organizations will actively manage interdependencies both to ensure the stability of acquiring key resources for organizational survival and to maintain their autonomy for allowing adaptation to new contingencies (D'Aunno & Zuckerman, 1987). This assumption contrasts with the population ecology theory that assumes the passive compliance of organizations with demands from their environments. Specifically, resource dependence theory emphasizes the importance of balancing organizational autonomy, degree of interdependence, and stability in resource acquisition.

The most important assumption is that organizations will try to maximize their relative power to other organizations with the purpose of obtaining more control over critical resources. According to social exchange theory, an organization's power is a function of its dependence on other external entities. Therefore, the power maximization implies reducing the focal organization's self-dependence on others and increasing the dependence of others in its environment on itself. Such an assumption and its implications are consistent with the concepts of co-optation proposed by Selznick (1949).

Based on the concept of power maximization, resource dependence theory posits that organizations employ a variety of tactics to achieve two related objectives: 1) to obtain control over resources for minimizing their dependence on other organizations, and 2) to acquire control over resources for maximizing the dependence of other organizations on themselves (Cook, 1977; Pfeffer & Salancik, 1978; Ulrich & Barney, 1984). In response to the first objective, certain tactics focus mainly on developing more interorganizational relations, both to cultivate alternative sources of resource supply and to secure the availability of complementary resources (Casciaro & Piskorski, 2005). On the other hand, organizations will adopt certain strategies, such as interlocking and specialization approaches, both to increase their importance to other organizations and to possess more scarce and valued resources, thereby maximizing the dependence of other organizations on themselves.

The underlying concepts of prevalent integration (both vertical and horizontal) strategies in the health care sector are compatible with the resource dependence perspective. Except for the considerations of transaction cost (such as better management of internal processes and lower costs of exchanges), vertical and horizontal integration can be viewed as strategic responses of organizations to the need of interdependence. Specifically, vertical integration allows organizations to acquire direct control over critical complementary resources, and horizontal integration can increase the relative power of organizations for countervailing threats from buyers in the vertical channel.

In contrast to transaction cost theory, the resource dependence perspective implies that managing the exchanges and relationships with interdependent organizations should be more important to a firm’s survival than pursuing operation and production efficien-

cies. Therefore, organizational restructuring decisions based on resource dependence will be more strategic than based on transaction cost calculation (Luke & Walston, 2003). In addition, the features of vertical and horizontal integration in health care networks indicate the importance of developing external linkages and retaining core functions. As a result, it is suitable to apply resource dependence theory in explaining the prevalence of health care networks.

However, the literature on resource dependence theory focuses mainly on the importance of establishing more external linkages to secure and stabilize needed resources, but pays little attention to the necessity of the focal organization possessing more valuable resources. In addition, resource dependence theory is good at describing why organizations need to engage in interdependent arrangements, but is unable to explain why organizations decide to form network, rather than hierarchy, governance structures. Thus, the inclusion of the RBV and transaction cost theory in this study can resolve these shortcomings and explain more precisely why a freestanding hospital decides to affiliate with health care networks.

Resource-based View

The RBV has become increasingly popular and important in understanding organizational structures and their strategic behaviors (Das & Teng, 2000) since it was proposed by Barney in 1991. Built upon assumptions of firm resource heterogeneity and immobility (Mata, Fuerst, & Barney, 1995; Wernerfelt, 1984), the RBV contends that a firm's competitive advantages depend largely on whether the firm possesses and employs valuable resources to conceive of and implement value-creating strategies (Barney, 1991,

2001). In other words, the RBV focuses on a firm's resources and insists that what a firm possesses determines what it will accomplish. Such an internal emphasis is completely contrary to an external emphasis regarding competitive environment and position that is posited by the majority of prominent organization theories, such as resource dependence theory.

In order to generate sustained competitive advantages, it is necessary to define firm resources and firm strategic resources. Wernerfelt (1984) defines resources as "those tangible and intangible assets which are tied semi-permanently to the firm," but other researchers provide different definitions from various aspects (Becker, 1964; Bharadwai, 2000; Tomer, 1987; Williamson, 1975). For developing the theory, Barney (1991) consolidates all opinions and then defines firm resources as including "all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc., controlled by a firm that enable the firm to conceive of and implement value-creating strategies." However, firm strategic resources imply those resources that have the following four idiosyncratic attributes that enable firms to obtain sustained competitive advantages.

Valuability. Firm resources will be viewed as valuable only when they can be applied to conceive of and implement strategies to exploit opportunities or neutralize threats in a firm's environment (Barney, 1991), which in turn will improve the firm's efficiency, effectiveness, and performance (Combs & Ketchen, 1999). In addition, if firm resources have other attributes (i.e., rareness, inimitability, and nonsubstitutability) but lack the attribute of valuability, they still cannot generate competitive advantages for the firm.

Therefore, being valuable is the most fundamental criterion for firm resources to be considered as strategic resources to produce competitive advantages.

Rareness. The importance of having rare resources lies in the fact that if large numbers of competitors or potential competitors possess the same resources, it is hard for the firm to generate competitive advantages because the benefits of exploiting such resources will be shared by many competing firms. In general, as long as the number of firms possessing a particular valuable resource is less than the number of firms needed to create perfect market competition (Hirshleifer, 1980), that resource can be viewed as a rare resource with the potential of generating competitive advantages (Barney, 1991). However, the function and importance of rareness will be realized only when those valuable, rare resources cannot be easily imitated (Hoopes, Madsen, & Walker, 2003) or substituted (Peteraf & Bergen, 2003); otherwise, the expected competitive advantages of such rare resources can also be generated by the firm's competitors through the means of imitation or substitution.

Imperfect imitability. In order to generate sustained competitive advantages, the third attribute requests firm resources to be imperfectly imitable, which implies that it should be difficult for competitors to either imitate the resources or employ substitutes (Peteraf, 1993) for getting the same competitive advantages. Without the attribute of inimitability, those resources, even if they are valuable and rare, cannot let the firm enjoy competitive advantages for a long time, because such competitive advantages will quickly be shared by other competitors by means of imitation or substitution. As a result,

being imperfectly imitable is critical to ensure rare and valuable firm resources to be a source of sustained competitive advantages (Barney, 1986b; Lippman & Rumelt, 1982).

Firm resources with imperfect imitability can be attributed to one or a combination of three reasons (Barney, 1991), including unique historical conditions, causal ambiguity, and social complexity. Unique historical conditions assert that the ability of the firm to acquire and exploit certain resources depends largely on a firm's place in time and space. Thus, if the unique time in history passes, it is impossible for other competing firms to obtain such time- and space-dependent resources.

Causal ambiguity indicates that the relationship between the resources controlled by a firm and a firm's competitive advantages is not understood or is imperfectly understood (Mancke, 1974; Reed & DeFillippi, 1990). Consequently, it is difficult for competitors to identify which resources generate such competitive advantages, and this in turn makes the imitation of those resources very costly or even impossible. Because the relationship between firm resources and competitive advantages is so complex, it is not implausible for the firm and its competitors to have an incomplete understanding of the relationship and underlying mechanisms.

Social complexity implies that if the competitive advantages depend in large part on the firm's complex social phenomena, the ability of other firms to imitate such resources is significantly constrained (Barney, 1991). This is because the complex social phenomena of firm resources are beyond systematic management and influence (Dierickx & Cool, 1989), so it is very difficult for the firm's competitors to imitate such social complex resources even if they possess the other similar resources as the firm. Accordingly, there is a wide variety of firm resources that could be socially complex, such as

managers' interpersonal relations (Hambrick, 1987) and a firm's culture (Barney, 1986a) and reputation (Klein & Leffler, 1981; Porter, 1980).

Imperfect substitutability. To be a source of sustained competitive advantages, firm resources need to have the attribute of imperfect substitutablility (Barney, 1991); namely, there must be no strategically equivalent valuable resources that are neither rare nor imitable. If two bundles of valuable firm resources are strategically equivalent, they are believed to allow different firms to conceive and implement the same strategies, and generate the same competitive advantages. Therefore, if there are enough firms that either possess (due to not rare) or can acquire (via imitation) these valuable substitute resources, none of these firms can expect to have sustained competitive advantages. In general, substitutability can come either from similar resources or very different resources.

The application of the RBV in the study of organizational governance structures is mainly based on assumptions of resource heterogeneity and immobility. Resource heterogeneity not only indicates the importance of possessing valuable, scarce, inimitable, and unsubstitutable resources for firms to obtain sustained competitive position and advantages (Barney, 1991, 2001; Peteraf, 1993), but also implies that the firm must access those valuable resources from other firms for maximizing the value of its own resources (Das & Teng, 2000). Resource immobility posits that some resources are difficult to be obtained from other organizations or are not tradable in the markets. Consequently, from the RBV perspective, Eisenhardt & Schoonhoven (1996) posits that it is necessary for firms to develop IORs (i.e., hierarchical systems and cooperative networks) to maximize

resource value, because firms are either in vulnerable strategic positions or with strong social opportunities.

The RBV postulates that adequate resource integration is the key to value maximization and even viability for organizations. The concept of resource integration means that firms had better identify and enhance their own valuable resources (Combs & Ketchen, 1999; Espino-Rodriguez & Padron-Robaina, 2006), then pool and use complementary resources to realize value maximization for all firms (Das & Teng, 2000). This implies that efficient integration and management of complementary resources (Barney, Wright, & Ketchen, 2001) can create greater synergy, via economies of scope (Ireland et al., 2002), for organizations in generating sustainable competitive advantage, enhancing organizational learning, and developing new capabilities and skills (Harrison, Hitt, Hoskisson, & Ireland, 2001). Such resource complementarity is viewed as an important criteria in partner selection (Gulati et al., 2000), especially in forming cooperative governance structures (Hitt, Levitas, Arregle, & Borza, 2000).

In addition, the RBV indicates two conditions under which firms prefer cooperative governance structures (e.g., networks or strategic alliances) over hierarchical governance structures (e.g., systems or mergers/acquisitions) according to different rationales (Das & Teng, 2000). From the perspective of obtaining resources, cooperative governance structures are preferred when the target firms' valuable resources are mixed with many unwanted resources that cause too great a loss for the acquiring firms. This is similar to the concept of asset specificity in transaction cost theory. From the perspective of retaining resources, cooperative governance structures are preferred only when the discounted present value of firm resources devoted in cooperation is higher than the realized

value of selling those resources in the present. This is based on the concept of opportunity cost.

According to the RBV, organizations with more valuable internal resources will become more visible and powerful, because of the increased dependence on them of other organizations. However, the literature on the RBV mainly emphasizes the significant function of internal resources, with little attention to external environmental effects on organizational structures. Therefore, the RBV is a suitable complement to the resource dependence theory in more thoroughly explaining organizational restructuring. Similarly, the RBV provides criteria for the selection of organizational governance structures, but it only mentions the analysis of internal asset costs. As a result, it is necessary to include transaction cost theory in the conceptual framework in order to explain more adequately how a firm makes the affiliation choice between cooperative and hierarchical structures (i.e., health care networks versus health care systems).

Transaction Cost Theory

Transaction cost theory, or transaction cost economics, has become one of the predominant theories in explaining the choice of organizational governance structures. The central argument of transaction cost theory is to match governance mechanisms with characteristics of transactions and environments for organizations with the criteria of minimizing the sum of production and transaction costs of exchanges (Kogut, 1988; Ulrich & Barney, 1984). Based on the assertions of Coase (1937), Williamson (1975, 1981) proposes an organizational failures framework that indicates bounded rationality, opportunism, environmental uncertainty/complexity, and small-numbers bargaining as major

factors of market failure (Johanson & Mattsson, 1987). Market failure implies the rise of transaction costs, which in turn motivates organizations to develop nonmarket governance structures for obtaining those needed resources more efficiently (Reitan, 1998). In general, undertaking any kind of exchanges will generate transaction costs, which include ex-ante costs of searching, negotiation, and monitoring, as well as ex-post costs of administration and compromise (Garcia-Canal, 1996; Luke & Walston, 2003).

Due to the rapid proliferation of cooperative governance structures in the past two decades, transaction cost theory has been refined and extended to explain three categories of governance structures, including market, relational (or cooperative), and hierarchical governance (Geyskens et al., 2006). However, the criteria employed to evaluate incurred transaction costs do not change; namely, the criteria are three dimensions of transaction costs, including asset specificity, uncertainty, and transaction frequency (David & Han, 2004).

Asset specificity. Asset specificity refers to the degree to which transaction assets can be redeployed to alternative purposes or by alternative users without sacrificing productive value. The increase in asset specificity will reduce the likelihood of redeploying those transaction assets for other purposes, which in turn will increase mutual dependence and contracting hazards between partners (David & Han, 2004). If the contracting partners take opportunistic behaviors, the firm with investments in specific assets faces a great risk of forgoing the expected value of its specific assets (Combs & Ketchen, 1999). Namely, the transaction costs will increase with the rise in degree of asset specificity.

Based on the transaction cost theory, market, relational, and hierarchical governance structures are preferred when transaction costs are expected to be at low, medium, and high level, respectively (Das & Teng, 2000). With the presence of asset specificity, a firm confronts the problem of preventing opportunistic behaviors by its partners (Geyskens et al., 2006), which is related to the choice of governance structure. Because the internalization mechanism has the strongest control on resource allocation, authority organizations can avoid the costs of opportunism most effectively. Consequently, market structure is preferred for transactions with low asset specificity, cooperative governance structure is good for those with intermediate asset specificity, and hierarchical governance structure is desired for those with high asset specificity.

Uncertainty. Uncertainty refers to the inability to accurately predict the relevant contingencies surrounding an exchange (i.e., demand, supply, and technology requirements) and/or the behaviors for an exchange. When firms cannot accurately forecast environmental conditions and behaviors pertaining to the exchange, they experience increases in production and transaction costs. Although empirical studies show slight differences in the relationship between transaction costs and various dimensions of uncertainty (Geyskens et al., 2006), especially as regards technology uncertainty, increases in uncertainty generally result in the rise of transaction costs for organizations.

David and Han (2004) assert that the effects of uncertainty on the choice of governance structures are contingent on the degree of asset specificity. At a low level of asset specificity, market structure is the first choice, no matter the degree of uncertainty. The uncertainty will influence the choice of governance structures only when the asset speci-

ficity causes nontrivial costs. Theoretically, hierarchical organizations have better capability in coordinating production streams efficiently than do cooperative organizations and market structures. Therefore, hierarchical, cooperative, and market governance structures will be preferred when the uncertainty of transactions is at high, medium, and low levels, respectively.

Transaction frequency. Transaction frequency means the extent to which transactions recur (Geyskens et al., 2006). The increase in transaction frequency will raise the accumulation of transaction costs for those recurred exchanges. When the overhead cost of making such recurred exchanges in a hierarchical structure are lower than the accumulated transaction costs, firms will prefer the hierarchical governance structure to make the recurred exchange internally (Williamson, 1981). Although little empirical research has been conducted to detect the effects of transaction frequency, it is believed that market structure is chosen when transactions rarely recur, and hierarchical governance structure is preferred when the transaction frequency is at a high level.

The importance of transaction cost theory lies in its ability to address a core issue inherent in the study of IORs; that is, the choice of “make or buy” decisions. Specifically, the analysis of transaction costs of exchanges is crucial in deciding whether an organization acquires needed resources by “making” them through vertical integration strategies, or whether it procures essential resources by “buying” them via free markets or the development of cooperative arrangements. As a result, it is suitable to include transaction cost theory in the study of choosing interorganizational arrangements (i.e., networks ver-

sus systems), and this assertion is supported by some studies (Sriram, Krapfel, & Spekman, 1992; Ulrich & Barney, 1984).

The application of transaction cost theory in this study focuses mainly on explaining the influence of market competition on a hospital's choice of loose or tight cooperation. As environmental uncertainty (i.e., market competition) increases, organizations have to spend more on inspecting and assuring exchanges. Consequently, firms will be more likely to develop tight IORs (i.e., health care systems) in the face of increased competition and uncertainty (Mick & Conrad, 1988). The inference can be demonstrated by the findings of Dansky, Milliron, and Gamm (1996) that reveal the preference of hospitals to own home health agencies in competitive urban areas, but to form cooperation in rural markets. Moreover, the prevalence of applying transaction cost theory in examining IORs in the 1990s is also related to the rapidly growing complexity and competition in health care environments (Luke & Walston, 2003; Robinson, 2001; Robinson & Casalino, 1996; Stiles, Mick, & Wise, 2001).

Conceptual Framework and Hypotheses Development

In addition to the rationale provided by these theories, the development of the conceptual framework and hypotheses in this study is built upon several assumptions. The first, and fundamental, assumption is that hospitals are similar to other organizations, with the tendency to remain independent and self-sufficient, all things being equal. Although the formation and type of the affiliation of a hospital with other organizations will largely depend on both the extent of its perceived environmental threats on vital resources and its ability to cope with those threats (Bazzoli et al., 1997), the high priority of

keeping control and autonomy (Cook et al., 1983) needs to be taken into account when a hospital makes its affiliation choice. Specifically, hospitals are more likely to develop loose IORs (i.e., health care networks) when faced with favorable environments and abundant internal resources, and will form tight IORs (i.e., health care systems) only when environments are unfavorable and internal resources are deficient (Zinn et al., 1997).

The second assumption is the bilateral selection process during the affiliation with health care networks or systems. In other words, not only do hospitals make the choice of affiliation strategies on the basis of the need to change and the perceived benefits from system or network affiliation, but the decision of a system or network to include a new affiliate is related to what benefits the prospective hospital will bring, referred to as the value-adding or value-based partnership (Foreman & Roberts, 1991; Young et al. 2001). This can be implicitly demonstrated by the existing selective membership criteria in practical health care networks (Moscovice et al., 1997). Consequently, except for physical resources, intangible resources (e.g., managerial capability and social relations) also have influential effects on the affiliation decision process.

The last assumption is based on the findings of Dess and Beard (1984), who suggest that an organization's task environments should be evaluated from three important dimensions -- environmental munificence, dynamism, and complexity -- because they represent various environmental challenges and have different impacts on an organization. Environmental dynamism can be referred to as those unpredictable environmental changes that may heighten uncertainty for organizations within an environment (Dess & Beard, 1984; Emery & Trist, 1965), and environmental complexity reflects the number

and types of potential competitors in the local market. However, Begun & Kaissi (2004) postulate that environmental dynamism and complexity eventually combine to produce uncertainty, which creates challenges to management and is one important factor of transaction costs. It is thus reasonable to use environmental uncertainty to represent both environmental dynamism and complexity.

This study's conceptual framework (Figure 1) encompasses three dimensions for predicting a hospital's affiliation choice, and the rationale of developing the three-dimension affiliation model is based on three employed theories. In addition, the selection of variables used to represent those three constructs is in accordance with previous research (Alexander & Morrisey, 1989; Bazzoli et al., 2003; Succi, Lee, & Alexander, 1997; Trinh & O'Connor, 2002; Zinn et al., 1997) and is based on the availability of data.

Effects of Environmental Munificence

Environmental munificence refers to the economic resource level or capacity of the environment to sustain the needs of organizations (e.g., income level, economic strength, and expenditures on health and hospitals). From the resource dependence perspective, organizations will engage in forming IORs to acquire and secure stable flows of vital resources, when the supply of needed resources becomes insufficient and uncertain. In other words, organizations (here hospitals) that operate in markets with munificent resources have less or no need to develop external cooperation linkages for survival, because they can remain self-sufficient and autonomous. Many studies have demonstrated the negative relationship between environmental munificence and the need for IORs

(Alexander & Morrisey, 1989; Boyd, 1990; Gamm, Kassab, Brannon, & Fennell, 1996; Mick et al., 1993; Provan et al., 1996; Schermerhorn, 1975; Sofaer & Myrtle, 1991).

In general, important environmental resources include a variety of economic (e.g., funds and clients) and noneconomic (e.g., information, personnel, and legitimacy) resources, and they have different effects on an organization's survival and/or ways of cooperation. For hospitals, the important influential environmental resources can be divided into three groups, referred to as enabling, referral, and demand factors, and are discussed in the following sections.

The enabling factors represent the availability of economic resources and the potential purchasing power in local markets. There are two variables that are widely used in the health care literature to represent such economic capacity. One is per capita income, which indicates the amount of economic resources available for organizations in markets, and the other is the unemployment rate, which implies the availability of health insurance in counties. Many previous studies have proven the negative relationship between per capita income and the tightness of interorganizational relationships (Alexander & Morrisey, 1989; Succi et al., 1997; Zinn et al., 1997); however, per capita income cannot show whether a person has health insurance that is usually job-based and is a direct indicator of health care use. Consequently, the unemployment rate is believed to be a more appropriate enabling factor than per capita income.

The unemployment rate implies the affordability of health services and can be viewed as an indicator of potential health care use in a county. Because health services are very expensive in the U.S., people without health insurance are less likely to be able to afford health services and tend to use fewer services than insured persons. In the U.S.,

job offers often include health insurance benefits; therefore, increases in the unemployment rate indicate that more people will become uninsured and, as a result, hospitals will face decreased health care use and revenues (Rosko, 1999). Moreover, uninsured people tend to produce more uncompensated health care use for hospitals (Rosko, 2001). Hospitals in counties with higher unemployment rates suffer more financial pressures, which increase the hospital's need to develop inter-firm cooperation.

Zinn et al. (1997) posit that organizations in favorable environments (i.e., high munificence, and low dynamism and complexity) tend to form loose cooperative structures (e.g., alliances and networks), but they will develop tight cooperative structures in unfavorable environments. Compared with perfect environments, increases in unemployment rate force hospitals to seek loose cooperation. When the unemployment rate rises to high levels, hospitals are more likely to be in tightly linked organizations in order to obtain greater control (Alexander & Morrisey, 1988, 1989; Bazzoli et al., 2003; Burns, Bazzoli, Dynan, & Wholey, 2000). Accordingly, hospitals in counties with intermediate levels of unemployment rate are more likely to affiliate with health care networks.

> *H1a: The unemployment rate is positively related to the odds of affiliating with health care networks.*
> *H2a: The unemployment rate is positively related to the odds of affiliating with health care systems.*

The referral factors indicate the amount of potential patient referrals to hospitals. From the resource dependence perspective, hospitals with more referral sources have a greater ability to ensure sufficient and stable patient flows, and are more likely to remain independent or join loosely linked organizations. Alternatively, decreases in referral sources will promote hospitals to seek stronger control over referral sources, through tighter external relations, in order to secure patient flows and avoid high transaction costs.

However, technological advances have changed the relationship between referral sources and organizational governance structures, especially for specialty physicians.

For hospitals, the role of specialist physician has changed from resource provider to competitor, which results in changes in the choice of organizational governance structures. A hospital's major source of patient referrals derives from specialists or specialty physicians, because patient referrals come originally from general practitioners to specialists then to hospitals. With technological advances, more hospital services can be performed by general practitioners and specialists; consequently, the competition for patients between specialists and hospitals will increase (Kahn, 2006). Increasing numbers of specialists will intensify the competition among hospitals for patients, forcing hospitals into unfavorable situations (Shactman, 2005).

In addition, the increase in specialists creates high competition among them, which implies hospitals have great risks of suffering more opportunistic behavior from specialists (Dobson & Haught, 2005). Under the cost-containment pressures of Medicare's resource-based relative value scale (Worzala, Pettengill, & Ashby, 2003), specialists faced with higher competition are more likely to refer those patients needing costly care to hospitals (Esposto, 2004) or to order more hospital services for their patients. Hospitals thus have to spend more money on monitoring the behavior of specialists, which means increased transaction costs.

The rising number of referral physicians (here specialists) indicates not only more patient resources that mean favorable conditions for hospitals, but also intense competition among specialists and hospitals for patients from other service providers. Consequently, hospitals are likely to develop loosely coupled relationships with other health

care providers to secure patient flows (Burns et al., 2000; Zinn et al., 1997). However, when the number of specialists grows to large levels, hospitals are faced with unfavorable environments and will develop tight interorganizational relationships. Thus, hospitals located in counties with small or large numbers of specialists are less likely to affiliate with health care networks.

> *H1b: The number of specialists is positively related to the odds of affiliating with health care networks.*
> *H2b: The number of specialists is positively related to the odds of affiliating with health care systems.*

The demand factors represent how many health services and what kinds of services are needed in communities. Compared to the variable of total population, the percentage of aged population is a superior and sufficient variable of demand of health services in the market. This is because the aged population consumes the largest part of health care utilization and needs more integrated services.

Older people usually have more than one chronic disease, so they tend to consume a greater amount of health care services, including hospital and long-term care services. If hospitals locate in markets with large numbers of elderly people, hospitals theoretically can attract sufficient, insured acute care patients independently, due to Medicare insurance, and then have no need of developing cooperative relations with other providers. Moreover, the increased elderly population also increases the need for post-acute care services, which in turn enhances hospitals to diversify into long-term care (Shah, Fennell, & Mor, 2001) or to affiliate with health care networks for discharging elderly patients as soon as possible (Dansky et al., 1996).

However, elderly people are mainly covered by Medicare, which generally provides less reimbursement to hospitals (Worzala et al., 2003), so the growth in elderly

populations implies the increased possibility of bearing financial loss. When the percentage of aged population becomes larger, it is more likely for hospitals to face greater potential loss. As a result, health care systems tend to view those counties with large elderly populations as less munificent and not to include hospitals in those areas as new members (Alexander & Morrisey, 1988, 1989; Wilke & Choi, 1988).

> *H1c: The percentage of aged population is positively related to the odds of affiliating with health care networks.*
> *H2c: The percentage of aged population is negatively related to the odds of affiliating with health care systems.*

Based on these discussions, H1 and H2 are generalized hypotheses of the overall negative relationship between environmental munificence and the probability of hospital affiliation with health care networks or systems.

Effects of Environmental Uncertainty

Environmental uncertainty can be defined as unpredictable or unanticipated environmental events that interfere with one's ability to fulfill the planned transactions or exchanges (Stiles et al., 2001), and it is composed of two dimensions: environmental dynamism and complexity (Begun & Kaissi, 2004). Daft (2001) asserts that environmental uncertainty will increase with the rise in either environmental dynamism or complexity or both. According to transaction cost theory, increased uncertainty causes an increase in transaction costs, so it is logical to infer that increases in environmental dynamism and/or complexity result in the growth of transaction costs. Thus, the effects of environmental uncertainty on hospital's affiliation choice not only include effects of both environmental dynamism and complexity, but also can be evaluated from these two perspectives by using both transaction cost theory and resource dependence theory.

Environmental dynamism refers to those unpredictable environmental changes that may heighten uncertainty for organizations within an environment (Dess & Beard, 1984; Emery & Trist, 1965); namely, it indicates the amount of turbulence, instability, and unpredictability for exchanges. In environments with a dynamic supply of resources, organizations have to develop various interorganizational linkages for securing and stabilizing critical resource flows (Oliver, 1990; Zajac, D'Aunno, & Burns, 2000) at the price of losing some autonomy and control.

Environmental complexity reflects the number and types of potential competitors in the local market. According to resource dependence theory, increased complexity raises the uncertainty and instability in resource flows, which in turn motivates organizations to develop external linkages for assuring the procurement of needed resources. Therefore, increases in environmental dynamism and complexity will reduce the favorability of environments and raise the transaction costs of exchanges due to increased uncertainty.

From the resource dependence perspective, the choice of governance structures depends mainly on the balance between perceived benefits of decreased dependency on the environment and associated costs of lost autonomy and control. Zinn et al. (1997) posit that when environmental dynamism or complexity is low, the benefits obtained from developing loosely cooperative arrangements (i.e., health care networks) are enough for organizations to cover the associated costs of lost autonomy and control. When environmental dynamism or complexity is higher, organizations, especially those without enough internal resources, are likely to relinquish more autonomy and control in exchange for a

more stable and sufficient resources supply from tightly linked arrangements (i.e., health care systems).

These results are the same as what are predicted by resource dependence theory. Namely, low environmental dynamism and complexity means low uncertainty and transactions, and implies the choice of cooperative governance structure; however, high environmental dynamism and complexity produces high uncertainty and transaction costs, which make firms more likely to develop hierarchical governance structure.

Based on the definitions of environmental dynamism and complexity, three variables are included in this study to represent environmental uncertainty and are used to explore the relationship between environmental uncertainty and hospital affiliation choice. These variables include the HMO penetration rate, from the perspective of environmental dynamism, and both hospital competition and nursing home competition, from the viewpoint of environmental complexity.

The inclusion of the HMO penetration rate is attributed to the great potential of managed care organizations to influence freestanding hospitals to develop cooperative linkages with other health care providers, due to the increased control of patient and financing resources vital to hospitals' survival. The use of capitation reimbursement shifts the cost-control responsibility from managed care plans to hospitals; thus, hospitals are induced to provide less costly alternatives for expensive inpatient care in order to maintain financial viability. Specifically, the rise of the HMO penetration rate will intensify the instability of financial resources for hospitals, which in turn will force hospitals to develop various beneficial cooperative arrangements (Alexander & Morrisey, 1989; Shortell et al., 1994).

The application of selective contracting means that managed care organizations can affect potential patient flows for freestanding hospitals; therefore, the rise of the HMO penetration rate implies that hospitals become more dependent on managed care plans for securing stable patient resources. Such increased dependency on managed care plans make freestanding hospitals more likely to develop external linkages.

In summary, an increased HMO penetration rate enhances the need and likelihood of freestanding hospitals to affiliate with other health care providers, and such an affiliation trend can be explained from two assertions of resource dependence theory. On the one hand, affiliating with health care networks or systems can reduce the focal hospital's dependence on managed care enrollees by exploiting more patient sources, such as primary care physicians (Alexander, Morrisey, & Shortell, 1986; Burns et al, 1997, 2000) and subacute care units. On the other hand, affiliating with health care networks or systems can enhance the focal hospital's market position and bargaining power via collective effects; consequently, it will increase the dependence of managed care plans on the focal hospital, because managed care plans are more likely to contract with health care networks or systems to enjoy the benefits of lower contracting costs and one-stop shopping with wide geographic distribution (Alexander & Morrisey, 1989).

Although an increased HMO penetration rate can enhance freestanding hospitals' affiliation with health care networks (Bazzoli et al., 1997), such network cooperation is likely to evolve into system ownership when HMO penetration reaches higher levels (Burns et al., 2000). This is because of possible opportunistic behaviors and flexible (but fluctuating) referrals inherent in loosely coupled cooperation (like health care networks), and those situations will worsen the effectiveness of loose cooperation under high envi-

ronmental dynamism. Thus, freestanding hospitals are more likely to affiliate with health care systems when HMO penetration rate becomes higher. These situations are in accordance with the propositions of transaction cost theory for the relationship between environmental dynamism/uncertainty and hospital affiliation choice.

> *H3a: The HMO penetration rate is positively related to the odds of affiliating with health care networks.*
> *H4a: The HMO penetration rate is positively related to the odds of affiliating with health care systems.*

In a concentrated hospital market, hospitals face lower competition, which in turn makes hospitals more likely to possess the ability to arrange the necessary services and be less dependent on other organizations. Moreover, hospitals in a concentrated market are scarce resources for other organizations, so they are relatively powerful and can survive even with financial distress. This situation is confirmed by the lingering firm literature, which suggests that the presence of only a few competitors can help to sustain the existence of a distressed firm (D'Aveni, 1989; Zammuto & Cameron, 1985).

In contrast, the ability to respond to the needs of key-resource-providing constituents is critical in more competitive environments, because of the greater demands on a shared pool of limited resources (Pfeffer & Salancik, 1978; Ulrich & Barney, 1984). That is to say, in a more competitive market, hospitals are more dependent on other health care providers and are more likely to form cooperative relations with other organizations (Alexander & Morrisey, 1989; Gamm et al., 1996; Miller, 1996; Proenca et al., 2000; Zinn et al., 1998). For example, hospitals in more competitive markets will be more likely to integrate with physicians for securing patient referrals or developing more profitable services (Alexander et al., 1986; Burns et al., 2000).

However, the preferred cooperative linkages will change with increases in market competition. When situated in highly competitive environments, each organization has almost no salient market power and resources, so it is difficult for them to afford the high transaction costs for developing and maintaining sufficient external linkages. As a result, organizations in such highly competitive environments tend to form tightly linked organizations, in exchange for stable resources.

In contrast, environments with moderate competition are likely to be composed of well-balanced competitors with similar levels of market power. Due to similar and sufficient market power, organizations in such environments will significantly influence each other, which in turn will lead to high uncertainty and increased needs for loose cooperation (Boyd, 1990). The above discussion is similar to the propositions of transaction cost theory for relating environmental complexity/uncertainty to hospital affiliation choice.

> *H3b: The hospital competition is positively related to the odds of affiliating with health care networks.*
> *H4b: The hospital competition is positively related to the odds of affiliating with health care systems.*

The importance of exploring nursing home competition in this study is attributed to the facts that nursing homes can provide less costly long-term care services than hospitals, and that the need for hospitals to develop stable linkages with nursing homes increases with the aged population and the pressures from prevailing managed care organizations. Both resource dependence theory and transaction cost theory are applied to explain the influences of nursing home competition on hospital affiliation choice.

From the resource dependence perspective, the growing number of nursing homes implies the increased power of the focal hospital, because more nursing homes compete for hospital's patient referrals and increase their dependence on the focal hospital. In ad-

dition, from the transaction cost viewpoint, the higher dependence of nursing homes on the hospital reduces their opportunistic behaviors, which in turn indicates lower transaction costs for the hospital to search and inspect nursing homes for ensuring stable patients outplacement. Because of low dependence and transaction costs, hospitals operating in markets with highly competitive nursing homes are more likely to develop loosely cooperative governance structures (Dansky et al., 1996; Guihan et al., 1995), like health care networks.

In contrast, the decrease in the number of nursing homes means that hospitals have to compete for scarce nursing home beds to assure stable patient outplacement and become more dependent on nursing homes. On the other hand, fewer nursing homes not only indicate greater power for nursing homes, but also imply a greater likelihood of exerting opportunistic behaviors for nursing homes. Consequently, hospitals suffer higher transaction costs from contracting with nursing homes and monitoring their commitment compliance. Faced with high dependence and transaction costs, hospitals located in markets with low nursing home competition are more likely to form governance structures with tight linkages (Shah et al., 2001), such as health care systems.

> *H3c: The nursing home competition is negatively related to the odds of affiliating with health care networks.*
> *H4c: The nursing home competition is negatively related to the odds of affiliating with health care systems.*

According to these discussions, two generalized hypotheses (H3 & H4) have been reached, and they are the overall positive relationships between environmental uncertainty and the probability of hospital affiliation with health care networks and systems.

Effects of Organizational Resources

Organizational resources are defined here as those existing internal resources that can be applied to exploit external opportunities or neutralize external threats, and to cope with intraorganizational changes. Organizational resources are important in studying organizational governance structures, because they can greatly influence an organization's power relative to other actors in the environment and are critical to the design and implementation of strategies for an organization. From the resource dependence perspective, internal resources can facilitate an organization to accommodate to environmental changes via internal restructuring (i.e., service diversification), and thus lessen the organization's dependence on the environment. In addition, the amount and types of an organization's internal resources determine the degree of other organizations' dependence on it, and this is in accordance with the proposition of RBV. From the viewpoint of strategic management, not only are internal resources essential to plan appropriate strategies, but they also can prevent organizations from failures while employing strategic changes (Greening & Gray, 1994; Kaluzny, McLaughlin, & Jaeger, 1993).

Organizational resources can be generally classified into three groups: 1) intangible resources (such as reputation, quality, knowledge, and information); 2) tangible resources (such as assets and funds); and 3) human resources (i.e., skilled personnel). Because they function in different ways to help an organization deal with environmental pressures, it is reasonable to believe that they probably have various impacts on the development of IORs. In order to examine the application of the RBV in studying health care organizations, four variables of hospital's internal resources are included in this study, and they must meet the resource criteria, including valuability, rareness, imperfect

imitability, and imperfect substitutability. These variables are the number of hospital beds, registered nurse (RN) staffing, occupancy rate, and community orientation.

As a well-known influential factor, the number of hospital beds represents the available slack resources that affect the hospital's ability to gain total control over required resources in the face of external turbulence in supplies and demands, so it has the effect of exploiting external opportunities and neutralizing external threats, such as converting some beds to provide more profitable services under the stress of cutting hospital costs (Grim, 1990). The high cost of setting up qualified hospital beds and Certificate of Need laws can contribute to the availability of extra hospital beds in some areas.

There is an ambiguous causal relationship between the number of hospital beds and hospital performance, because hospital beds must combine with other resources, such as better managerial capability and appropriate strategies, to achieve higher performance. In addition, it is difficult to completely replace the function of hospital beds with other resources (i.e., nursing home or ambulatory beds), based on cost concern and regulatory constraint. Thus, the number of hospital beds belongs to strategic resources.

Previous studies have revealed contrary results on the relationship between the number of hospital beds and hospital affiliation choice. Based on resource dependence theory, some studies indicate that those hospitals with abundant equipped beds have more internal resources to deal with external contingencies through internal strategies, such as diversification (Alexander, 1990; Shah et al. 2001; Shortell, Morrison, & Hughes, 1989; Trinh & O'Connor, 2002; Wheeler, Burkhardt, Alexander, & Magnus, 1999), and are less likely to cooperate with other health providers (Alexander & Morrisey, 1988; Gamm et al. 1996; Zinn et al. 1998). However, other studies show that the number of hospital beds is

positively associated with the likelihood of developing external linkages (Bazzoli et al., 2003; Burns et al., 2000).

These contradictory results could be attributed to the causal ambiguity mentioned above; namely, possessing more slack resources (i.e., set-up beds) is not sufficient for hospitals to be financially viable. For example, to succeed in diversification, hospitals must have strong management ability to coordinate more complex internal relations, and develop more relations to guarantee sufficient patients for hospital beds. From the view-point of health care systems, merging hospitals with a larger number of beds will be more efficient and effective in the expansion of market share and provided services.

In contrast, hospitals with fewer beds are believed to be most susceptible to rapid environmental changes, because they do not have enough reserved resources to overcome the volatile changes. Namely, small hospitals have a large probability of experiencing economic loss, even if they possess good managerial capability. In response to such financial distress, hospitals with small number of beds are more likely to close, to convert services (e.g., becoming specialty hospitals or ambulatory centers), or to affiliate with health care systems (McCue, 1996; Wilke & Choi, 1988) for obtaining supplemental resources or strong managerial help.

In summary, hospitals with an intermediate number of set-up beds not only have sufficient resources to cope with environmental challenges, but also are more likely to operate efficiently. As a result, these hospitals tend to be ideal partners for cooperation, and they are also likely to affiliate with health care networks to sustain and even enhance their performance in increasingly competitive, complex environments.

H5a: The number of hospital beds is positively related to the odds of affiliating with health care networks.
H6a: The number of hospital beds is positively related to the odds of affiliating with health care systems.

The study of nurse staffing patterns has become increasingly popular in the last decade, because it challenges health care managers to make a balance between ensuring adequate quality of care and controlling hospital costs efficiently. Due to high cost-containment pressures from insurers and employers, hospitals have tried to replaced RNs with less expensive nursing staff (i.e., licensed practical nurses and nurse aides), because the nursing staff accounts for the largest group of hospital employees and a significant portion of hospital labor costs. However, there is strong empirical evidence supporting the positive relation of nurse staffing to quality of care in hospitals (Aiken, Clarke, Sloane, Sochalski, & Silber, 2002) and in other health care organizations (Davis, 1991; Eaton, 2000). As a result, the mix of nurse staffing is believed to have impacts on hospital performance and associated affiliation choice.

From the resource-based perspective, the RN staffing can be viewed as a strategic resource. RNs are valuable because their skills and their ability to care for patients can increase the quality of hospital care by reducing mortality rates or length of stay (Aiken, Smith, & Lake, 1994; Blegen, Goode, & Reed, 1998; Bond, Raehl, Pitterle, & Franke, 1999; Hartz et al., 1989; Lichtig, Knauf, & Milholland, 1999; Scott, Forrest, & Brown, 1976); in the long run, they can increase the reputation and attract more patients for hospitals. Both the shortage and disproportionate distribution of RN supply could result in decreases in RN staffing. As mentioned previously, hospitals with increased RN staffing are likely to have improved reputations and good community relations, which are socially complex, so the criterion of imperfect imitability is met. Finally, it is hard to completely

substitute RNs with other nursing staff, because RNs are believed to possess more tacit knowledge and skills (Weech-Maldonado, Meret-Hanke, Neff, & Mor, 2004) that are difficult to be transferred (Lei, Hitt, & Bettis, 1996; Teece, 1998).

With control of the number of hospital beds, increases in the number of RNs will make hospitals more likely to develop external relations with other health care organizations. Because higher RN staffing implies better hospital quality of care, those hospitals with more RNs per bed have the higher probability of being viewed as beneficial partners for health care networks and systems, due to those hospitals' good reputations and potential numerous social relationships (Gittell & Weiss, 2004). However, if the number of RNs per bed becomes too large, it is possible for hospitals to have economic losses because the high costs of hiring so many RNs will offset the potential benefits generated. In the face of such situations, stronger management is necessary to control large increases in labor costs. Hospitals with moderate levels of RN staffing are thus more likely to affiliate with health care networks.

> *H5b: The number of RNs per bed is positively related to the odds of affiliating with health care networks.*
> *H6b: The number of RNs per bed is positively related to the odds of affiliating with health care systems.*

The most straightforward determinant of an organization's affiliation decision is its operational performance. Operational performance is referred to the net result of management efforts, exerted by the organization, against the environmental challenges and is crucial to the institute's financial viability or survival. Organizations with great operational performance have few incentives to change current practices or strategies and tend to maintain their independent status. All things being equal, declines in operational per-

formance indicate poor management ability and increased financial pressures that cause the organization to seek external help through cooperation.

Because members of loosely coupled organizations are responsible for their own operation and management, organizations with poor performance in operations are less likely to be considered as potential partners on the basis of value-adding concerns. Alternatively, organizations with poor operational performance tend to seek strong management help from tight IORs (Alexander & Morrisey, 1989). From the viewpoint of hierarchical organizations, those firms with poor operational and management capabilities have more room for improvement, which implies a greater amount of economic benefits in the future.

The occupancy rate means the degree of hospital beds occupied by patients; therefore, higher occupancy rate implies that the hospital has better management ability to position itself and to attract sufficient patient flows, and that it is not necessary for the hospital to build external relations. This argument is well demonstrated by most research findings (Alexander & Morrisey, 1988, 1989; Bazzoli et al., 2003; Burns et al., 2000; McCue, 1996; Trinh & O'Connor, 2002; Wilke & Choi, 1988; Zinn et al., 1997). From the value-adding perspective, we posit that hospitals with lowest occupancy rates are less likely to be allowed to affiliate with health care networks, even though no empirical evidence exists.

> *H5c: The occupancy rate is negatively related to the odds of affiliating with health care networks.*
> *H6c: The occupancy rate is negatively related to the odds of affiliating with health care systems.*

Community orientation is an important predictor in this study because it reflects not only the hospital's responses to the environmental pressure of improving community

health, but also the extent of the hospital's willingness to cooperate. Proenca (1998) defines community orientation as "the organization-wide generation, dissemination, and use of community intelligence to address present and future community health needs," and states that the generation of community intelligence comes from collective actions among cooperative providers and agencies through information sharing and dissemination.

According to the RBV, the degree of community orientation can be viewed as one of a hospital's strategic resources. Hospitals engaging in more community orientation activities will build more social relations and obtain higher reputations among community actors. Such social relations and reputations are intangible resources that are rare and hard for the hospital's competitors to imitate and substitute. In addition, hospitals with improved social relationships and reputations are likely to obtain more resources, such as funds and patients, from the community, so the degree of community orientation is valuable for hospitals. For example, if a hospital pays more attention to understanding community needs, it can allocate resources more efficiently and will be more likely viewed as a potential partner by health care networks.

To date, research findings indicate inconsistent relationships between health care systems membership and the degree of community orientation. Lee, Alexander, and Bazzoli (2003) demonstrate that system-affiliated hospitals are less likely to engage in community oriented activities, because they focus more on system-wide achievements rather than local community interests. In exchange for resource support, freestanding hospitals are likely to mimic the culture and behaviors of system-affiliated hospitals, in order to become desired targets and avoid potential conflicts after the system affiliation.

In contrast, community care networks emphasize the importance of community health improvement and accountability to the community (Proenca et al., 2000). The degree of a hospital's community orientation indicates its willingness and experiences to collaborate with network members. In comparison to freestanding and system-affiliated hospitals, network-affiliated hospitals would be more accountable and responsive to community health needs (Lee et al., 2003; Lee, Chen, & Weiner, 2004). Therefore, hospitals with higher levels of community orientation not only have more interorganizational exchanges with other community entities (Provan, 1984), but also are more likely to be accepted by health care networks.

H5d: The level of community orientation is positively related to the odds of affiliating with health care networks.
H6d: The level of community orientation is negatively related to the odds of affiliating with health care systems.

Based on these discussions, two generalized hypotheses (H5 and H6) can possibly be developed, and they are the overall positive relationships between organizational resources and the probability of hospital affiliation with health care networks and systems.

CHAPTER 3

RESEARCH METHODOLOGY

This chapter delineates a study plan that was used to empirically test the conceptual framework proposed in Chapter 2, and consists of three major components. First, the sources of data for the investigation are described, and the composition and selection reasons of the research sample population are discussed. Second, measures and their operationalized definitions of variables (including dependent, independent, and control variables) in the conceptual framework are discussed. Finally, a set of statistical techniques for screening data and testing hypotheses are presented.

Data Sources and Sample Population

Data for this study were merged from three principle sources: the AHA Annual Survey of Hospitals from 1993 to 1997, the 1993-1997 ARF, and data on nursing home competition index from Dr. David Grabowski.

The AHA and ARF databases have been well documented (Kralovec & Muller, 1981; U.S. Department of Health and Human Services, 1984), and have been applied in numerous studies of American hospitals. The AHA database provided the facility-level data for the study, including the dependent variable of hospital's affiliation choice, and predictors of organizational resources.

The ARF is a publicly available data set, which compiles useful census, health, and social resource information for all U.S. counties. It is a major source of county-level contextual information about the community in which hospitals are located, including population demographics, socioeconomic status, and health care facilities and personnel. Therefore, the constructed indicators based on ARF data provide important information not only on demand for health care services and potential resources available to hospitals, but also on competition among hospitals and other health care providers.

The data on county-level HMO penetration rates were directly extracted from ARF that are based on the InterStudy County Surveyor Database. InterStudy collects county enrollment information from roughly half of the HMOs and metropolitan statistical area (MSA) enrollment information from most remaining HMOs.

The competition data for nursing homes were provided by Dr. David Grabowski, who used county information from the Online Survey, Certification, and Reporting System (OSCAR) to calculate nursing home competition index. The OSCAR data contain information from state surveys of all federally certified Medicaid and Medicare nursing homes in the U.S. and are used to determine whether nursing homes comply with federal regulatory requirements (Grabowski & Hirth, 2003).

The sample for this investigation was composed of nongovernment general acute care community hospitals that were reported as freestanding in 1993 and traced from 1993 to 1997. The unit of analysis for this study was the individual hospital, and the hospital market area was defined as the county in which the hospital was located. Hospitals with missing data in any variable during the study period 1993-1997 were excluded from the final sample population. In addition, those freestanding hospitals reported as belong-

ing to both health care systems and networks in the same year were also excluded. The reasons for selecting the sample population, the market area, and the study period are discussed in the following sections.

Nongovernment general hospitals that were freestanding and provided acute care services as their mission were chosen for the following reasons. First, there are great differences between public and private hospitals in terms of mission, sources and availability of financial resources, and organizational structure and control; therefore, the inclusion of government-run hospitals could disturb the analytical results and make the interpretation more difficult. Second, compared to hospitals focusing on specialty or long-term care services, nongovernment general hospitals have traditionally been the core of the hospital industry. Third, as the majority of U.S. hospitals are composed of these hospitals, they should be the focus of this investigation for obtaining more generalizable results. Finally, differences in the accessibility and availability of resources between freestanding and affiliated (as with health care networks and systems) hospitals could greatly influence a hospital's responses to environmental pressures.

Similarly, concerns regarding perceived differences in accessible and available resources contributed to the exclusion of those freestanding hospitals that reported as being affiliated with both health care systems and networks in the same year. In comparison to freestanding hospitals, system-affiliated hospitals are able to obtain extra resources and support from health care systems that could affect the decision on affiliating with health care networks. For the same reasons, network-affiliated hospitals will benefit from cooperative partners, so their choice of system affiliation will also be influenced. Those hospitals with dual network and system membership could have mixed idiosyncratic features

from health care networks and systems; consequently, it is difficult and inappropriate to assign hospitals affiliating with health care networks and systems in the same year into either the network group, system group, or another independent group.

Several methods have been developed to define the market for hospital competition, including geographic areas (White & Chirikos, 1988), health services areas (Makuc et al., 1991), radius approach (Succi et al., 1997), and hospital-specific market areas (Goody, 1993). Basically, each approach has its own advantages and disadvantages (Luft et al., 1986). Garnick and his colleagues (1987) conducted a study to delineate the appropriate market definitions and concluded with three major empirical approaches, including geopolitical boundary (such as MSAs and counties), distances among hospitals, and patient origin. They also suggested that research on health care competition can get robust results across various market specifications. In addition, the county has been applied to represent the market for health care services in numerous studies (Alexander & Morrisey, 1988; Dranove & Wehner, 1988; Elzinga & Hogarty, 1973; Morrisey, Sloan, & Valvona, 1988). Thus, for obtaining comparable results, it was reasonable to define the hospital market at the county level.

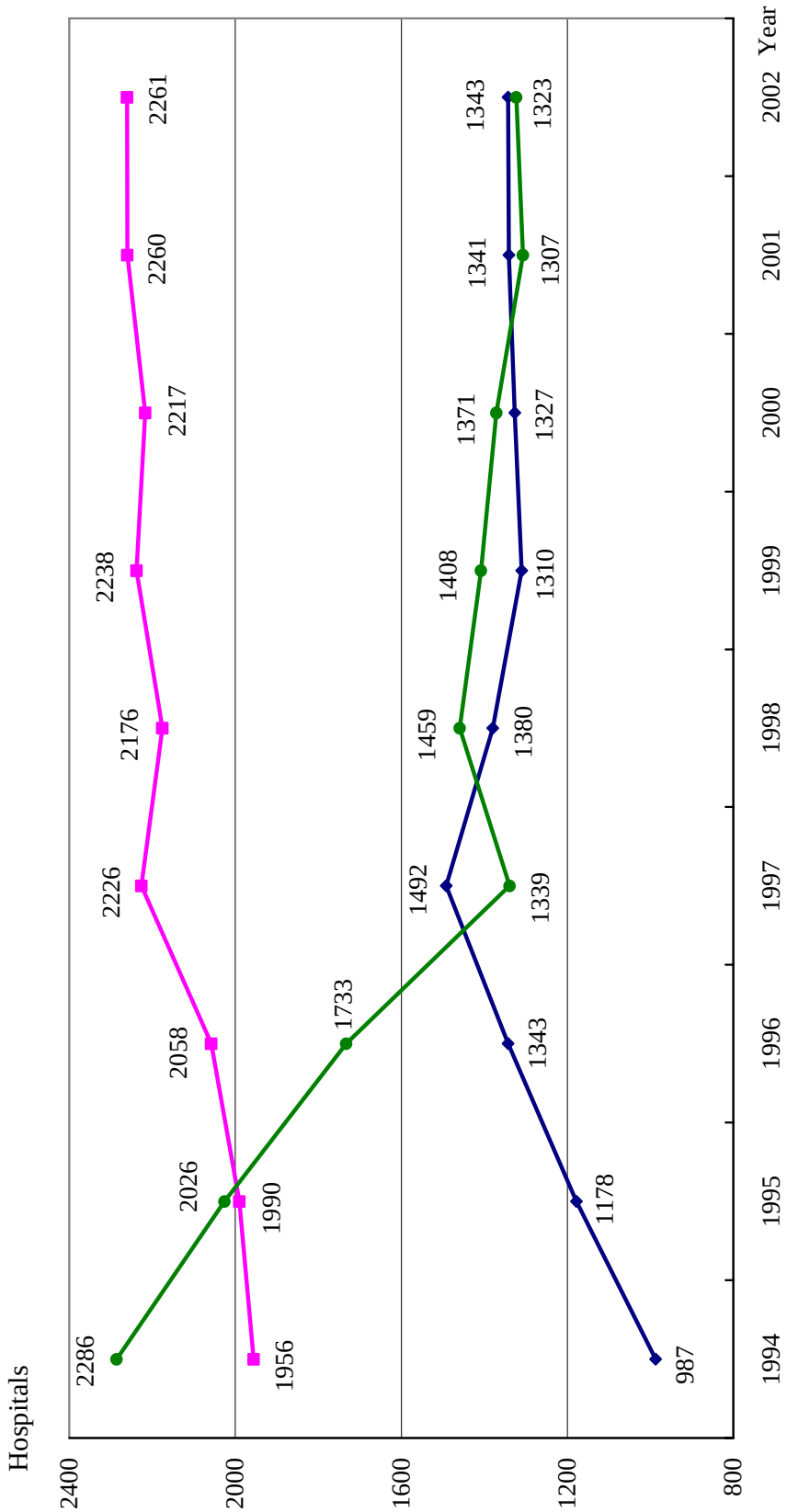
In addition to the validity of the county approach, there were two other major reasons contributing to the use of county to approximate the market for hospital competition in this analysis. One was the availability of data on contextual information of markets in which hospitals operate. Basically, all environmental data in this study were collected (i.e., those data from the ARF) or calculated (i.e., HMO penetration rates and nursing home competition index) at the county level. The other reason was that this research focused on hospital affiliation with health care networks, which involve many public and

private health-related agencies generally providing services on the basis of county boundary.

The use of the 1993-1997 time period for the analysis was based on the following concerns. First, in 1993 the AHA began to ask hospitals if they belonged to any health care network; therefore, freestanding hospitals in 1993 would be the target population. Second, the numbers of hospitals affiliating with health care networks increased after 1993, reached a maximum in 1997 (Figure 2), and had a big drop in 1998 due to the implementation of the Balanced Budget Act (BBA).

According to the reformed payment mechanisms of the BBA for Medicare beneficiaries, hospitals have few incentives to transfer patients to a status of postacute care (McCall, Korb, Pettersons, & Moore, 2003), especially skilled nursing facilities. Alternatively, postacute care facilities will avoid those patients needing costly, medically complex services (Angelelli et al., 2002). Theses situations indicate the damaged and even broken cooperation among health care providers (Rivers & Tsai, 2002), which can be illustrated by the big drop in the number of health care networks and systems in 1998. In addition, those situations caused by the BBA also imply the decreased likelihood of freestanding hospitals to affiliate with other health care providers. In order to get the largest number of eligible hospitals into this study and to avoid the unexpected impacts of the BBA (Angelelli et al., 2002; Bazzoli, Lindrooth, Hasnain-Wynia, & Needleman, 2004; Glavin, Tompkins, Wallack, & Altman, 2002; Schoenman, 1999) on hospital's affiliation decision (through affected predictors, such as indicators of environmental uncertainty), sampled hospitals were traced only from 1993 to 1997.

Figure 2. Trends of American community hospitals' affiliation types, 1994-2002



Note: Data sources are AHA Annual Survey Reports.

Third, the use of 1993-1997 data, rather than more recent data, could be attributed to the small number of new health care network hospitals since 1998 and the unavailability of the latest data. According to the AHA annual reports, the number of hospitals in health care networks increased from 1,310 in 1999 to 1,343 in 2002. AHA data indicated that by 1997 there were only 546 freestanding hospitals, and that health care network affiliation rates decreased from 10.8% in 1995 to 6.3% in 1997. Additionally, the latest available data were 2002 AHA Annual Survey of Hospitals data. Therefore, it is reasonable to expect that the number of new health care network hospitals during 1998-2002 should be much smaller than that during 1993-1997. Even more, it is very possible that the small number of hospitals affiliating with health care networks during 1998-2002 are not sufficient to support a test of the proposed model.

Fourth, in order to accurately test hypotheses, it is important to employ the lagged value for each independent variable. The use of lagged values for independent variables aimed at clarifying the time sequence between proposed predictors and the observed organizational response, which is a necessary condition for demonstrating causal relationships (Wheeler et al. 1999).

Finally, the use of 1-year "level" data was more suitable for this study. The framework proposed by Cook et al. (1983) implied that organizational managers would prefer long-term, stable "change" data rather than short-term, volatile "level" information to make important strategic decisions (e.g., the interorganizational strategy of health care network/system affiliation), especially in more turbulent and uncertain environments. However, Alexander & Morrisey (1988) concluded that "level" data would produce better results than "change" data. In addition, the data of some predictors were not available

before 1993, which made it impossible to compare the effects between “change” and “level” data in this study. As a result, this study went back to 1993 to get the “1-year level” lagged values for those hospitals that change their freestanding status to network or system affiliation in 1994.

Measures Description

Based on the proposed conceptual framework, this section describes the operationalization of conceptual variables in the model. The list of measures of variables and data sources are presented in Table 1. Three groups of variables are delineated and discussed as follows.

Dependent Variable

The measure of the dependent variable in this investigation was constructed as the hospital’s choice of membership affiliation, which represented a hospital’s decision to join a health care system, participate in a health care network, or maintain individuality and independence. The measure was a categorical indicator with three levels: (0) remaining a freestanding hospital; (1) affiliating with a health care network; and (2) affiliating with a health care system.

The use of a three-category dependent variable, rather than a two-category “affiliation vs. keeping freestanding,” could be attributed to two major concerns. First, health care networks and systems are two popular trends of organizational structures in the health care industry, but they have both similar features and idiosyncratic differences in organizational structure, formation, and behaviors. Using a 2-category dependent vari-

Table 1. Measures of study variables and data sources

Variable	Measure Definition	Format	Data Source
Dependent Variable			
Affiliation Choice	Choice of membership affiliation (hospital's decision to keep freestanding, to enter into health care networks, or to join health care systems)	Categorical 0 = Freestanding (reference group) 1 = HC Networks 2 = HC Systems	1993-1997 AHA Annual Survey of Hospitals
Environmental Munificence			
Unemployment rate	Number of unemployed / Civilian labor force (100s)	Continuous	1999 ARF
# Specialists	Number of all specialty physicians / County population (1,000s)	Continuous	1999 ARF
% Aged population	Number of residents aged 65+ / County population	Continuous	1999 ARF
Environmental Uncertainty			
HMO penetration rate	Number of HMO enrollees / County population	Continuous	1999 ARF
Hospital competition	Sum of squares of ratios of each hospital's beds to total hospitals beds in county	Continuous	1993-1997 AHA Annual Survey of Hospitals and 1999 ARF
Nursing home competition	Sum of squares of ratios of each nursing home beds to total nursing homes beds in county	Continuous	Dr. David C. Grabowski

Table 1. Measures of study variables and data sources (Continued)

Variable	Measure Definition	Format	Data Source
Organizational Resources			
# Hospital beds	Number of acute beds set up and staffed in study period	Continuous	1993-1997 AHA Annual Survey of Hospitals
# RNs	Number of full-time-equivalent RNs / Number of acute beds	Continuous	1993-1997 AHA Annual Survey of Hospitals
Occupancy rate	Average daily census / Average number of acute beds	Continuous	1993-1997 AHA Annual Survey of Hospitals
Community orientation	Ratio of offered community-oriented services to total community-oriented services	Continuous	1993-1997 AHA Annual Survey of Hospitals
Control Variable			
Hospital setting	Urban or rural areas in which hospitals are located	Binary 1 = Urban areas (reference group) 0 = Rural areas	1999 ARF

able reduces the applicability and generalizability of the study findings. Second, and most important, health care networks and systems have various features in attracting and requiring potential partners; it is thus reasonable to believe that the effects of environmental and organizational factors on potential hospital partners of health care networks and systems could be different in degree and even direction. Consequently, the research results will probably be misleading (Lee et al., 2003) if hospitals affiliating with health care networks or systems are grouped in the same category.

Independent Variables

The concept of environmental munificence was indicated by three variables representing three types (enabling, referral, and demand) of environmental resources.

Unemployment rate. Unemployment rate was one measure of enabling factors and was constructed as the average number of unemployed labor-eligible residents per 100 civilian labor force in the county. It pertains to the economic resources available for health care providers in a county.

Number of specialists. The variable used in the model to indicate potential patient referrals to hospitals was the number of specialists. It was measured by the number of all specialty physicians per 1,000 residents in a county.

Percentage of aged population. The demand for health services was indicated by the percentage of aged population. This measure was constructed as the percentage of county population with age 65 or above.

The construct of environmental uncertainty combined the concepts of environmental dynamism and complexity in the study. It was indicated by three variables, including HMO penetration rate, hospital competition, and nursing home competition.

HMO penetration rate. The variable of HMO penetration rate was measured by the number of county residents enrolled in HMOs divided by the county population, and implied the power of managed care organizations over health care providers and facilities in the county. The HMO enrollment data were derived from the InterStudy County Surveyor database that accounts for slightly more than 97 percent of the total HMO enrollment in the United States. Studies show that HMO penetration rates are highly correlated with the population's insurance coverage of managed care plans. As a result, this measure was a reasonable proxy for indicating the degree of managed care penetration.

Hospital competition. The variable of hospital competition was measured by a Hirschman-Herfindahl index (HHI) and was constructed by summing the squares of the market share for each hospital located in the same county. The market share was calculated by dividing the number of beds per hospital by the total number of hospital beds in the county. Basically, the HHI represents the degree of industry concentration, and ranges from 0 to 1. Increases in the HHI indicate a more concentrated industry with lower com-

petition among fewer competitors, and a HHI of 0 indicates complete dispersion and the greatest competition among firms.

Nursing home competition. Similarly, another variable indicating environmental complexity was nursing home competition, and was also measured by a HHI. The nursing home HHI was calculated by summing the squares of ratios of each nursing home's beds to total nursing homes beds in the county, and also ranges from 0 to 1. The nursing home HHI was developed and calculated by Dr. David Grabowski on the basis of the OSCAR database.

The concept of organizational resources was represented by four different variables in this study, and included the number of hospital beds, the number of registered nurses, occupancy rate, and community orientation.

Number of hospital beds. The variable of hospital beds was measured by the number of hospital acute care beds that were set up and staffed during the study period. It was used in this study to represent hospital size and to imply the physical capacity of a hospital that has buffering effects for environmental changes.

Number of registered nurses. This nurse staffing variable was measured by the number of full-time-equivalent RNs divided by the number of hospital beds. It was used to indicate some valuable intangible resources (i.e., quality of care and reputation) that could be generated by registered nurses.

Occupancy rate. The occupancy rate was measured by the ratio of average daily census to the average number of hospital beds. Based on the AHA definitions, the average daily census refers to the average number of inpatients, excluding newborns, receiving care each day during the reporting period, and the average number of hospital beds has the same meaning as the number of hospital beds defined previously. This variable was applied to represent intangible resources (i.e., management capability) for hospitals.

Community orientation. The variable of community orientation was constructed by the ratio of offered community-oriented services to total community-oriented services (Appendix A). Larger values on this measure indicate that the hospital tends to be more community oriented and more likely to collaborate with other health-related providers in the community. It also implied some possible resources (e.g., social relations and funds) for hospitals.

Control Variable

According to the existing literature, there are two major factors that should be controlled in this study, because they are perceived to generate various amounts and types of moderating effects on hypothesized relationships. These two factors are hospital setting (i.e., urban and rural areas) and hospital ownership (i.e., profit vs. nonprofit hospitals). However, hospital setting is perceived to have a highly positive correlation to hospital ownership. This is because for-profit hospitals are more likely to be observed in urban areas with abundant resources, whereas nonprofit hospitals are more common in rural

areas and provide more charity care. Controlling hospital setting can significantly reduce the moderating effects of hospital ownership. In addition, there were not enough cases available to support the inclusion of two control variables in the study. Therefore, only the hospital setting was proposed as a control variable in the model.

Hospital setting is an important moderating factor because it affects both environmental characteristics and affiliation choice simultaneously. Many studies indicate that rural hospitals have suffered from more stringent or unfavorable environmental conditions than their urban counterparts (Lillie-Blanton et al., 1992; Mick & Morlock, 1990; Shah et al., 2001; Trinh & O'Connor, 2000; Williams, Hadley, & Pettengill, 1992), which in turn causes differential impacts on hospital performance (Mullner & Whiteis, 1988; Mullner, Rydman, & Whiteis, 1990). In addition, some studies also demonstrate that hospital setting affects the likelihood of developing certain cooperative relationships for hospitals (Dansky et al., 1996; Zinn et al., 1997).

Hospital setting was defined as a binary indicator, with 1 as urban areas and 0 as rural areas. Urban hospitals are those hospitals located in counties that are classified in the ARF data as being in classes 0 through 5; in other words, those counties include 1 million or more individuals to more than 20,000 people living in an urban area within the county. Rural hospitals are those hospitals located in counties classified in the ARF data as being in classes 6 through 9; namely, those counties have less than 20,000 residents in an urban area within the county to fewer than 2,500 individuals in all.

In order to detect and adjust perceived moderating effects of hospital setting, the interactions between hospital setting and each of the predictors would be included in the analytic model.

Statistical Approaches

The pooled data from various sources were entered into SPSS 13.0 to clean and finalize the data set for analysis, and to run a series of statistical techniques to analyze the study population and test the proposed hypotheses. The multinomial (or polytomous) logistic regression model was used to examine the affiliation patterns of freestanding hospitals.

First, the analysis of power and sample size was performed to detect whether the sample size is sufficient to test the proposed model validly. Actually, it is impossible to get the true power of the model at this moment. According to previous studies (Murphy & Myors, 2004), there are some requirements for determining power levels, including number of cases, effect size, and statistical significance criterion; however, the formula for power calculation is based on a simple model with one predictor. Although researchers (Hsieh, Bloch, & Larsen, 1998) have developed advanced formulas to estimate sample size and power for multivariate logistic regression, data simulation is needed to get results. Due to lacking extra cases for simulation, it is impossible to get the power estimate.

Therefore, the evaluation of sample size is necessary to judge whether the model has a sufficient power level, because power increases with sample size (Murphy & Myors, 2004). However, current existing formulas for sample size calculation are either too simple (Agresti, 1996; Hosmer & Lemeshow, 2000; Hsieh, 1989; Whittemore, 1981) to be suitable for this model, or too complicated (Hsieh et al., 1998; Shieh, 2001) to be performed without computer assistance. Because the sample size of this study is already

known, the central question is whether the sample can fit the proposed model based on the criterion of events per variable.

The approach of events per variable is a general guideline that is widely applied to evaluate if the sample size can fit the logistic regression model with a reliable power level. In general, researchers (Harrell, Lee, Califf, Pryor, & Rosati, 1984; Harrell, Lee, & Mark, 1996; Hosmer & Lemeshow, 2000; Peduzzi, Concato, Kemper, Holford, & Feinstein, 1996; Steyerberg, Eijkemans, Harrell, & Habbema, 2000) have suggested 10 events per variable as the minimum criterion to avoid the problem of overfitting. Specifically, the number of predictors in the model should not exceed the ratio of the smallest events of outcome categories to 10. Otherwise, the model could have problems of overestimating coefficients and even failure-to-convergence.

For this study, the smallest number of system-affiliated hospitals was 276; therefore, the number of variables allowed in the model should not exceed 27. According to the proposed model, there is 1 control variable, 10 predictors, and 10 interaction variables. The total largest number of covariables in the model was 21, far lower than 27. Therefore, it was reasonable to believe that the proposed model was feasible for use with the final sample population and can have an acceptable and reliable power level.

The choice of the multinomial logistic regression model as the principal analytical approach was based on two major factors. First, the dependent variable was measured by an indicator with three discrete categories, and the relationships between dependent and independent variables are assumed to be nonlinear (DeMaris, 1992; Orme & Buehler, 2001); therefore, using ordinary least squares multiple regression will violate several assumptions, including linearity, normality, and homoscedasticity (Menard, 1995; Spicer,

2005). In contrast, polytomous logistic regression, as an extension of binary logistic regression, assumes the logistic distribution between the conditional probability of an event occurrence and the predictors; namely, the probability of the dependent outcome is an S-shaped function of the independent variables (Cleary & Angel, 1984).

Second, among statistical techniques capable of handling multiple categorical dependent variables, multinomial logistic regression is more suitable than other approaches for this research (Agresti, 1996; Hosmer & Lemeshow, 2000; Tabachnick & Fidell, 2001). In comparison to discriminant function analysis, logistic regression models, including dichotomous and polytomous models, do not need to meet the assumptions of the multivariate normality of the independent variables. In other words, the predictors in this study are not strictly required to be normally distributed or homogeneous within each group. Unlike the requirement of using discrete independent variables in multiway frequency analysis, multinomial logistic regression allows the use of any mix of continuous, discrete, and binary covariates in the analysis, and it conforms to the features of covariates' measures in this investigation.

The process of data screening has to be implemented prior to formal statistical analyses for testing the theoretical framework and hypotheses, and includes dealing with missing data as well as the handling of outliers and assumptions. Although there is no required assumptions about the predictors in polytomous logistic regression, researchers have suggested that meeting some essential assumptions, such as normality, linearity, homoscedasticity, and absence of multicollinearity and singularity, would increase the validity and generalization of the test statistics (DeMaris, 1992; Menard, 1995; Unrau &

Coleman, 1998). As a result, the data screening here would involve detecting and handling missing data and outliers, as well as important assumptions.

The SPSS Missing Values Analysis (MVA) was employed to detect the pattern and number of missing data, and the handling of those missing data would depend on the following criteria. Because there has been no consensus on how much missing data is tolerable for a given sample size, the most conservative way is to test the differences between cases with and without missing data. If the number of missing data was small and were randomly distributed, those cases with missing data were deleted. If the number of missing data was large and/or obvious patterns of missing data presented (i.e., concentration on certain variables or case groups), those missing data were preserved with appropriate adjustment (i.e., imputation) for other analyses, in order to avoid distortions of the study sample. Although the mean substitution would be the easiest adjustment for missing data, the expectation maximization method using NORM software would make better adjustments for missing data than the mean substitution approach (Tabachnick & Fidell, 2001).

On the basis of pairwise plots, the degree of linearity was evaluated. If such assumptions as normality, linearity, and/or homoscedasticity were violated, suitable data transformations were needed and then results of data transformation had to be rechecked. Moreover, the regression function of SPSS was used to identify possible multivariate outliers (by checking Mahalanobis distances) and influential cases, and to investigate the degree of multicollinearity and singularity on the basis of tolerance values of variables.

Identified outliers, especially those multivariate outliers, were explored to see what reasons led the cases to be outliers. If the outlying cases could be identified as not

belonging to the intended study population, these cases were deleted. On the other hand, if no specific reasons explained the formation of those outliers, those cases were kept and described in the study.

After finishing the data screening, descriptive analyses were performed to obtain basic information on the study populations and variables in the model. As the dependent variable has three categories, the analytical methods include a Chi-square test for categorical variables, and both analysis of variance (ANOVA) and analysis of covariance (ANCOVA) tests for continuous variables. The use of ANCOVA detects the differences in means among groups (here freestanding vs. health care network affiliation vs. health care system affiliation) on proposed predictors, with the removal of moderating effects of control variable (here hospital setting). In addition, the ANCOVA also produces mean plots that show the trends of means of predictors among groups. Although the results of ANCOVA were not related to testing hypotheses, they can reveal some useful information (unavailable from the multinomial logistic regression) on understanding the sample population and help the interpretation of study results. These statistical analyses were run for total cases.

For examining which predictors are critical to a hospital's strategic decision on affiliation choice, multinomial logistic regression models in SPSS were applied for the final sample population. Studies (Steyerberg et al. 2000; Tabachnick & Fidell, 2001) indicated that the stepwise procedure in regression models would probably fail to include some significant predictors and have worse predicting power than the full model procedure. However, in order to increase the power of the study, all control and independent vari-

ables were included in multinomial logistic regression models, but the stepwise approach was applied to verify and include those significant interaction terms in the final mode.

CHAPTER 4

ANALYTICAL RESULTS

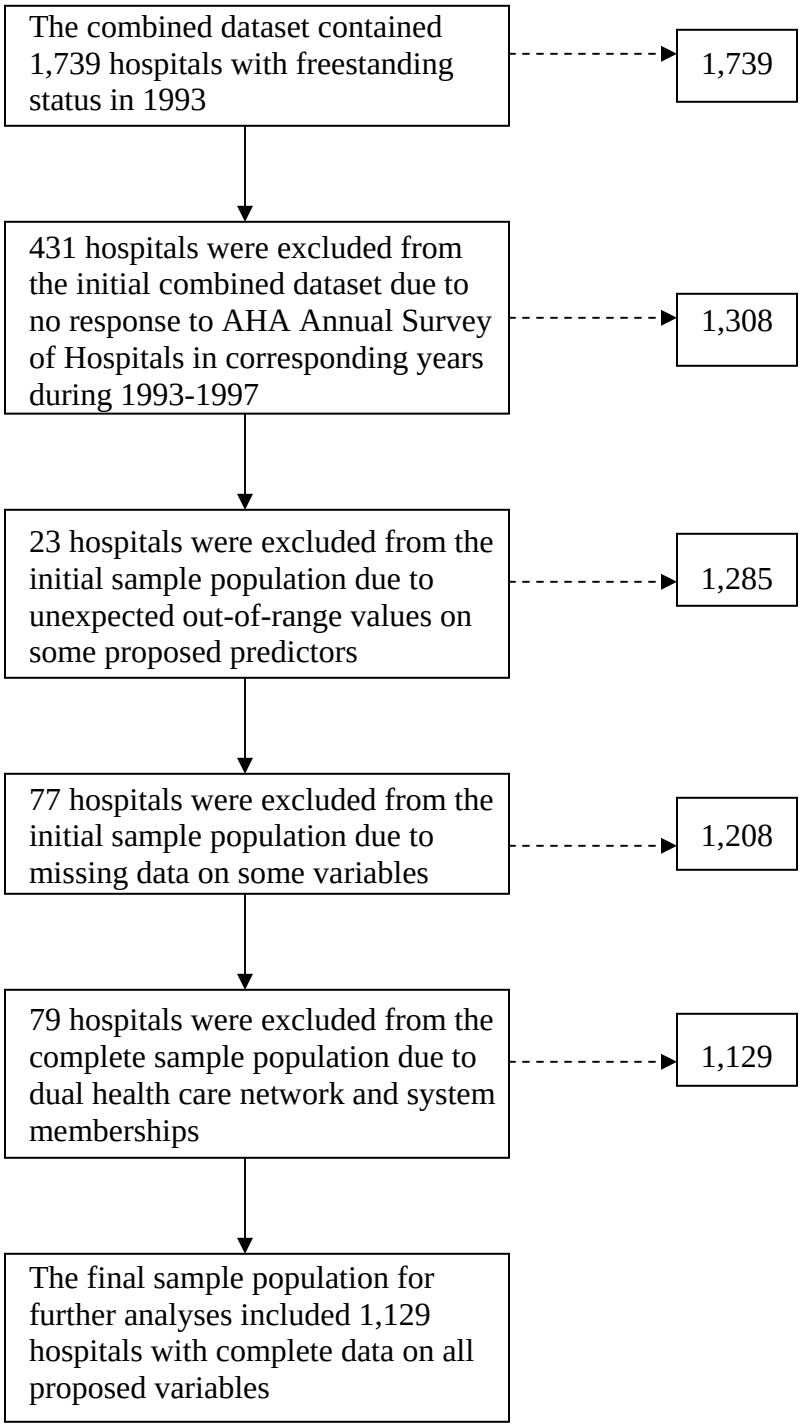
This chapter delineates the findings of the statistical analyses of the study sample population using the procedures proposed in the methodology chapter, and includes four major sections. First, the process and evidence for selecting the final sample population for this study are discussed. Second, the characteristics of the study sample population, including all proposed variables, are described. Next, the key assumptions of logistic regression are examined and discussed. Finally, the statistics of multinomial logistic regressions are presented, and the support for the proposed hypotheses is analyzed.

The Process of Sample Selection

The main logic of the sample selection process was to ensure the reasonability, accuracy, and appropriateness of the data used for the analyses in the present study. Specifically, this process (Figure 3) included the exclusion of hospitals without self-reported data on organizational variables, the check and correction of unreasonable data, the examination of missing data, the analysis and exclusion of hospitals with dual health care network and system memberships, and the exclusion of influential cases if they existed.

Because the sample population encompassed data mainly from the AHA Annual Survey of Hospitals and ARF, it is necessary to check if those AHA data were actually reported by hospitals. This is because the AHA usually uses the last available information

Figure 3. Flow chart of sample selection process



for those nonrespondent hospitals on many surveyed facility questions, such as organizational structure (here, the affiliation type and the number of hospital beds). This can be demonstrated by those nonrespondent hospitals still with data on many variables in the nonresponding year.

Therefore, without the exclusion of those nonrespondent hospitals during the 1993-1997 study period, the consistence and accuracy of the sample data would be questionable, and the analytical results could also be biased and misleading. Although the combined dataset initially contained 1,739 hospitals with freestanding status in 1993, it involved 431 hospitals that did not respond to the AHA Annual Survey of Hospitals in the corresponding data collection years of 1993-1997. Consequently, after the exclusion of those 431 nonrespondent hospitals, the initial sample dropped to 1,308 hospitals.

After examining the descriptive statistics of all proposed variables in the sample of 1,308 hospitals, there were 23 cases with unexpected out-of-range values on two variables, including the variable of HMO penetration rate (20 cases) and the variable of occupancy rate (3 cases). Because the data associated with these two variables were derived from two secondary datasets (ARF and AHA), it is impossible to determine why those out-of-range values were coded and then correct them reasonably. In order to maintain the accuracy of the sample data, the most appropriate approach was the deletion of those 23 cases with implausible values on the two variables mentioned. As a result, the sample population dropped further, to 1,285 hospitals.

Except for those out-of-range values, the problem of missing data was also encountered in this study. According to descriptive statistics, there were 77 hospitals with missing data; specifically, 8 hospitals had no data on hospital setting and related envi-

ronmental variables, 8 hospitals lacked information on nursing home competition, 60 hospitals had missing data on community orientation, and 1 hospital had no data on both the nursing home competition and community orientation variables. Because the seriousness of missing data depends in large part on the pattern, the amount, and the reason for the missing data, a further analysis of the missing data is necessary in deciding an appropriate method of handling them (i.e., deletion vs. imputation).

The possible explanation for those eight cases with missing data on hospital setting is the inconsistent hospital identification number coded in the ARF dataset. This can be confirmed by the lack of data on all environmental variables extracted from the ARF dataset for those eight hospitals. Because there is no cue for correcting this problem of missing data on hospital setting, and the percentage of missing data on this variable is very small (less than 1%), the most suitable approach was to delete those eight hospitals.

Table 2 shows the distribution of hospitals with missing data on independent variables. Taking a close look at the distribution of missing data, the most interesting thing was the concentration of hospitals without community orientation data in 1993. The reason for this may be that AHA began to collect the community orientation information in 1993; consequently, many hospitals probably forgot to provide the information or just did not know how to answer the survey questions. Other numbers in Table 2 do not help explain why those 61 hospitals had missing community orientation data.

The SPSS MVA was applied in this study to investigate the patterns of missing data, and the summary of MVA outputs is presented in Appendix B. Building on Appendix B, Table 3 reveals that the fact that nursing home competition data was missing was not related to other independent variables, while considering the adjusted significance α

Table 2. The distribution of missing data on independent variables

	Nursing Home Competition	Community Orientation
	n	n
Total hospitals with missing data	9	61
Year with missing data		
1993	2	54
1994	0	5
1995	0	0
1996	7	2
Types of hospitals with missing data		
Freestanding	7	2
Health care networks	0	15
Health care systems	1	39
Health care networks and systems	1	5
Location of hospitals with missing data		
Rural areas	3	21
Urban areas	6	40

Table 3. t-Tests of missing data on independent variables

	Nursing Home Competition			Community Orientation		
Independent Variable	$Mean_{NM}$	$Mean_{M}$	*p*-value	$Mean_{NM}$	$Mean_{M}$	*p*-value
Unemployment rate	6.190	10.089	.034	6.151	7.551	.000***
# Specialists	1.072	2.259	.047	1.083	1.020	.573
% Aged population	.144	.123	.130	.143	.152	.173
HMO penetration rate	.093	.185	.156	.093	.106	.634
Hospital competition	.520	.474	.789	.522	.469	.315
Nursing home competition	.252	n/a	n/a	.251	.290	.286
# Hospital beds	174.98	184.78	.849	175.85	159.10	.474
# RNs	.909	1.251	.090	.923	.681	.000***
Occupancy rate	.570	.631	.430	.573	.529	.093
Community orientation	.670	.611	.636	.670	n/a	n/a

*** $p < .006$ (adjusted significance level at original $\alpha = .05$)

Note: $Mean_{NM}$ is the mean of those cases without missing data, and $Mean_{M}$ is the mean of those cases with missing data. The adjustment for the original significance level ($\alpha = .05$) is required to prevent the family-wise Type I error for the 9 t-tests for each independent variable with missing data.

level. However, the absence of community orientation data was significantly associated with the unemployment rate and the number of registered nurses. Moreover, the Little's MCAR test of MVA (shown under the EM Correlations table in Appendix B) indicated that the missing pattern was not random. Namely, there was a significant deviation from a completely random pattern of missing data in the study sample.

Considering these statistics, we decided to exclude those hospitals with missing data on nursing home competition and community orientation from the sample population for the following reasons. First, no imputation method is appropriate for application in this study. Because the expectation maximization method can only be applied to random missing data, it was not suitable for this study's nonrandom missing data. The important predictors of those two variables with missing data are unknown and are also probably unavailable in the dataset; thus, it was impossible to use the regression method to impute those missing data. Although the group means could be used to replace the missing data, the mean substitution method would cause other problems, such as spuriously large differences among groups. Second, as mentioned before, the missing data on community orientation could be attributed to certain unpredictable reasons, such as forgetfulness or unfamiliarity with the new survey on community orientation. Third, compared to the sample size, the numbers of missing data on nursing home competition and community orientation were relatively small (about 0.7% and 4.7%, respectively).

Therefore, the sample population with complete data on all proposed variables decreased from 1,285 to 1,208 hospitals. In addition, the deletion of nonrandom missing data could influence the generalizability of the study results.

From the theoretical perspective, as discussed previously, those hospitals with dual memberships (both network and system affiliation) were excluded from the sample. As a result, the sample population dropped to 1,129 hospitals. However, Table 4 and 5 indicate that those dual-membership hospitals were more likely to be located in urban

Table 4. Comparison of hospital setting between hospitals with dual membership and other hospitals

	Dual-Membership Hospitals (n = 79)		Other Hospitals (n = 1,129)		*p*-value
Variable	n	%	n	%	
Hospital setting					.009**
Rural areas	16	20.3%	390	34.5%	
Urban areas	63	79.7%	739	65.5%	

* $p < .05$; ** $p < .01$

Table 5. Comparisons of independent variables between hospitals with dual membership and other hospitals

	Dual-Membership Hospitals (n = 79)		Other Hospitals (n = 1,129)		*F*-value
Independent Variable	Mean	S.D.	Mean	S.D.	
Unemployment rate	5.901	1.885	6.139	2.643	.619
# Specialists	1.456	.992	1.050	.793	18.694**
% Aged population	.139	.034	.143	.038	1.039
HMO penetration rate	.173	.250	.087	.194	13.904**
Hospital competition	.371	.383	.533	.406	11.908**
Nursing home competition	.174	.207	.256	.247	8.312**
# Hospital beds	275.03	233.51	168.78	143.84	6.431**
# RNs	.914	.379	.920	.460	.014
Occupancy rate	.604	.171	.570	.174	2.837
Community orientation	.677	.306	.670	.296	.050

* $p < .05$; ** $p < .01$

areas and were significantly different from other sample hospitals in five proposed variables, including four environmental factors (number of specialists, HMO penetration rate, hospital competition, and nursing competition) and one organizational factor (number of hospital beds).

In addition, the results of the ANOVA's post hoc analysis (Table 6) reveal that those hospitals with dual membership had significant differences with both freestanding

Table 6. Comparisons of independent variable's means for four hospital affiliation choices

N = 1,208	Post Hoc Analysis (ANOVA)		
Independent Variable	MD_{NS-FS}	MD_{NS-N}	MD_{NS-S}
Unemployment rate	-.017	-.383	-.489
# Specialists	.538**	.418**	.140
% Aged population	-.006	-.005	-.001
HMO penetration rate	.088**	.112**	.052
Hospital competition	-.204**	-.184**	-.058
Nursing home competition	-.097**	-.098**	-.035
# Hospital beds	143.480**	89.440**	55.000*
# RNs	.022	.014	-.084
Occupancy rate	.061	.022	-.003
Community orientation	-.035	.060	.028

* $p < .05$; ** $p < .01$

Note: MD_{NS-FS} is the difference in means between hospitals with dual membership and freestanding hospitals. MD_{NS-N} is the difference in means between hospitals with dual membership and network-affiliated hospitals. MD_{NS-S} is the difference in means between hospitals with dual membership and system-affiliated hospitals.

and network-affiliated hospitals in five variables, but were similar to hospitals with system affiliation, except for one variable. After eliminating the moderating effects of hospital setting, these results were also found in the ANCOVA's post hoc analysis. This situation is in accordance with the reality that many national or regional health care system hospitals will also join local health care networks. Therefore, from the statistical perspec-

tive, the exclusion of those dual-membership hospitals may weaken the analytical results of the model and even lead to biased conclusions.

The last step of the sample selection was to investigate and correct the existence of influential cases. Compared to outliers, influential cases cause more serious problems on data analysis, because they tend to have significant impacts on the model fit and related coefficients. Cook's distance from binary logistic regression was used to determine if there was any hospital suspected to have great influence on model statistics, and the results showed that there was no influential case in the remaining sample population. Consequently, the final sample contained only 1,129 hospitals to test the conceptual model and proposed hypotheses.

Descriptive Statistics of Sample Populations

Before testing the theoretical model and hypotheses, this section describes the characteristics of the sample populations and examines the basic information on all variables used in the study.

Table 7 shows the numbers of survey-respondent freestanding hospitals that changed their affiliation status during the period 1993-1997. At the end of 1997, 755 hospitals (about 57.7%) changed their freestanding status to other affiliation types, including 346 hospitals to health care networks, 324 hospitals to health care systems, and 85 hospitals to dual network/system membership. Although the cumulative growth curves of health care network- and system-affiliated hospitals were very similar (Figure 4), the curves of affiliation rate were different for health care network and system affiliation.

Figure 5 implies a continuously decreasing affiliation rate for health care networks, but an increased affiliation rate for health care systems since 1996.

Table 7. Numbers of freestanding hospitals with affiliation status changes

Year	Freestanding	Health Care Networks	Health Care Systems	Health Care Networks/Systems
1993	1,308	0	0	0
1994	976	137	153	42
1995	785	106	72	13
1996	665	63	42	15
1997	553	40	57	15

The characteristics of the final sample population and all variables are described in Table 8. The final sample contains 1,129 hospitals, with three types of affiliation status; 527 hospitals (46.7%) were freestanding, 326 hospitals (28.9%) were affiliated with health care networks, and 276 hospitals (24.4%) joined health care systems. In addition, two thirds of the sample hospitals were located in urban areas and were significantly different from their rural counterparts in almost all environmental and organizational factors (Table 9). Specifically, urban hospitals, as expected, were more likely to have munificent environmental resources, to operate in competitive environments, and to possess more organizational resources. Moreover, the values of all independent variables were not normally distributed, with significantly large skewness and kurtosis.

The histograms and expected normal probability plots (or P-P plots) in Appendix C also confirm the significant deviation from normal distribution for many independent variables, especially for those environmental uncertainty indicators and the variable "number of hospital beds." Although the normality of independent variables is not re-

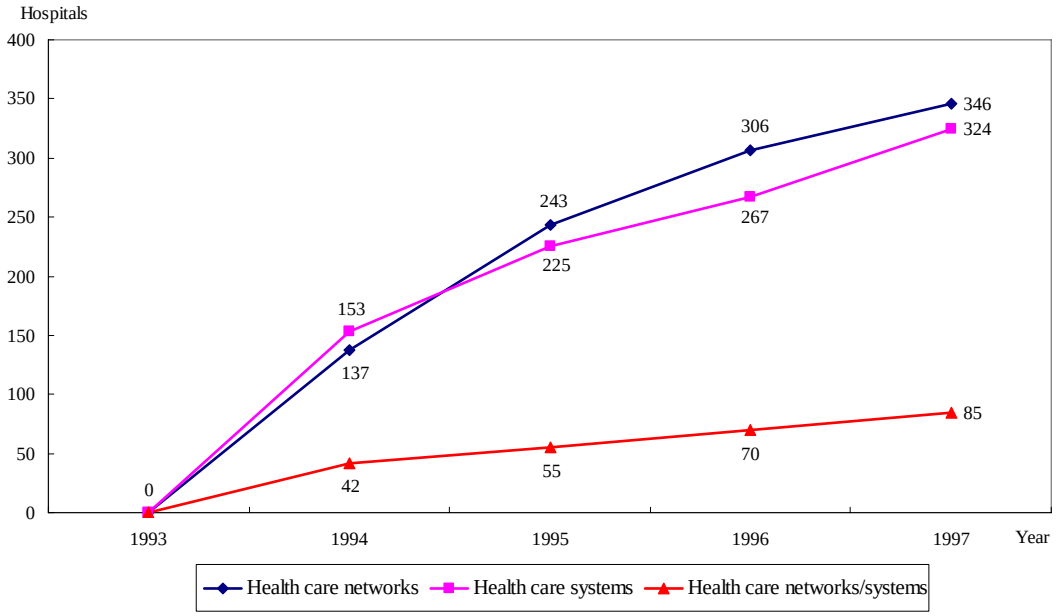


Figure 4. Changes in affiliation types for initial freestanding hospitals
Note: N = 1,308

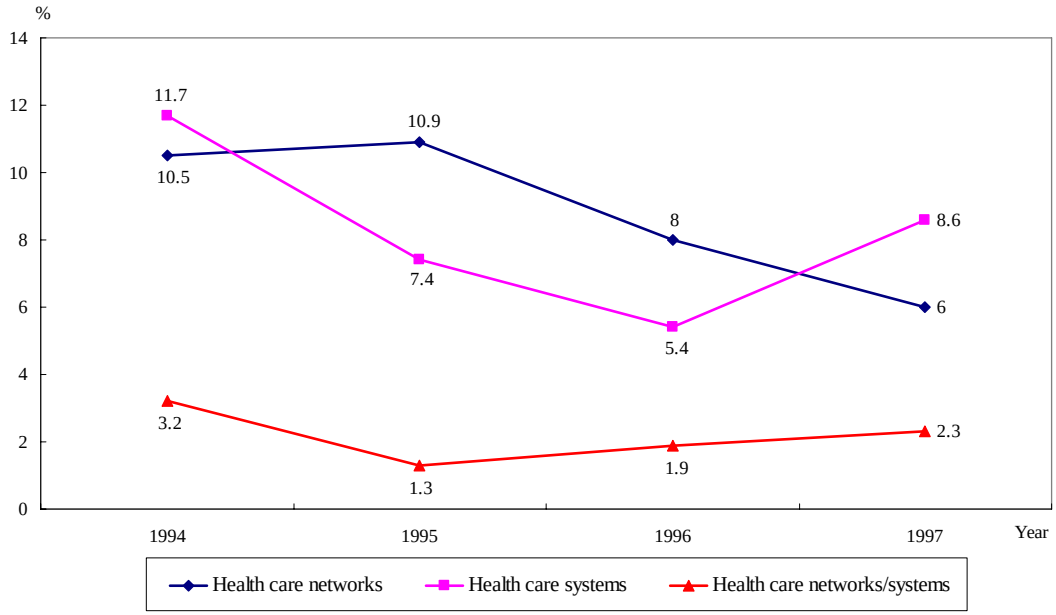


Figure 5. Percentage of freestanding hospitals changed in affiliation types

Table 8. Descriptive statistics for the final sample (N = 1,129) and all variables

Variable	n	%	Mean	S.D.	Min	Max	Skewness§	Kurtosis§
Affiliation Choice								
Freestanding	527	46.7						
Health care networks	326	28.9						
Health care systems	276	24.4						
Hospital setting								
Rural areas	390	34.5						
Urban areas	739	65.5						
Unemployment rate			6.139	2.643	1.50	31.00	25.699**	61.834**
# Specialists			1.050	.793	.00	4.81	17.384**	16.179**
% Aged population			.143	.038	.04	.33	13.151**	18.076**
HMO penetration rate			.087	.194	.00	.99	34.808**	42.834**
Hospital competition			.533	.406	.00	1.00	.425	-11.614**
Nursing home competition			.256	.247	.00	1.00	21.301**	14.703**
# Hospital beds			168.8	143.8	9	1027	25.836**	33.455**
# RNs			.920	.460	.02	5.41	22.192**	68.593**
Occupancy rate			.570	.174	.09	1.00	-3.630**	-2.034
Community orientation			.670	.296	.00	1.00	-7.548**	-5.200**

** Significant at $\alpha = .01$

Note: § indicates the standardized *z* scores.

quired for multinomial logistic regression, the violation of normality results in the choice of Spearman correlation to measure bivariate relationships among independent variables. Additionally, Appendix C shows that there were over 800 hospitals with the HMO penetration rate of 0, and over 400 hospitals were the single hospital (HHI = 1) in their counties. This situation of so many cases with such extreme values needed to be taken into account in interpreting the final results.

Table 9. Comparisons of independent variable's means for hospital setting

N = 1,129	Rural Areas	Urban Areas	*F*-value
Independent Variable	Mean	Mean	
Unemployment rate	6.266	6.073	1.37
# Specialists	.495	1.343	394.53**
% Aged population	.164	.133	197.70**
HMO penetration rate	.002	.132	127.61**
Hospital competition	.843	.369	503.07**
Nursing home competition	.461	.148	638.11**
# Hospital beds	85.680	212.630	241.17**
# RNs	.719	1.027	127.31**
Occupancy rate	.527	.593	37.74**
Community orientation	.630	.690	10.58**

* $p < .05$; ** $p < .01$

The statistics of association between all variables in this study are presented in Table 10. Because hospital affiliation choice and hospital setting are categorical variables, the absolute values of Eta (η) were calculated to measure their strength of association to independent variables. Statistically, η^2 is the ratio of the sum of variance between groups to the total sum of variance, so the absolute value of Eta (η) can be used to indicate the association of a categorical variable to a continuous variable. In addition, the Phi coefficient, which is a modification of the chi-square statistic for measuring the association be-

Table 10. Association and correlations among all variables

	1§	2§	3	4	5	6	7	8	9	10	11	12
Dependent Variable												
1. Affiliation Choice	1											
Control Variable												
2. Hospital setting	.17£*	1										
Independent Variable												
3. Unemployment rate	.08*	.03	1									
4. # Specialists	.20*	.51*	-.02	1								
5. % Aged population	.06	.39*	.09*	-.26*	1							
6. HMO penetration rate	.11*	.32*	-.10*	.61*	-.31*	1						
7. Hospital competition	.15*	.56*	-.06	-.64*	.24*	-.63*	1					
8. Nursing home competition	.11*	.60*	-.02	-.66*	.25*	-.64*	.79*	1				
9. # Hospital beds	.26*	.42*	.09*	.61*	-.22*	.38*	-.35*	-.50*	1			
10. # RNs	.10*	.32*	-.07*	.39*	-.24*	.21*	-.20*	-.31*	.20*	1		
11. Occupancy rate	.15*	.18*	.08*	.29*	-.02	.18*	-.14*	-.18*	.50*	.11*	1	
12. Community orientation	.14*	.10*	-.10*	.10*	-.05	.05	-.01	-.06	.15*	.12*	.10*	1

* $p < .05$

Note: § means the association coefficient (Eta, η) between categorical variable (hospital affiliation choice & hospital setting) and continuous independent variables. $\eta^2 = SS_{between}/SS_{total}$.

£ indicates the Phi coefficient of the association between hospital affiliation choice and hospital setting (Chi-Square test).

tween nominal variables, was used to examine the association between those two categorical variables. The bivariate correlations among independent variables were expressed by Spearman correlation coefficients. Basically, the Spearman correlation is simply the Pearson correlation when the data are ordinal values or are not normally distributed.

As shown in Table 10, not only was hospital affiliation choice significantly associated with hospital setting, but it also had significant association with most independent variables, except for the percentage of aged population. Similarly, in addition to the unemployment rate, hospital setting was significantly associated with other independent variables. Therefore, it was logical to apply hospital setting as a control variable in this study. Most of the bivariate correlation coefficients were significant and reasonable. There was no extremely large correlation ($r > .9$) in the correlation matrix, and only a few correlations greater than .6 were observed. Moreover, those large correlations mainly happened among the number of specialists and environmental uncertainty indicators and could be attributed to the effect of hospital setting. The problem of multicollinearity or singularity could thus be very small if it really exists.

Both Table 11 and 12 present the differences among hospital affiliation status in hospital setting and independent variables in the study. The area distribution of hospitals

Table 11. Distribution of hospital affiliation choices in rural and urban areas

	Hospital Affiliation Choice			Total
	Freestanding	Health Care Network	Health Care System	
Hospital setting				
Rural areas	219 (41.6%)	112 (34.4%)	59 (21.4%)	390 (34.5%)
Urban areas	308 (58.4%)	214 (65.6%)	217 (78.6%)	739 (65.5%)
Total	527 (46.7%)	326 (28.9%)	276 (24.4%)	1,129

Table 12. ANCOVA of independent variables in regard to hospital affiliation choice and hospital setting

Independent Variable	*F*-value	Post Hoc Analysis		
		MD_{N-FS}	MD_{S-FS}	MD_{N-S}
Unemployment rate	4.197 (main effect)*	.366	.471*	-.106
	1.207 (interaction effect)			
# Specialists	4.327 (main effect)*	.120*	.398**	-.278**
	3.043 (interaction effect)*			
% Aged population	.156 (main effect)	-.001	-.005	.004
	1.466 (interaction effect)			
HMO penetration rate	4.818 (main effect)**	-.024	.036*	-.059**
	2.069 (interaction effect)			
Hospital competition	.078 (main effect)	-.020	-.146**	.126**
	6.479 (interaction effect)**			
Nursing home competition	1.864 (main effect)	.002	-.061**	.063**
	3.255 (interaction effect)*			
# Hospital beds	14.111 (main effect)**	54.040**	88.480**	-34.440**
	9.922 (interaction effect)**			
# RNs	1.438 (main effect)	.007	.105**	-.098*
	.356 (interaction effect)			
Occupancy rate	4.315 (main effect)*	.040**	.064**	-.024
	5.469 (interaction effect)**			
Community orientation	13.394 (main effect)**	-.094**	-.062**	-.032
	.946 (interaction effect)			

* $p < .05$; ** $p < .01$

Note: MD_{N-FS} is the difference in means between network-affiliated hospitals and freestanding hospitals. MD_{S-FS} is the difference in means between system-affiliated hospitals and freestanding hospitals. MD_{N-S} is the difference in means between network-affiliated hospitals and system-affiliated hospitals.

Note: Main effect indicates the effect of hospital affiliation choice on the means of independent variables. Interaction effect indicates the effect of hospital setting on the means of independent variables.

was significantly different for hospital affiliation status. Namely, hospitals with network or system affiliation were more likely to operate in urban areas. Specifically, the ratio of urban hospitals to rural hospitals increased from 1.41 for freestanding hospitals to 1.91 for network hospitals, and to 3.68 for system hospitals. This implied that urban hospitals would be the most likely to join health care systems, and it was also in accordance with previous research findings.

The ANCOVA was applied to detect and remove the influences of hospital setting on the relationships of hospital affiliation choice to environmental and organizational factors, and the results were presented in Table 11. The interaction effects indicated that the distribution of five variables among hospital affiliation types was significantly different in regard to hospital setting. Such interaction effects seemed to be the greatest for hospital competition and nursing home competition, because they caused significant difference in the means of those two variables among hospital affiliation types.

After the effects of hospital setting were removed, hospital affiliation choice was significantly related to six predictors in this study. Specifically, hospital affiliation types had significantly different means in unemployment rate, number of specialists, HMO penetration rate, number of hospital beds, occupancy rate, and community orientation. The post hoc analysis revealed which groups of hospital affiliation contributed to those significant differences in means of independent variables. In comparison with freestanding hospitals, network hospitals were more likely to locate in counties with more specialists, had more hospital beds and higher occupancy rates, and were less community oriented. Network hospitals were significantly different from system hospitals in two environmental situations (fewer specialty physicians and lower HMO penetration rates) and

in two organizational features (smaller numbers of hospital beds and registered nurses). Moreover, compared to freestanding counterparts, system-affiliated hospitals not only were more likely to operate in environments with fewer resources and higher uncertainty, but also had more organizational resources (except for being less community oriented).

Tests for Multivariate Outliers, Multicollinearity, and Linearity in the Logit

Prior to testing the proposed model and hypotheses using multinomial logistic regression, it was necessary to determine if several important assumptions of logistic regression were met. This section discusses the process and results of those determinations, including the absence of multivariate outliers and multicollinearity, and the linearity in the logit.

Instead of checking univariate outliers, Mahalanobis distance in linear regression was examined to detect those multivariate outliers. There was a total of 60 hospitals with unexpected outlying distance from the multivariate centroid of the study sample, and the characteristics of those multivariate outliers are summarized in Table 13. The multivariate outliers seemed to distribute evenly among hospital affiliation types, but had significantly different distribution for hospital setting. Specifically, they were more likely to operate in rural areas. In addition, Table 13 also indicates that multivariate outliers were significantly different from the nonoutlying sample population in all predictors, except for unemployment rate, occupancy rate, and community orientation.

Although those multivariate outliers were significantly different from nonoutlying hospitals, they were included in the final sample population. This decision was attributed to two major reasons. First, the multivariate outliers were not serious enough to be influ-

Table 13. Comparisons between multivariate outliers and nonoutlying sample population

	n		Chi-Square	Mean		*F*-value
Variable	Multivariate Outliers	Non-Outliers		Multivariate Outliers	Non-Outliers	
Hospital Affiliation Choice			.371			
Freestanding	28	499				
Health care networks	19	307				
Health care systems	13	263				
Hospital setting			4.119*			
Rural areas	28	362				
Urban areas	32	707				
Unemployment rate				6.328	6.129	.324
# Specialists				1.725	1.012	47.851**
% Aged population				.160	.142	12.500**
HMO penetration rate				.238	.078	39.729**
Hospital competition				.390	.541	7.960**
Nursing home competition				.333	.252	6.254*
# Hospital beds				214.780	166.190	6.514*
# RNs				1.209	.904	25.424**
Occupancy rate				.606	.568	2.680
Community orientation				.698	.668	.595

* $p < .05$; ** $p < .01$

ential cases. Second, the existence of outlying cases is normal in the real world, so the exclusion of those noninfluential outliers will reduce the generalizability of the study results. However, a remedy for the inclusion of multivariate outliers was proposed, and it was to perform a sensitivity analysis of the differences in the results of multinomial logistic regression on the sample with and without those multivariate outliers.

Multicollinearity was evaluated by scrutinizing the statistics of tolerance, condition index, and variance proportions from linear regression on those variables used in the final model. According to the criterion of condition index and variance proportions, there was no multicollinearity problem. However, from the tolerance perspective, hospital setting (.052) and the interaction of hospital setting by occupancy rate (.070) seemed to be problematic, because their tolerance values were smaller than .10. Although some scholars suggest that the criterion of tolerance is .10, other researchers (Tabachnick & Fidell, 2001) recommend .01 to .001 as the tolerance criterion. Therefore, it was believed that the multicollinearity problem would not be serious and could be ignored. Namely, the assumption of the absence of multicollinearity was not violated in this study.

By using the Box-Tidwell approach (Hosmer & Lemeshow, 2000), we examined whether there was a linear relationship between the logarithm of odds ratios and studied predictors. The results in Appendix D indicate that the assumption of the linearity in the logit was not violated under the adjusted significance level (.002). Consequently, it was appropriate to apply multinomial logistic regression in this study.

Model Estimates and Testing for Hypotheses

This section focuses on delineating and interpreting the statistical results of multinomial logistic regression for the theoretical model, and on examining if the proposed hypotheses are supported by the empirical data. For answering the research questions of this study, the fit between the proposed model and the data is discussed first, the description of individual effects of environmental and organizational variables follows, and the interaction effects of hospital setting are explained last. Finally, a sensitivity analysis of the differences in the analytical results of the model using the sample with and without multivariate outliers is performed.

Statistics of Model Fit and Classification Ability

Table 14 summarizes the log-likelihood statistics for the full model (Model 1) of the relationship between hospital affiliation choice and all proposed variables, including a control variable, ten environmental and organizational predictors, and two interaction terms. Although the strength of the proposed relationship in Model 1 was not impressive with $R^2_N = .171$, the goodness-of-fit statistics indicated that this full model is an acceptable model, with $p = .636$ by the Deviance criterion. Using $\alpha = .05$ as the criterion, the log-likelihood ratio test (referred to $X^2_{reduced}$) showed that there were eight statistically significant predictors in this full model. Specifically, these significant factors included five variables (number of specialists, HMO penetration rate, nursing home competition, number of hospital size, and community orientation) with direct effects, and two variables (hospital competition and occupancy rate) with interaction effects, and one control variable (hospital setting) with direct effect.

Table 14. Summary of the statistics of model fit for the full model (Model 1)

N = 1,129	Model 1	$X^2_{reduced}$	*df*
X^2_{total} (*df*)	184.259 (26)*		
Deviance	.636		
R^2_{CS} (R^2_N)	.151 (.171)		
Location		9.394*	2
Environmental Munificence		10.341§	6
Unemployment rate		4.179	2
# Specialists		7.027*	2
% Aged population		.086	2
Environmental Uncertainty		36.355£*	8
HMO penetration rate		12.444***	2
HospHHI		.000	0
Nursing home competition		6.701*	2
Location*HospHHI		11.941***	2
Organizational Resources		90.670Ψ*	10
# Hospital beds		32.012***	2
# RNs		1.745	2
Occupancy		.000	0
Community orientation		34.343***	2
Location*Occupancy		8.189*	2

* $p < .05$; *** $p < .004$ (adjustment at $\alpha = .05$)

Note: R^2_{CS} (by Cox and Snell) and R^2_N (by Nagelkerke) indicate pseudo R-square. Location means hospital setting, HospHHI means hospital competition, and Occupancy means occupancy rate.

Note: § indicates the improvement in the chi-square value due to the addition of environmental munificence variables, and is equal to the difference between X^2_{total} (26) and X^2_{EU+OR} (20). £ indicates the improvement in the chi-square value due to the addition of environmental uncertainty variables, and is equal to the difference between X^2_{total} (26) and X^2_{EM+OR} (18). Ψ indicates the improvement in the chi-square value due to the addition of variables of organizational resources, and is equal to the difference between X^2_{total} (26) and X^2_{EM+EU} (16).

Note: X^2_{EU+OR} (20) is the chi-square value of multinomial logistic regression on hospital setting, environmental uncertainty variables, variables of organizational resources, and two interaction effects (including Location*HospHHI and Location*Occupancy). X^2_{EM+OR} (18) is the chi-square value of multinomial logistic regression on hospital setting, environmental munificence variables, variables of organizational resources, and one interaction effect (Location*Occupancy). X^2_{EM+EU} (16) is the chi-square value of multinomial logistic regression on hospital setting, environmental munificence variables, environmental uncertainty variables, and one interaction effect (Location*HospHHI).

In addition, Table 14 also indicates the group effects of the proposed environmental and organizational dimensions on predicting hospital affiliation choice. Generally speaking, the dimension of organizational resources could make the largest improvement in predicting hospital affiliation choice, with the $X^2_{reduced}$ (10) = 90.670, and such improvement was statistically significant at a level of α = .05 level. Moreover, the dimension of environmental uncertainty also had the significantly predictive improvement, with the $X^2_{reduced}$ (8) = 36.355. However, the dimension of environmental munificence could not significantly improve the prediction of hospital affiliation choice, because its $X^2_{reduced}$ (6) = 10.341 was smaller than $X^2_{(\alpha=.05;\ df=6)}$ = 12.59.

The results of the models' correct prediction percentages of hospital affiliation choice are presented in Table 15. Overall, these models had an approximately 50% correct prediction for hospital affiliation choice, with the largest correct prediction rates for freestanding hospitals. Specifically, the proposed full model (Model 1) was overall suitable for predicting changes in hospital affiliation status, because it had the largest correct

Table 15. Percentages of correct prediction of hospital affiliation choice

N = 1,129	% Correct Prediction			
	Model 1	$Model_{EU+OR}$	$Model_{EM+OR}$	$Model_{EM+EU}$
Freestanding	84.4	83.9	87.1	88.2
Health care networks	20.9	21.5	18.1	5.8
Health care systems	27.5	23.9	27.5	19.2
Overall	52.2	51.2	52.6	47.6

Note: $Model_{EU+OR}$ is the multinomial logistic regression on hospital setting, environmental uncertainty variables, variables of organizational resources, and two interaction effects (including hospital setting*hospital competition and hospital setting*occupancy rate).
$Model_{EM+OR}$ is the multinomial logistic regression on hospital setting, environmental munificence variables, variables of organizational resources, and one interaction effect (hospital setting*occupancy rate).
$Model_{EM+EU}$ is the multinomial logistic regression on hospital setting, environmental munificence variables, environmental uncertainty variables, and one interaction effect (hospital setting*hospital competition).

prediction rate for system affiliation, and the second largest correct prediction rates for network affiliation and overall prediction. Compared to the full model, $Model_{EM+EU}$ revealed that factors of organizational resources had the obvious improvement in predicting health care network or system affiliation, especially for correctly predicting health care network affiliation. Namely, the inclusion of the variables of organizational resources into $Model_{EM+EU}$ could improve the correct prediction rates for network affiliation (from 5.8% to 20.9%), system affiliation (from 19.2% to 27.5%), and overall prediction (from 47.6% to 52.2%). In addition, $Model_{EU+OR}$ showed that environmental munificence variables could improve the prediction of health care system affiliation (from 23.9% to 27.5%) and the overall prediction (from 51.2% to 52.2%). After all, $Model_{EM+OR}$ indicated that environmental uncertainty variables could only make a slight improvement in the prediction of network affiliation (from 18.1% to 20.9%).

Main Effects of Environmental Munificence

Environmental munificence was hypothesized to be overall negatively related to the probability of hospital affiliation with health care networks (H1) or systems (H2). Results of three variables (unemployment rate, number of specialists, and percentage of aged population) in Table 16 were used to examine these generalized negative relationships and six corresponding sub-hypotheses (H1a, H1b, H1c, H2a, H2b, and H2c). In fact, two environmental munificence indicators were statistically significant in predicting hospital affiliation choice.

Table 16 indicates that unemployment rate had positive β coefficients for both logit models of network vs. freestanding and system vs. freestanding, and a negative β

Table 16. Parameter estimates of multinomial logistic regression for the full model (N = 1,129)

Model 1	Network vs. Freestanding			System vs. Freestanding			Network vs. System	
Variable	Hypothesis	*β*	OR	Hypothesis	*β*	OR	*β*	OR
Intercept		-1.409*			-2.095***		.686	
[Location = 0]		1.852***	6.371		-.213	.808	2.065*	7.885
[Location = 1]		0			0		0	
Environmental Munificence	H1			H2				
Unemployment rate	H1a	.030	1.030	H2a	.062*	1.064	-.032	.968
# Specialists	H1b	.267	1.306	H2b	.376*	1.457	-.109	.896
% Aged population	H1c	-.628	.534	H2c	-.335	.715	-.292	.747
Environmental Uncertainty	H3			H4				
HMO penetration rate	H3a	-1.829***	.161	H4a	-1.122*	.326	-.707	.493
HospHHI	H3b	.225	1.253	H4b	-.466	.628	.691*	1.996
Nursing home competition	H3c	.977*	2.656	H4c	.921	2.512	.056	1.057
[Location = 0]*HospHHI		-1.222*	.295		1.204	3.333	-2.426***	.088
Organizational Resources	H5			H6				
# Hospital beds	H5a	.004***	1.004	H6a	.004***	1.004	.000	1.000
# RNs	H5b	-.094	.910	H6b	.174	1.190	-.268	.765
Occupancy	H5c	1.543*	4.679	H6c	1.639*	5.148	-.095	.909
Community orientation	H5d	-1.410***	.244	H6d	-1.120***	.326	-.290	.748
[Location = 0]*Occupancy		-2.174*	.114		-2.296*	.101	.122	1.130

* $p < .05$; *** $p < .004$ (adjustment at $\alpha = .05$)

Note: Location means hospital setting, HospHHI means hospital competition, and Occupancy means occupancy rate. OR means the odds ratio, and is equal to Exp(*β*). Network indicates health care networks, and System means health care systems.

coefficient for the logit model of network vs. system. Specifically, a one-unit increase in unemployment rate would make freestanding hospitals 3% (= (OR – 1) * 100%) and 6.4% more likely to affiliate, respectively, with health care networks and systems. In addition, it also indicates that a one-unit increase in unemployment rate would make hospitals 3.2% less likely to join health care networks, in comparison to health care systems. These β coefficients were not only in accordance with H1a and H2a, but also indicated that intermediate levels of unemployment rate would more likely make hospitals affiliate with health care networks. Because only $\beta = .062$ was statistically significant, H1a was not supported, but H2a was supported.

Table 16 shows that the number of specialists had, similar to the unemployment rate, positive β coefficients for both logit models of network vs. freestanding and system vs. freestanding, and a negative β coefficient for the logit model of network vs. system. Basically, a one-unit increase in the number of specialists would make freestanding hospitals 30.6% and 45.7% more likely to affiliate with health care networks and systems, respectively. In comparison with health care systems, hospitals tended to be 10.4% less likely to join health care networks, in the face of one more specialist per 1,000 county residents. Although the p value of $\beta = .267$ was .072 (< .10), H1b was not statistically significant. Thus, only H2b was significantly supported in the study.

The negative β coefficients of the aged population variable implied that if the percentage of a county's aged population increased one unit, freestanding hospitals would be 46.6% and 28.5% less likely to develop network and system affiliation, respectively. Compared to health care systems affiliation, hospitals were 25.3% less likely to affiliate with health care networks, in the face of a one-unit increase in the percentage of aged

population. An increased aged population would make hospitals more likely to keep their freestanding status, or to choose health care systems (rather than health care networks) for affiliation. Because these β coefficients were not statistically significant, there was no support for both H1c and H2c.

Because H2a and H2b were significantly supported in the study, the hypothesis (H2) of a overall negative relationship between environmental munificence and the probability of hospital affiliation with health care systems was partially supported. However, the proposed overall negative relationship between environmental munificence and the probability of hospital affiliation with health care networks (H1) was not supported. Although all of the β coefficients had the same prediction directions as the proposed hypotheses (except for H1c), only two of them were statistically significant; therefore, the generalized overall negative relationship between environmental munificence and hospital affiliation with health care networks or systems could not be inferred from this study.

Main Effects of Environmental Uncertainty

Environmental uncertainty was proposed to have an overall positive relationship with health care network affiliation (H3) and system affiliation (H4). The results of three variables (HMO penetration rate, hospital competition, and nursing home competition) in Table 16 were applied to test these two generalized positive relationships and six corresponding sub-hypotheses (H3a, H3b, H3c, H4a, H4b, and H4c). After all, all three indicators were demonstrated to have significant impacts on the prediction of hospital affiliation choice.

As shown in Table 14, the HMO penetration rate was found to be a significant predictor of hospital affiliation choice; however, Table 16 reveals further that the HMO penetration rate could make significant predictions for hospital affiliation with health care networks or systems. Specifically, a 1% increase in HMO penetration rate would make freestanding hospitals 83.9% and 67.45% less likely to join health care networks and systems, respectively. Although these two β coefficients were statistically significant, their prediction directions were opposite to what H3a and H4a proposed; consequently, these two hypotheses were not supported by the study. As expected, highly increased HMO penetration rate seemed to motivate hospitals to choose health care systems for affiliation, rather than health care networks (with β = -.707). However, this implied negative relationship did not reach the statistically significant level.

With regard to hospital competition, most of the results (Table 16) were statistically nonsignificant. The result (β = .225) showed that a one-unit increase in hospital competition index would make freestanding hospitals 25.3% more likely to affiliate with health care networks; namely, decreased hospital competition (here, increased hospital competition index) was related to an increased probability of health care network affiliation. This was opposite to what was proposed by H3b. The estimated negative β coefficient (-.466) implied that decreases in the hospital competition index (or increased hospital competition) would make freestanding hospitals more likely to join health care systems. However, these two estimated β coefficients were not statistically significant. In addition, compared to system affiliation, hospitals were 99.6% more likely to affiliate with health care networks when the hospital competition index increased one unit. This was in the same direction as implied in this study, and it was statistically significant. In

brief, H3b and H4b were not supported here, if the significant interaction effect of hospital setting was not taken into account.

The β coefficients for nursing home competition suggested that a one-unit increase in nursing home competition index would make freestanding hospitals 2.656 times and 2.512 times as likely to develop affiliation relationships with health care networks and systems, respectively. These results were the same as what H3c and H4c proposed. According to the significance level, H3c was significantly supported, but H4c was not supported, even though the $p = .059$ was slightly larger than the α level (= .05). Moreover, freestanding hospitals in environments with highly increased nursing home competition indices would be more likely to join health care networks than systems. This was opposite to what was implied in the study, and was not statistically significant.

Because H3c was significantly supported, the hypothesis (H3) of an overall positive relationship between environmental uncertainty and the probability of hospital affiliation with health care networks was partially supported. However, there was no support found for the proposed overall positive relationship between environmental uncertainty and the probability of hospital affiliation with health care systems (H4). Therefore, the proposed overall positive relationship between environmental uncertainty and hospital affiliation with health care networks or systems could not be inferred in the study.

Main Effects of Organizational Resources

Organizational resources were hypothesized to have overall positive relationships with health care network affiliation (H5) and system affiliation (H6). The results of four indicators (number of hospital beds, number of registered nurses, occupancy rate, and

community orientation) were evaluated to infer the two generalized overall positive relationships and to test those eight sub-hypotheses (H5a, H5b, H5c, H5d, H6a, H6b, H6c, and H6d). In sum, the number of hospital beds, occupancy rate, and community orientation were demonstrated to have the ability to make a significant prediction of hospital affiliation with health care networks or systems.

The results (Tables 14 and 16) demonstrated that hospital affiliation decisions were related to the number of hospital beds. Specifically, hospitals with 100 more beds would be 40% more likely to affiliate with health care networks or systems. Because both β coefficients (= .004) were statistically significant, H5a and H6a were strongly supported in this study. However, the "0" value of the third β coefficient implied that the number of hospital beds by itself cannot help hospitals make an affiliation choice between health care networks and systems.

According to the β coefficients in Table 16, increases in the number of RNs seemed to make freestanding hospitals more likely to join health care systems (same as H6b), but less likely to affiliate with health care networks (opposite to H5b). Namely, one more full-time-equivalent RN per acute care bed would make hospitals 19% more likely to join health care systems, but 9% less likely to join health care networks. In addition, the largely increased number of RNs could probably make hospitals more likely to affiliate with health care systems rather than health care networks. This result was similar to what was implied in this study. However, all of these β coefficients were statistically nonsignificant, thus H5b and H6b were not supported by the data.

The results of occupancy rate implied a relationship with hospital affiliation choice that was completely opposite to what was proposed in the study. Theoretically,

H5c and H6c proposed that increases in occupancy rate would reduce the likelihood of freestanding hospitals to develop affiliation relations. However, contrary to H5c and H6c, the β coefficients (Table 16) indicated that freestanding hospitals with higher occupancy rates would be more likely to affiliate with health care networks or systems. As a result, H5c and H6c were not supported at this moment, if the statistically significant interaction effect of hospital setting on occupancy rate was not taken into account. As expected, the result (β = -.095) indicated that the highly increased occupancy rate could probably make hospitals more likely to affiliate with health care systems than networks, but it was not statistically significant.

Tables 14 and 16 demonstrate that community orientation was a significant predictor of hospital affiliation choice in this study. However, the β coefficients revealed some contrary information for hypothesis testing. In other words, a one-unit increase in the degree of community orientation would make freestanding hospitals 75.6% and 67.4% less likely to affiliate with health care networks and systems, respectively. Because these coefficients were statistically significant, H5d was not supported, but H6d was supported by the sample population. In addition, the results also showed that hospitals with a higher degree of community orientation could be more likely to join health care systems than networks; however, this opposite result was statistically nonsignificant.

Because H5a was statistically supported, hypothesis 5 (H5) was partially supported. However, the generalized overall positive relationship between organizational resources and health care network affiliation could be questionable, because the results showed opposite prediction directions for H5b, H5c, and H5d. Similarly, hypothesis 6 (H6) was also partially supported, because both H6a and H6d were demonstrated to be

correct. Moreover, the generalized overall positive relationship between organizational resources and health care system affiliation could be inferred in the study. This is because the results showed the same predictive directions as all corresponding sub-hypotheses, except for H6c.

Interaction Effects

Although hospital setting was proposed to moderate the relationships between the predictors and hospital affiliation choice, only two interaction effects (hospital competition and occupancy rate) were statistically significant and retained within the full model using the Stepwise approach. The results (Table 16) indicated that hospital setting demonstrated statistically significant moderation of the relationships for hospital competition and occupancy rate on hospital affiliation choice.

Table 16 shows that the interaction effect of hospital competition had significant impacts on two logit models (network affiliation vs. freestanding and network affiliation vs. system affiliation), and these two significant interaction impacts were negative (β = -1.222 and β = -2.426). This suggests that a rural location tended to increase the effect of hospital competition on health care network affiliation. The statistically nonsignificant interaction effect of hospital competition with hospital setting and hospital competition main effect for the logit model (system vs. freestanding) indicates that hospital competition may not be associated with the health care system affiliation choice.

Similarly, the interaction of occupancy rate by hospital setting was found (Table 16) to have significant effects on two logit models (network affiliation vs. freestanding and system affiliation vs. freestanding), and these two significant interaction impacts

were also negative (β = -2.174 and β = -2.296). As with hospital competition, this indicates that a rural location tended to reduce the effect of occupancy rate on the decision to affiliate with a health care network or system. The statistically nonsignificant main effect of occupancy rate and interaction effect of occupancy rate with hospital setting for the logit model (network affiliation vs. system affiliation) suggests that occupancy rate may not affect the type of affiliation decision for either rural or urban institutions.

Ideally, a simple main effects analysis would be performed to specifically identify the differences in the relationship between hospital competition and occupancy rate on hospital affiliation choice for rural and urban institutions. However, Table 11 indicates that only 59 hospitals in rural areas changed their status from freestanding to health care system affiliation. Under the power consideration, it is inappropriate to run separate multinomial logistic regression for rural and urban hospitals. In summary, H3b, H4b, H5c, and H6c were all not supported in this study.

Sensitivity Analysis of Multivariate Outliers' Effects

In order to compensate for the violation of the outlier assumption, a sensitivity analysis was performed to investigate the effects of multivariate outliers on the statistical results of multinomial logistic regression. The same full model (Model 2) was run by multinomial logistic regression for the sample population without any multivariate outliers, and the statistical results are summarized in Appendix E.

In comparison with Model 1, Table E1 shows that there was an improvement in the model fit for Model 2 in terms of increased values of chi-square, deviance, and R^2_N. Such an improvement in model fit information was not a surprise, because many outlying

values were excluded. One variable, unemployment rate, was found to become statistically significant in Model 2; however, the original significant factor, nursing home competition, became statistically nonsignificant ($.05 < p < .10$).

After comparing Table E2 with Table 16, the exclusion of multivariate outliers caused several changes in the estimated parameters. For the logit model of health care network affiliation to freestanding, the number of specialists became a significant predictor (from $p = .072$ to $p = .016$), but nursing home competition became nonsignificant ($p = .063$). For the logit model of health care system affiliation to freestanding, the HMO penetration rate became nonsignificant ($p = .225$), but nursing home competition became a significant factor (from $p = .059$ to $p = .039$). In addition, the effect of the number of RNs became negative for predicting hospital affiliation with health care systems, but this change was not statistically significant. For the logit model of network affiliation to system affiliation, only one variable, HMO penetration rate, changed as a significant factor. However, the direction of three nonsignificant coefficients was found to be changed (including the percentage of aged population, nursing home competition, and interaction term of occupancy rate).

Although there were changes in the significance of some predictors, the overall influence of such changes could be tolerated due to the following reasons. First, the unemployment rate became a significant predictor from the perspective of model fit, but the direction and significance of β coefficients of this predictor were not changed. Second, for the logit model of health care network affiliation to freestanding, the significant β coefficient of the number of specialists was previously marginally significant ($p = .072$). Third, the β coefficients of nursing home competition were changed between marginally

significant and statistically significant. Last, the problem of many cases with the "0" value for HMO penetration rate probably reduced the influence of changed significance for the β coefficients of HMO penetration rate. Briefly, the exclusion of multivariate outliers did not influence the study's analytical results largely. Therefore, it is acceptable to use the sample population with multivariate outliers.

Summary of Results

In summary, three environmental factors (number of specialists, HMO penetration rate, and nursing home competition) and two organizational factors (number of hospital beds and community orientation) were found to be significantly related to hospital affiliation choice, from the perspective of model fit. Hospital setting not only had significant impacts on hospital affiliation choice, but also had moderating effects on the relationship between hospital affiliation choice and the environmental and organizational factors. At least, the relationships of hospital affiliation choice to both hospital competition and occupancy rate were found to be significantly different in rural and urban areas.

No support was found for five hypotheses (H1, H1a, H1b, H1c, and H2c) related to environmental munificence. Because H2a and H2b were significantly supported, H2 could be partially supported. In addition, the proposed overall negative relationship between environmental munificence and hospital affiliation with health care networks or systems could not be inferred in the study, because only H2a and H2b were supported.

Similarly, no support was found for six hypotheses (H3a, H3b, H4, H4a, H4b, and H4c) related to environmental uncertainty. Because H3c was significantly supported, H3 could be seen as partially supported. In addition, the proposed overall positive relation-

ship between environmental uncertainty and hospital affiliation with health care networks and systems found little support, because the directions of most β coefficients were opposite to what were proposed in the study.

Hypotheses 5 and 6 were partially supported by the present study, because H5a, H6a, and H6d were significantly supported. In addition, only the proposed overall positive relationship between organizational resources and hospital affiliation with health care systems seemed to be reasonable, because empirical results showed the same predictive directions proposed by most sub-hypotheses, except for H6c.

For easy understanding, the comparison of proposed and estimated directions of relationships is presented in Table 17, and the summary of hypotheses testing is shown in Table 18.

Table 17. Summary of proposed and estimated directions of hypotheses

	Network vs. Freestanding			System vs. Freestanding			(Network vs. System)§	
	H	Directions		H	Directions		Directions	
Independent Variable		Proposed	Estimated		Proposed	Estimated	Proposed	Estimated
Environmental Munificence								
Unemployment rate	H1a	P	P	H2a	P	P*	N	N
# Specialists	H1b	P	P	H2b	P	P*	N	N
% Aged population	H1c	P	N	H2c	N	N	P	N
Environmental Uncertainty								
HMO penetration rate	H3a	P	N*	H4a	P	N*	N	N
Hospital competition (HHI)	H3b	N	P	H4b	N	N	P	P*
Nursing home competition (HHI)	H3c	P	P*	H4c	P	P	N	P
Organizational Resources								
# Hospital beds	H5a	P	P*	H6a	P	P*	N	0
# RNs	H5b	P	N	H6b	P	P	N	N
Occupancy rate	H5c	N	P*	H6c	N	P*	P	N
Community orientation	H5d	P	N*	H6d	N	N*	P	N

* indicates that the estimated coefficient is statistically significant ($\alpha = .05$).
Note: § indicates that these relationships are described and implied in the study, but are not written as hypotheses.
HHI means the Hirschman-Herfindahl index, and higher HHI means lower competition.
P indicates positive relationship, N indicates negative relationship, and H indicates the hypothesis.
Network indicates health care networks, and System means health care systems.

Table 18. Summary of hypotheses testing

Environmental Munificence

H1: There is an overall negative relationship between environmental munificence and the probability of hospital affiliation with health care networks. **Not Supported**

H1a: The unemployment rate is positively related to the odds of affiliating with health care networks. **Not Supported**
H1b: The number of specialists is positively related to the odds of affiliating with health care networks. **Not Supported**
H1c: The percentage of aged population is positively related to the odds of affiliating with health care networks. **Not Supported**

H2: There is an overall negative relationship between environmental munificence and the probability of hospital affiliation with health care systems. **Partially Supported**

H2a: The unemployment rate is positively related to the odds of affiliating with health care systems. **Supported**
H2b: The number of specialists is positively related to the odds of affiliating with health care systems. **Supported**
H2c: The percentage of aged population is negatively related to the odds of affiliating with health care systems. **Not Supported**

Environmental Uncertainty

H3: There is an overall positive relationship between environmental uncertainty and the probability of hospital affiliation with health care networks. **Partially Supported**

H3a: The HMO penetration rate is positively related to the odds of affiliating with health care networks. **Not Supported**
H3b: The hospital competition is positively related to the odds of affiliating with health care networks. **Not Supported**
H3c: The nursing home competition is negatively related to the odds of affiliating with health care networks. **Supported**

H4: There is an overall positive relationship between environmental uncertainty and the probability of hospital affiliation with health care systems. **Not Supported**

H4a: The HMO penetration rate is positively related to the odds of affiliating with health care systems. **Not Supported**
H4b: The hospital competition is positively related to the odds of affiliating with health care systems. **Not Supported**
H4c: The nursing home competition is negatively related to the odds of affiliating with health care systems. **Not Supported**

Table 18. Summary of hypotheses testing (Continued)

Organizational Resources

H5: There is an overall positive relationship between organizational resources and the probability of hospital affiliation with health care networks. **Partially Supported**

H5a: The number of hospital beds is positively related to the odds of affiliating with health care networks. **Supported**

H5b: The number of RNs per bed is positively related to the odds of affiliating with health care networks. **Not Supported**

H5c: The occupancy rate is negatively related to the odds of affiliating with health care networks. **Not Supported**

H5d: The level of community orientation is positively related to the odds of affiliating with health care networks. **Not Supported**

H6: There is an overall positive relationship between organizational resources and the probability of hospital affiliation with health care systems. **Partially Supported**

H6a: The number of hospital beds is positively related to the odds of affiliating with health care systems. **Supported**

H6b: The number of RNs per bed is positively related to the odds of affiliating with health care systems. **Not Supported**

H6c: The occupancy rate is negatively related to the odds of affiliating with health care systems. **Not Supported**

H6d: The level of community orientation is negatively related to the odds of affiliating with health care systems. **Supported**

CHAPTER 5

DISCUSSION AND CONCLUSIONS

In the face of the wide, rapid proliferation of integrated health care delivery systems, the conditions that lead freestanding hospitals to affiliate with other health care organizations at the cost of losing autonomy and how freestanding hospitals make the choice between health care networks and systems are increasingly important in developing cooperation among health care providers, especially with the lack of related empirical evidence. The present study used a longitudinal study design to demonstrate the impact of environmental and organizational factors on hospital affiliation choice. Specifically, this study focused on clarifying the potential relationships and effects of three dimensions (environmental munificence, environmental uncertainty, and organizational resources) in hospital affiliation choice.

This chapter includes four major parts. The discussion and implications of the analytical results are examined in the first section. The limitations of this study are explored in the next section. Possible directions for future research are delineated in the following section. Conclusions are provided in the last section.

Discussion and Implications

The proposed conceptual model in the present study was acceptable on the whole (with $p = .636$ by the Deviance criterion); however, it could only explain a small part of

hospital affiliation behavior and revealed some unexpected findings. Specifically, the results of multinomial logistic regression indicated that only 17.1% of hospital affiliation behavior was explained by the study model. In addition, it could make an approximately 52.2% correct prediction of hospital affiliation choice, with the highest correct prediction rate (84.4%) for maintaining freestanding status. Although 7 out of 10 proposed predictors were demonstrated to be statistically significant in making a prediction of hospital affiliation choice, the results also revealed that some of those significant predictors had unexpected predictive directions (i.e., HMO penetration rate and community orientation), and some of them could only make significant predictions concerning certain types of hospital affiliation choice (i.e., number of specialists and number of hospital beds).

Although many of our proposed hypotheses were not supported in the present study, some of the results, even if statistically nonsignificant, revealed specific information worthy of notice and further investigation. Therefore, explanations and implications of the results for proposed variables are discussed in the following sections.

Impacts of Environmental Munificence

Results from the study indicated that unemployment rate was a significant predictor of hospital affiliation choice, but it could only reliably separate a hospital's choice of health care system affiliation from freestanding choice. Namely, increases in the unemployment rate increase the likelihood of hospital affiliation with health care systems. This finding supports previously published results (Alexander & Morrisey, 1988, 1989) that demonstrated increased unemployment rates to be positively related to the development of tighter external relations (i.e., multihospital system selection or contract management).

However, the proposed positive relationship between unemployment rate and the likelihood of hospital affiliation with health care networks was not statistically significant. Two possible reasons may contribute to this nonsignificant result. One reason is that some of those hospitals retaining freestanding status could operate in counties with fewer environmental resources (e.g., higher unemployment rates) and lower competition. Previous studies demonstrated that such hospitals tend to be in rural areas (Chang & Tuckman, 1991) and can survive for a long time (Bazzoli & Andes, 1995). The study data confirm that the group of freestanding hospitals had more hospitals in rural areas (Table 11) in which unemployment rates were higher and hospital competition was lower (Table 9). The other reason is that the relationship between employment and the availability of health insurance may be uncertain. This assertion can be confirmed by the increased number of employers providing less or no health insurance coverage for their employees; that is, lower unemployment rates could also imply, to some extent, fewer environmental resources for hospitals. Consequently, the effect of unemployment rate will not be significant when the difference in the unemployment rates is not large enough.

Several implications can be derived from the results of unemployment rate. First, for health care managers, higher unemployment rates imply the increased need and possibility for hospitals to develop external relations, and it will be more obvious in environments with high competition. Second, for health policymakers, more attention should be paid to those hospitals in counties with high unemployment rates and fewer competitors, because they are more likely to suffer from financial distress but less likely to obtain help from external relationships. Third, for health care researchers, it is necessary to de-

velop more appropriate measures of health care affordability, because the unemployment rate cannot fully represent the ability of people to purchase health services.

As expected, the number of specialists was demonstrated in the study to be a significant predictor of hospital affiliation choice. Specifically, it could help in making the statistically significant prediction of hospital affiliation with health care networks (Table E2) and systems (Table 16). The results are opposite to the findings of Alexander and Morrisey (1988, 1989), which showed a nonsignificant negative relationship between the number of specialists and the development of tighter external relations. In addition, these findings confirm the changing role of specialists in the delivery of health services, especially given recent advances in medicine and technology. Specialists, once the source of patient referrals for hospitals, have gradually become competitors in providing certain services.

Based on the discovery of a changed role for specialists, some implications can be developed for further discussion. From the research perspective, studies need to verify if the changed role of specialists can be applied for all types of specialty physicians. Namely, it is necessary to clarify the different roles (i.e., referral and competitor) played by various types of specialists, because the clarification will be useful for health care managers and policymakers in developing competition strategies and educational policies, respectively. From the management perspective, the competitive role of specialists will make hospital managers develop different strategies. Specifically, for hospitals in areas (such as urban areas) with an excess of specialists, hospital managers may develop external cooperation relations or focus on more advanced, high-technology health services in order to improve their competitive advantages and survival chances. In contrast, for hos-

pitals in environments with fewer specialists (such as rural areas), hospital managers may focus on the provision of diversified and complementary health services in order to ensure their financial survival and maintain patient referrals from specialists. From the policy perspective, the excess capacity and hospital-competitive role of specialists could raise the competition among health care providers and increase the bargaining power of governments in negotiating the prices of health services. On the other hand, the increased competition could also enhance investments in more advanced and costly medical technologies, increasing the costs of health care for the country as a whole.

The study failed to find support for the percentage of aged population as a significant predictor of hospital affiliation choice. The nonsignificant and unexpected results could be attributed to the following reasons. One possible explanation for the nonsignificant estimated coefficients is the small differences in the means of the percentage of aged population among hospital affiliation types. Table 12 shows that the differences in the means of the percentage of aged population ranged from -.001 to -.005. Consequently, the small differences in the percentage of aged population will make it difficult to significantly separate hospital affiliation choices by using this predictor. In addition, such small values (e.g., -.001) would be very sensitive to changes in variable values or to changes in other influential variables; therefore, the direction of estimated coefficients would be apt to change. Another possible explanation is that the capacity of hospitals to provide subacute or long-term care services was not taken into account. Namely, if hospitals can provide such health services (e.g., the swing beds prevalent in rural hospitals) by themselves, it is not necessary for them to develop cooperative relationships (e.g., joining a health care network) in the face of increases in the aged population. The last explanation

is that the payer mix of hospitals was not considered in developing the hypotheses. In other words, the influence of the aged population will be contingent on the dependence of hospitals on the revenues from the elderly patients, such as Medicare payments.

Similarly, a few implications can be derived from the study results of the percentage of aged population. For health care managers, the increasing aged population not only indicates increased environmental resources but also implies increased financial risk, due to the lower reimbursement rates from Medicare, and reduced possibility of joining such cooperation arrangements as health care systems. Therefore, developing appropriate strategies for allocating internal resources is important for hospital managers to respond to the conflicting impacts of the increased aged population. If the lower reimbursement rates of Medicare plans did have a negative influence on a hospital's financial survival, it in turn could affect community benefits, such as provision of and access to hospital services. Consequently, it is important for policymakers to take into account both cost control and community benefits in setting up or modifying Medicare reimbursement rates. For researchers, it is necessary to apply a combination of related measures in studying the effects of the aged population on the performance and strategies of health care organizations.

Impacts of Environmental Uncertainty

Although the HMO penetration rate was found in this study to be a significant predictor of hospital affiliation choice, the predicted relationships seemed to run against what were proposed in the study. The estimated β coefficients (-1.829 and -1.122) indicated significant negative relationships that were completely converse to the proposed

positive relationship of the HMO penetration rate to the probability of hospital affiliation with health care networks and systems. Although the negative association of the HMO penetration rate to the choice of health care network affiliation (in comparison to health care system affiliation) was found in the study, it was not statistically significant.

There are several explanations for these unexpected findings. First, the effect of HMO penetration rate is correlated to and may be masked by other factors (e.g., unemployment rate). The negative correlation coefficient (r = -.10 in Table 10) between the HMO penetration rate and the unemployment rate implies that the counties with higher HMO penetration rates are more likely to be those areas, such as urban areas, with more environmental resources due to lower unemployment rates. Thus, if the HMO penetration rate is not too high, munificent environmental resources could make hospitals retain their freestanding status. However, increases in the HMO penetration rate are accompanied by increased hospital competition (r = -.63 between the HMO penetration rate and the hospital competition index); consequently, there was a negative relationship between the HMO penetration rate and hospital affiliation with health care systems, in comparison to health care network affiliation. This result is consistent with the finding of Bazzoli et al. (2003) that health care network members are more likely to operate in favorable environments (e.g., with lower HMO penetration rates) to exploit munificent resources. Second, it is possible that the HMO penetration rate cannot represent its true effect on predicting hospital affiliation choice. Burns and his colleagues (1998) asserted a nonlinear relationship between the HMO penetration rate and hospital collaborations, and this assertion was confirmed by their later study (Burns et al., 2000). In addition, the number of HMO contracts which hospitals hold could also be a confounding variable (Zinn et al., 1997). The

last possible explanation is the extremely skewed distribution of the HMO penetration rate. The data showed that there were 847 hospitals located in counties with HMO penetration rates equal to 0 percent. Although we tried to use the transformed data (e.g., the logarithm of the HMO penetration rate) to run the full model, there was no improvement in the results. Therefore, it is reasonable to suspect that such extreme values could lead to those unexpected results.

These unexpected results also generate some implications for health care managers, policymakers, and health care researchers. From the management perspective, the choice of hospital affiliation types will depend on the collective effects of the HMO penetration rate, the degree of hospital competition, and the availability of environmental resources. From the policy perspective, higher HMO penetration rates make hospitals more likely to develop tight cooperation arrangements (e.g., health care systems), which in turn will increase the market power of health care providers; consequently, governments could suffer from higher pressures in negotiating the prices of health services with health care providers and in monitoring the delivery and provision of health services to the populations. From a research perspective, because managed care organizations have great impacts on the delivery of health care services, it is necessary to develop more appropriate measures of the effects of managed care plans or to apply more suitable statistical methods for overcoming the potential problems of HMO penetration data.

The study found support for hospital competition to be a significant predictor of hospital affiliation choice and indicated that there were both direct and interaction effects for this factor. Hospital competition only had significant influence on the choice between network affiliation and system affiliation, and did not show a significant impact on the

change from freestanding status to affiliation with health care networks or systems. In addition, the relationship between hospital competition and the likelihood of health care network affiliation (in comparison to freestanding status) was statistically different for rural and urban hospitals. The significant β coefficient (= -1.222) of the interaction term for the logit model (network affiliation vs. freestanding) implied that the impact of hospital competition on health care network affiliation would be greater in rural areas. The possible explanation for the results is that hospitals in urban areas will be more likely to obtain sufficient environmental resources, so they do not need to develop cooperative relations (e.g., joining health care networks) to survive in the face of increased hospital competition. Similarly, the interaction effect of hospital competition (β = -2.426) for the logit model (network affiliation vs. system affiliation) revealed that the relationship between hospital competition and the likelihood of choosing health care networks (rather than health care systems) was statistically different for rural and urban hospitals. As expected, higher hospital competition made hospitals in urban areas more likely to choose system affiliation. However, higher hospital competition made hospitals in rural areas more likely to choose network affiliation. One possible explanation for the different results could be the effect of bilateral selection; health care systems could view rural areas as unfavorable environments and be less likely to purchase hospitals in these areas.

One important implication of these results is that environmental resources could have a significant influence on the reactions and choices of hospitals in response to increased hospital competition.

As proposed in the study, nursing home competition not only played a significant role in influencing hospital affiliation choice, but also made significant predictions of

hospital affiliation with health care networks or systems. These results provide support for the previous finding (Guihan et al., 1995) that demonstrated a negative relationship between nursing home competition and hospital cooperation.

Impacts of Organizational Resources

The number of hospital beds was shown by the present study to be one of the most significant predictors of hospital affiliation choice. The sub-hypothesis (H5a) proposed a positive relationship between the number of hospital beds and the odds of affiliating with health care networks, and it was supported by the estimated results. The result supported an earlier finding by Burns and colleagues (2000). In addition, the sub-hypothesis (H6a) proposed that the number of hospital beds is positively related to the odds of affiliating with health care systems, and this sub-hypothesis was also significantly supported in the study. This positive relationship was also demonstrated in a previous study by Bazzoli et al. (2003). However, the positive relationship is opposite to the findings of studies in 1980s (Alexander & Morrisey, 1988, 1989). As a result, there could be a shift in the merging strategies for health care systems; in the 1990s health care systems could have been more likely to choose large hospitals as potential targets rather than small hospitals.

Although the study implied that hospitals with moderate levels of set-up acute care beds were more likely to affiliate with health care networks, the expected negative odds ratio of network affiliation to system affiliation was not observed. Table 16 reveals that the effects of hospital beds on hospital affiliation with health care networks and systems were almost the same (with β = .004). The β coefficient (= 0) for the logit model

(network affiliation vs. system affiliation) could be attributed to the rounding setup of the SPSS software and imply that the number of hospital beds may not influence a hospital's choice between network affiliation and system affiliation.

Two implications can be derived from the positive relationship between the number of hospital beds and the likelihood of hospital affiliation with health care networks or systems. From the management perspective, hospitals with large numbers of set-up acute beds are more likely to become members of health care networks or systems; consequently, small hospitals will be confronted with more pressures and higher competition, and may be more likely to exit the market. From the policy perspective, the participation of large hospitals in health care networks or systems will concentrate on the provision of health services and increase the market power of health care providers in negotiating health plans.

The results did not find support for the number of RNs being a significant predictor of hospital affiliation choice. Moreover, the generated coefficient indicated a nonsignificant negative relationship between the number of RNs and the likelihood of hospital affiliation with health care networks. This result was converse to H5b. Although the study showed a positive relation of the number of RNs to the probability of hospital affiliation with health care systems (as proposed by H6b), it was not statistically significant. Similarly, the implied negative relationship between the number of RNs and the odds of network affiliation to system affiliation was found to be statistically nonsignificant.

The opposite prediction direction and nonsignificance could be explained by two reasons. One is that the study hospitals could have some idiosyncratic characteristics, be-

cause in order to survive until 1993 and be selected in the study sample these hospitals could either have better performance in markets with high competition or operate in areas with very low competition (e.g., single-hospital markets). If they did have superior performance, it implies that they had greater ability and more resources to buffer themselves from unfavorable environmental changes and then survive to be selected into this study. Therefore, for these superior hospitals, an increase in RN staffing could imply a rise in costs and a decrease in the likelihood of being accepted by health care networks. Another reason is that the proposed relationship between the number of RNs and intangible, valuable resources (e.g., quality of care and reputation) will be too weak or unclear to be realized. Consequently, the number of RNs was only viewed as an indicator of hospital costs.

The most apparent implication of the findings is that the number of RNs is not an appropriate measure of intangible organizational resources for this study. This is because the cost of RNs will offset the favorable meanings (e.g., quality of health care) implied by the number of RNs. Therefore, those measures of intangible resources without the feature of costs will be more suitable for studies with the application of transaction cost theory.

The results of the present study confirmed that occupancy rate had a significant impact on hospital affiliation choice. In addition, occupancy rate was another variable found in this study to have different distributions among hospital affiliation groups in rural and urban areas. The occupancy rate was found to have the significantly positive direct impact on a hospital's decision to affiliate with a health care network or system. These results were completely opposite to the proposed sub-hypotheses (H5c and H6c) and inconsistent with the findings of past studies (Alexander & Morrisey, 1988, 1989; Burns et al., 2000; McCue, 1996; Wilke & Choi, 1988; Zinn et al., 1997). However, the

significantly negative interaction effects (β = -2.174 and β = -2.296) of occupancy rate by hospital setting implied that the influence of occupancy rate on motivating freestanding hospitals to affiliate with health care networks or systems would be diminished in rural areas. Namely, all things being equal, an increase in the occupancy rate would make free-standing hospitals in urban areas more likely to affiliate with health care networks or systems than those in rural areas.

These unexpected findings of significantly positive relations of occupancy rate to the likelihood of hospital affiliation with health care networks and systems supported the study results of Bazzoli and her colleagues (2003), and were probably attributed to the following reason. Trinh and O'Connor (2002) indicated that during the 1990s changes in HMOs strategies had negative impacts on market shares for urban hospitals (with greater case-mix severity, higher occupancy rate, etc.); that is, those urban hospitals (with larger size and occupancy rate) suffered from lowering the cost by controlling utilized resources. Therefore, it is reasonable to expect those urban hospitals will join together to raise market power and reduce unnecessary utilization and costs. The negative interaction effect of occupancy rate by hospital setting could be explained by the lower environmental uncertainty in rural areas (i.e., lower HMO penetration rates and hospital competition). Namely, rural hospitals, compared to their urban counterparts, could suffer the fewer pressure of controlling costs; consequently, the increased occupancy rates would make rural hospitals be financially surviving and be less necessary to develop external relations.

From the management perspective, the positive relationship between the occupancy rate and the likelihood of hospital affiliation with health care networks or systems

implies that hospitals with low occupancy rates will suffer from greatly increasing competition in urban areas and even exit the urban market. In addition, for policymakers, the concentrated market share in urban areas will increase the bargaining power of certain health care providers (i.e., health care networks or systems) and the costs for governments to purchase health services and monitor the delivery of health services.

Community orientation was demonstrated in this study to be a significant predictor of hospital affiliation choice. However, the produced coefficients were not completely consistent with what were proposed in the study. Specifically, the results only supported the sub-hypothesis (H6d) of a negative relationship between the level of community orientation and the odds of hospital affiliation with health care systems. This negative relationship was the same as previous study findings (Lee et al., 2003).

This study showed a significantly negative relationship between the degree of community orientation and the odds of hospital affiliation with health care networks, which was opposite to the proposed direction. One explanation for this opposite predicted direction could be the existence of idiosyncratic characteristics, such as better performance, for hospitals in the final sample. As discussed previously, those hospitals with a higher degree of community orientation could have more social relations and resources, and therefore be less likely to develop interorganizational relations at the price of losing some autonomy and control. In contrast, those hospitals that were less community-oriented would try to join health care networks or systems in order to increase their available resources in the face of more competitive and uncertain environments. Another possible explanation is that it is just the reality that hospitals with a lower degree of commu-

nity orientation are more likely to join health care networks in order to obtain more external resources for the survival.

From the research perspective, more studies are needed to explore the dimensions of the concept of community orientation and clarify their effects on the development of cooperation arrangements, because the community orientation has been suggested as a multidimensional concept (Bazzoli et al., 1997). The AHA survey questions of community orientation cannot really measure the degree of community orientation, because they cannot tell how many resources are devoted by hospitals in community-oriented activities. Consequently, only using the AHA survey questions of community orientation to detect the effects of community orientation will probably generate biased or misleading results. This assertion was demonstrated by the study of Lee et al. (2003), in which the two measures of hospital community responsiveness showed inconsistent results and implications.

Impacts of Hospital Setting

According to the study results, hospital setting not only had significant impacts on hospital affiliation choice (network affiliation vs. freestanding status and network affiliation vs. system affiliation), but also had moderating effects on the relationships between hospital affiliation choice and two predictors (hospital competition and occupancy rate). The corresponding results, discussed in the previous sections, implied that without cautious examination of control variables (i.e., hospital setting) the statistical results could be biased and the interpretation of the results could be misleading.

Impacts of Other Findings

This study failed to find significant predictors that separated health care network affiliation from health care system affiliation. According to the results, only two variables (hospital setting and hospital competition) were demonstrated as significant predictors. Although four of the remaining factors showed the same proposed relationship directions (unemployment rate, number of specialists, HMO penetration rate, and number of registered nurses), they were statistically nonsignificant. The most plausible reason for such nonsignificant results was the influence of idiosyncratic characteristics of study hospitals, which implied that the sample hospitals were homogeneous to some extent. Therefore, it was difficult to observe factors that could significantly separate network-affiliated hospitals from system-affiliated hospitals. Another possible reason is the lack of suitable transaction cost variables in the model. Actually, the transaction cost theory was conceptually applied to separate network affiliation from system affiliation, but there was no variables employed to measure the real costs of transaction. Therefore, it was difficult to find significant predictors of the choice between network affiliation and system affiliation from those proposed measures.

Limitations

As with most research, there were several limitations in this study. The first and most important is the generalizability of the study results, which is affected by the quality of the AHA data and the time of data selection. Because of the broad definition of health care networks in the AHA data, it is reasonable to suspect the compatibility among different health care networks. For example, one health care network could probably include

all types of health care providers, but another health care network could only involve hospital(s) and physicians. Consequently, the poor quality of the AHA data will not only influence the analytical results of predicting factors, but also limit the external validity and application of such results.

The BBA of 1997 has been demonstrated by many studies not only to have great negative impacts on the financial profitability of health care providers (Bazzoli et al., 2004; Lin et al., 2006; McCall et al., 2003; Schoenman et al., 2001; Sear, 2004), but also to change the behaviors and corresponding strategies of health care providers. For example, hospitals are less likely to transfer patients to postacute care settings (Rivers & Tsai, 2002), and postacute care providers are more likely to select patients (Angelelli et al., 2002) and substitute for each other (Lin et al., 2006). Therefore, the generalizability of study results is constrained for years after 1997.

Finally, the selection of freestanding hospitals in 1993 as the target sample population further limits the generalizability of this study model and its results. For instance, only 5.4% of the study sample was for-profit hospitals. Therefore, it will be difficult to generalize the results of the present study to for-profit hospitals.

The second limitation is the applicability of the study findings. Based on the prospective design, this study could potentially discover more accurate causal relationships and predictors. However, by 1997 there were only 546 hospitals with freestanding status in the U.S.; therefore, the potential effectiveness and applicability of the results may be constrained.

The third limitation is the use of proxies for some variables in the model, especially those measures of hospital intangible resources (e.g., quality of care and manage-

ment capability), and the lack of important organizational variables (e.g., financial measures). Consequently, not only were unexpected findings found for some predictors, such as occupancy rate and RN staffing, but also organizational resources could not significantly separate network hospitals from system members. The lack of more direct measures of organizational resources will reduce the predictive power of this research model and generate misleading results.

Future Research

Except for those research implications mentioned in the previous discussion section, future research efforts can be made in several directions, based on these findings and limitations. First, in order to increase the model's generalizability, the following concerns should be addressed. It is important to clarify and remove the composition impacts of health care networks, because a fundamental model of hospital affiliation choice cannot be developed properly without the exclusion of such structural influences. In addition, studies may be conducted to include those 1993 health care network or system hospitals into the sample population and then re-examine the model. The simple but biased approach is to view those network/system hospitals as making their affiliation decision in 1993 and to use 1992 data for predictors. The complicated but accurate approach is to survey those 1993 health care network or system hospitals to obtain the affiliation data. Research should also explore the mechanisms of the BBA impacts on hospital affiliation choice and incorporate the findings to modify this model.

Second, the applicability of this model can be expanded in several ways. One is to apply this model in other health care organizations. For instance, the nursing home indus-

try is a plausible target, because nursing homes are important health care providers in complete health care networks or systems. In addition, it seems that little research has applied the similar model in nursing home industry. Consequently, the results of applying this model in nursing home industry could be very interesting and useful. Another approach is to apply this model in the hospital industry of other countries, especially those developing countries with the medical development behind the United States. Because the predictors in the model are not very specific, it is easy to modify the model, such as replacing the predictors with similar variables, to investigate the patterns of hospital affiliation choice in other countries. The comparison of the results in different countries will enrich the literature and verify the accuracy of the model.

Third, to enhance predictability, studies need to focus on including more valid and important indicators for proposed dimensions. From the perspective of environmental munificence, more appropriate measures of affordability of health services and indicators of health demands need to be developed. From the perspective of organizational resources, measures of financial performance need to be included, and more direct, valid indicators of intangible resources (e.g., quality of care, reputation, community orientation, etc.) have to be adopted in the model. In addition, the use of more accurate data or more appropriate scale of data can provide more clear and valid findings. For example, the HMO penetration data have been collected at the metropolitan level, so it is reasonable to believe that the HMO penetration data at this level will not be as highly skewed as the data at the county level. Thus, it is necessary to investigate if the replacement of the county-level HMO penetration rates with the metropolitan-level HMO data can improve the results or produce biased problems.

Fourth, research can be devoted to investigating the relations among network or system members. The majority of current health care research on health care networks or systems just focuses on the types of cooperation arrangements, rather than exploring the real working and relations among network or system members. The study on the degree of relations or the amount of transactions among participating members will reveal the facts related to the real world. Moreover, it is reasonable to believe that the transaction cost theory will exert much influence in such kind of studies.

Finally, research can be conducted to examine the performance after the changes in the hospital affiliation choice. Furthermore, it is also very interesting to investigate the effects of organizational performance on the dynamic changes in organizational structures or in cooperation arrangements.

Summary and Conclusions

In general, this study revealed that the proposed model is reasonable and acceptable. Several environmental and organizational variables were demonstrated to be statistically significant predictors of hospital affiliation choice. From the model fit perspective, these significant predictors included the number of specialists, HMO penetration rate, nursing home competition, the number of hospital beds, and community orientation. In addition, hospital setting not only had a significant direct effect on hospital affiliation choice, but also had moderating effects on the relationship of hospital affiliation choice to two predictors, including hospital competition and occupancy rate. However, most of these identified predictors had a significant influence, either proposed or unexpected, on predicting the change in a hospital's affiliation choice from freestanding status to health

care network or system affiliation; that is, this model could tell little about how a hospital makes a choice between network and system affiliation.

Environmental munificence can probably discourage hospitals from developing interorganizational arrangements. According to the direction of study results, freestanding hospitals tended to be more likely to affiliate with health care networks at the intermediate levels of environmental munificence, even though without sufficient, statistically significant supports. Specifically, only the proposed overall negative relationship between environmental munificence and the probability of hospital affiliation with health care systems (rather than networks) was partially supported, due to the significant support for the unemployment rate (H2a) and the number of specialists (H2b). The percentage of aged population was shown to be an inappropriate measure of environmental munificence from the dimension of health care demand, especially with the study data.

It is impossible to infer from this study that environmental uncertainty would enhance hospitals to build external relations with other health services providers. The study results only indicated that there was limited (or partial) support for the proposed overall positive association between environmental uncertainty and the likelihood of hospital affiliation with health care networks (H3), because of the significantly supported effect of nursing home competition on a hospital's network affiliation (H3c). The HMO penetration rate revealed significant yet converse effects on hospital affiliation choice, and the opposite finding was probably attributed to the data of HMO penetration rate. Moreover, the effects of environmental uncertainty seemed to be contingent on or greatly influenced by the available environmental resources of the areas in which hospitals operated.

Organizational resources were demonstrated in this study to exert the greatest and most important influence on predicting the hospital affiliation choice. Based on the direction and significance of estimated β coefficients, only the proposed overall positive relationship between organizational resources and the probability of hospital affiliation with health care systems (H6) could be inferred from the present study. The results indicated that the number of hospital beds had significantly supported effects, but that community orientation had significant yet opposite impacts on hospital affiliation choice. The findings implied that the various multidimensional effects of organizational resources could contribute to the difficulty of generalizing the relationship between organizational resources and hospital affiliation choice.

Finally, this study demonstrates the necessity of applying integrated multiple theories (here, the resource dependence theory, RBV, and transaction cost theory) in exploring the formation of interorganizational arrangements. One of the major contributions of the study is to verify the usefulness and importance of the RBV in explaining the mechanisms between organizational resources and the development of hospital affiliative relations. However, the results showed that the transaction cost theory did not perform well in the conceptual model, perhaps due to the study design (e.g., the lack of suitable variables employed).

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APPENDIX A

AHA ANNUAL SURVEY QUESTIONS OF COMMUNITY ORIENTATION

The AHA Annual Survey of Hospitals used nine questions to investigate the services and degree of community orientation for hospitals from 1994 to 1997. However, only six of these nine questions were included in the 1993 AHA Annual Survey of Hospitals. All the nine questions were dichotomous items with the answer of Yes/No. These questions are listed below:

(1) Does the hospital's mission statement include a focus on community benefit?

(2) Does the hospital have a long-term plan for improving the health of its community?

(3) Does the hospital have resources for its community benefit activities?

(4) Does the hospital work with other providers, public agencies or community representatives to conduct a health status assessment of the community?

(5) Does your hospital use health status indicators to design new services or modify existing services?

(6) Does your hospital work with other local providers, public agencies, or community representatives to develop a written assessment of the appropriate capacity for health services in the community?

(7) Does the hospital use the assessment to identify unmet health needs, excess capacity, or duplicative services in the community?

(8) Does the hospital work with other providers to collect, track, and communicate clinical and health information across cooperating organizations?

(9) Does the hospital, alone or with others, disseminate reports to the community on the quality and costs of health care services?

Note: The 1993 AHA Annual Survey of Hospitals only included six questions (4 to 9).

APPENDIX B

SUMMARY OF STATISTICS OF MISSING VALUES ANALYSIS

MVA

Univariate Statistics

	N	Mean	Std. Deviation	Missing		No. of Extremes[a]	
				Count	Percent	Low	High
UNEMPL1	1277	6.2181	2.65976	0	.0	0	42
OSP1	1277	1.0804	.82471	0	.0	0	39
AGED1	1277	.14340	.038588	0	.0	5	47
HMOPEN1	1277	.0935	.19970	0	.0	0	299
ST_COMP1	1277	.5197	.40658	0	.0	0	0
NH_COMP1	1268	.2524	.24745	9	.7	0	76
HOSSIZE1	1277	175.05	154.674	0	.0	0	61
RN1	1277	.9110	.45397	0	.0	0	18
OCCUPY1	1277	.5705	.17574	0	.0	0	0
COMORI1	1216	.6696	.29670	61	4.8	0	0
LOCATION	1277			0	.0		

a. Number of cases outside the range (Q1 - 1.5*IQR, Q3 + 1.5*IQR).

Separate Variance t Tests [a]

		UNEMPL1	OSP1	AGED1	HMOPEN1	ST_COMP1	NH_COMP1	HOSSIZE1	RN1	OCCUPY1	COMORI1
NH_COMP1	t	-2.6	-2.3	1.7	-1.6	.3	.	-.2	-1.9	-.8	.5
	df	8.0	8.0	8.1	8.1	8.1	.	8.1	8.1	8.1	7.1
	P(2-tail)	.034	.047	.130	.156	.789	.	.849	.090	.430	.636
	# Present	1268	1268	1268	1268	1268	1268	1268	1268	1268	1208
	# Missing	9	9	9	9	9	0	9	9	9	8
	Mean(Present)	6.1906	1.0720	.14355	.0929	.5200	.2524	174.98	.9086	.5701	.6700
	Mean(Missing)	10.0889	2.2585	.12323	.1846	.4739	.	184.78	1.2512	.6306	.6111
COMORI1	t	-3.9	.6	-1.4	-.5	1.0	-1.1	.7	5.5	1.7	.
	df	65.7	65.7	63.4	65.4	66.3	63.6	64.5	72.0	64.9	.
	P(2-tail)	.000	.573	.173	.634	.315	.286	.474	.000	.093	.
	# Present	1216	1216	1216	1216	1216	1208	1216	1216	1216	1216
	# Missing	61	61	61	61	61	60	61	61	61	0
	Mean(Present)	6.1512	1.0834	.14297	.0929	.5223	.2505	175.85	.9226	.5726	.6696
	Mean(Missing)	7.5508	1.0199	.15199	.1062	.4686	.2903	159.10	.6808	.5293	.

For each quantitative variable, pairs of groups are formed by indicator variables (present, missing).

a. Indicator variables with less than 0.5% missing are not displayed.

LOCATION

			Total	Rural Areas	Urban Areas
NH_COMP1	Present	Count	1268	427	841
		Percent	99.3	99.3	99.3
	Missing	% SysMis	.7	.7	.7
COMORI1	Present	Count	1216	409	807
		Percent	95.2	95.1	95.3
	Missing	% SysMis	4.8	4.9	4.7

Indicator variables with less than 0.5% missing are not displayed.

EM Covariances [a]

	UNEMPL1	OSP1	AGED1	HMOPEN1	ST_COMP1	NH_COMP1	HOSSIZE1	RN1	OCCUPY1	COMORI1
UNEMPL1	7.07430									
OSP1	-.18594	.68015								
AGED1	.00066	-.00647	.001489							
HMOPEN1	-.03966	.09800	-.001799	.03988						
ST_COMP1	.00948	-.19273	.003013	-.03832	.16530					
NH_COMP1	.05308	-.09922	.001734	-.01818	.06658	.06130				
HOSSIZE1	7.13794	68.57465	-.951001	11.27259	-22.40144	-15.41383	23923.997			
RN1	-.07306	.11131	-.003768	.01344	-.03508	-.03063	13.719	.20609		
OCCUPY1	.02538	.04381	-.000330	.00553	-.01255	-.00763	12.086	.01418	.03089	
COMORI1	-.06312	.02156	-.000504	.00269	-.00403	-.00753	5.512	.01498	.00522	.08807

a. Little's MCAR test: Chi-Square = 110.792, DF = 26, Sig. = .000

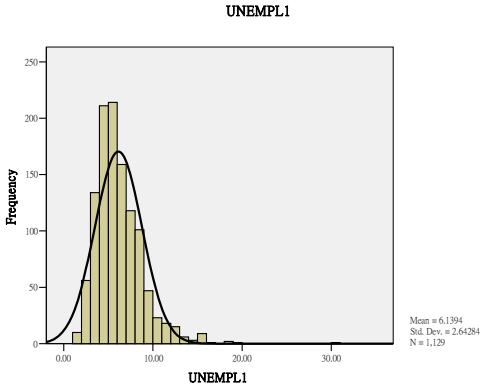
EM Correlations [a]

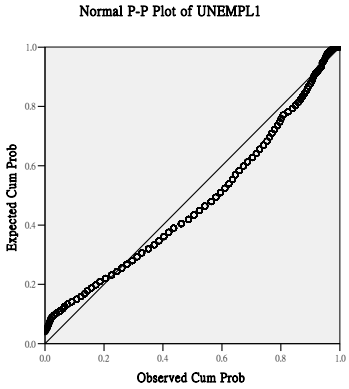
	UNEMPL1	OSP1	AGED1	HMOPEN1	ST_COMP1	NH_COMP1	HOSSIZE1	RN1	OCCUPY1	COMORI1
UNEMPL1	1									
OSP1	-.085	1								
AGED1	.006	-.203	1							
HMOPEN1	-.075	.595	-.233	1						
ST_COMP1	.009	-.575	.192	-.472	1					
NH_COMP1	.081	-.486	.182	-.368	.661	1				
HOSSIZE1	.017	.538	-.159	.365	-.356	-.402	1			
RN1	-.061	.297	-.215	.148	-.190	-.273	.195	1		
OCCUPY1	.054	.302	-.049	.158	-.176	-.175	.445	.178	1	
COMORI1	-.080	.088	-.044	.045	-.033	-.102	.120	.111	.100	1

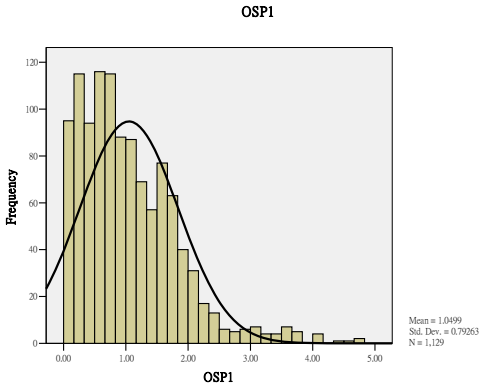
a. Little's MCAR test: Chi-Square = 110.792, DF = 26, Sig. = .000

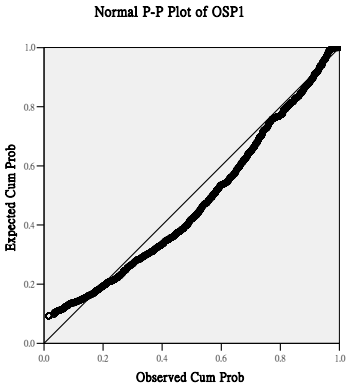
APPENDIX C

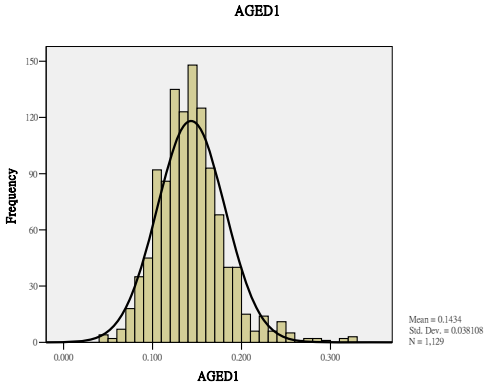
FREQUENCY DISTRIBUTIONS AND P-P PLOTS FOR ALL INDEPENDENT VARIABLES

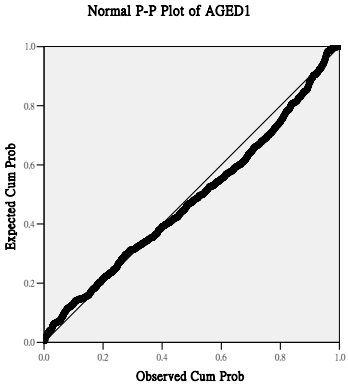

UNEMPL1
Frequency
UNEMPL1
Mean = 6.1394
Std. Dev. = 2.64284
N = 1,129

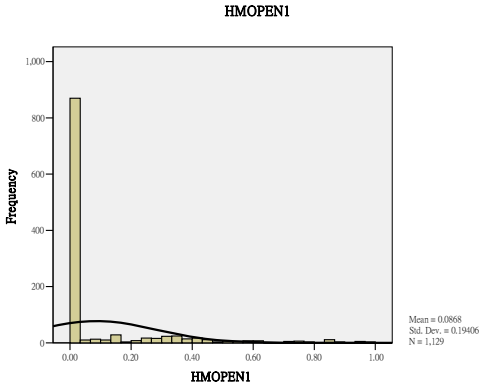

Normal P-P Plot of UNEMPL1
Expected Cum Prob
Observed Cum Prob

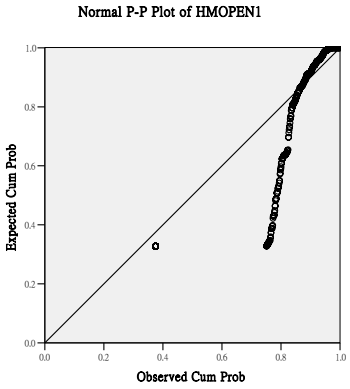

OSP1
Frequency
OSP1
Mean = 1.0499
Std. Dev. = 0.79263
N = 1,129

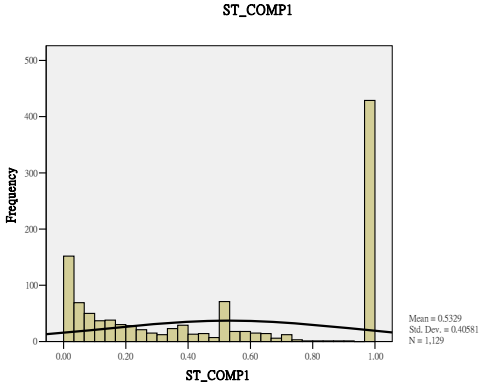

Normal P-P Plot of OSP1
Expected Cum Prob
Observed Cum Prob

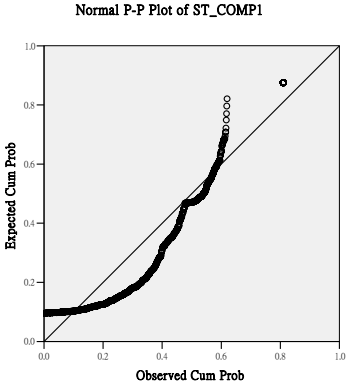

AGED1
Frequency
AGED1
Mean = 0.1434
Std. Dev. = 0.038108
N = 1,129

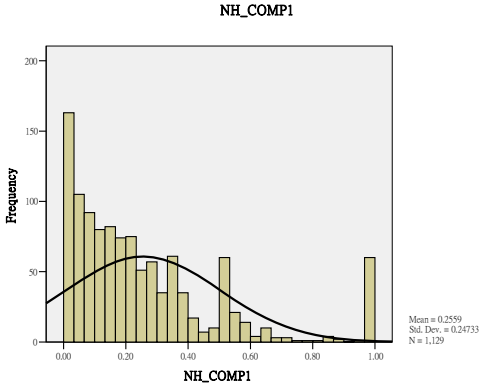

Normal P-P Plot of AGED1
Expected Cum Prob
Observed Cum Prob

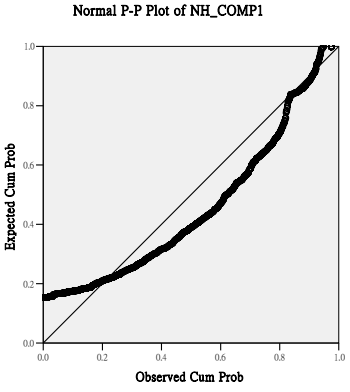

HMOPEN1
Frequency
HMOPEN1
Mean = 0.0868
Std. Dev. = 0.19406
N = 1,129


Normal P-P Plot of HMOPEN1
Expected Cum Prob
Observed Cum Prob

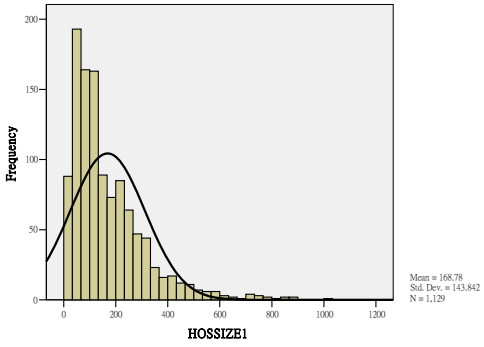

ST_COMP1
Frequency
ST_COMP1
Mean = 0.5329
Std. Dev. = 0.40581
N = 1,129


Normal P-P Plot of ST_COMP1
Expected Cum Prob
Observed Cum Prob

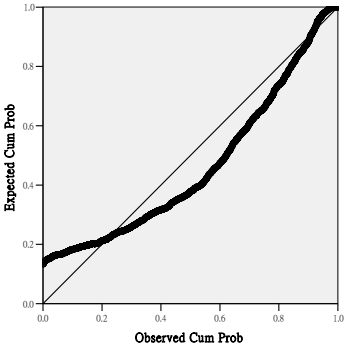

NH_COMP1
Frequency
NH_COMP1
Mean = 0.2559
Std. Dev. = 0.24733
N = 1,129


Normal P-P Plot of NH_COMP1
Expected Cum Prob
Observed Cum Prob

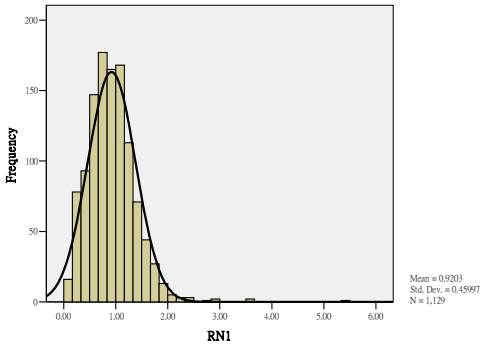
HOSSIZE1



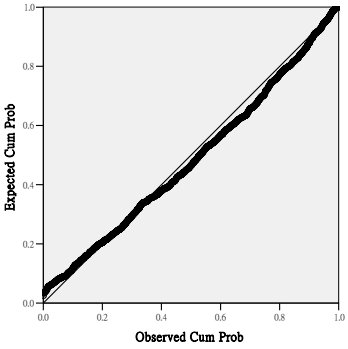
Normal P-P Plot of HOSSIZE1



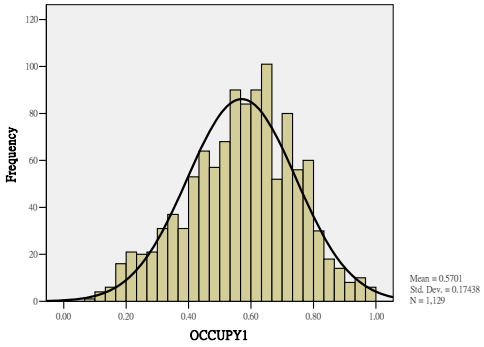
RN1



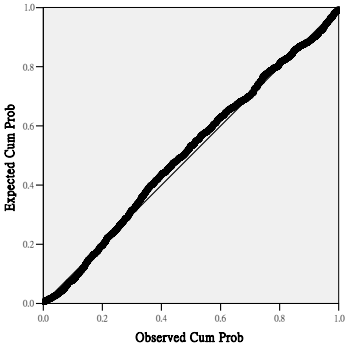
Normal P-P Plot of RN1



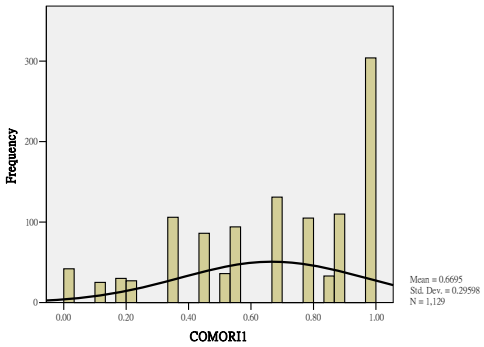
OCCUPY1



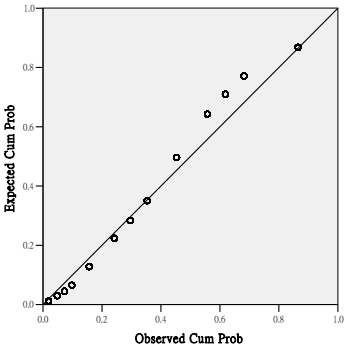
Normal P-P Plot of OCCUPY1



COMORI1



Normal P-P Plot of COMORI1



APPENDIX D

SUMMARY OF STATISTICS OF THE BOX-TIDWELL TEST

Likelihood Ratio Tests

Effect	Model Fitting Criteria: -2 Log Likelihood of Reduced Model	Likelihood Ratio Tests: Chi-Square	df	Sig.
Intercept	2108.371[a]	.000	0	.
UNEMPL1	2116.418	8.047	2	.018
OSP1	2109.561	1.190	2	.552
AGED1	2109.083	.711	2	.701
HMOPEN1	2124.717	16.346	2	.000
ST_COMP1	2109.120	.749	2	.688
NH_COMP1	2110.901	2.529	2	.282
HOSSIZE1	2112.085	3.714	2	.156
RN1	2109.989	1.618	2	.445
OCCUPY1	2109.843	1.472	2	.479
COMORI1	2119.098	10.726	2	.005
IA_V1	2120.771	12.400	2	.002
IA_V2	2111.587	3.216	2	.200
IA_V3	2109.196	.825	2	.662
IA_V5	2109.468	1.097	2	.578
IA_V6	2109.578	1.206	2	.547
IA_V7	2116.218	7.846	2	.020
IA_V8	2108.453	.082	2	.960
IA_V9	2108.670	.298	2	.861
IA_V10	2109.362	.991	2	.609
LN_V1	2116.382	8.011	2	.018
LN_V2	2110.588	2.216	2	.330
LN_V3	2108.969	.598	2	.742
LN_V4	2113.393	5.021	2	.081
LN_V5	2108.380	.008	2	.996
LN_V6	2111.101	2.730	2	.255
LN_V7	2112.914	4.543	2	.103
LN_V8	2111.142	2.771	2	.250
LN_V9	2111.602	3.231	2	.199
LN_V10	2109.301	.929	2	.628
LN_IA_V1	2120.453	12.082	2	.002
LN_IA_V2	2110.531	2.160	2	.340
LN_IA_V3	2108.828	.457	2	.796
LN_IA_V5	2109.044	.672	2	.715
LN_IA_V6	2111.245	2.873	2	.238
LN_IA_V7	2116.344	7.973	2	.019
LN_IA_V8	2108.568	.196	2	.907
LN_IA_V9	2109.067	.696	2	.706
LN_IA_V10	2109.200	.828	2	.661
LOCATION	2113.545	5.174	2	.075

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

Note: The adjusted significance level is .0013 (= .05/39).

Likelihood Ratio Tests

Effect	Model Fitting Criteria: -2 Log Likelihood of Reduced Model	Likelihood Ratio Tests: Chi-Square	df	Sig.
Intercept	2146.744[a]	.000	0	.
UNEMPL1	2160.773	14.029	2	.001
OSP1	2147.054	.310	2	.857
AGED1	2154.158	7.414	2	.025
HMOPEN1	2163.746	17.002	2	.000
ST_COMP1	2147.339	.595	2	.743
NH_COMP1	2156.180	9.436	2	.009
HOSSIZE1	2153.258	6.514	2	.039
RN1	2149.905	3.161	2	.206
OCCUPY1	2149.070	2.326	2	.313
COMORI1	2179.263	32.519	2	.000
IA_V5	2147.615	.871	2	.647
IA_V9	2150.874	4.129	2	.127
LN_V1	2159.293	12.549	2	.002
LN_V2	2148.353	1.608	2	.447
LN_V3	2154.387	7.643	2	.022
LN_V4	2153.245	6.501	2	.039
LN_V5	2146.897	.153	2	.926
LN_V6	2148.071	1.327	2	.515
LN_V7	2151.471	4.727	2	.094
LN_V8	2152.795	6.051	2	.049
LN_V9	2149.854	3.110	2	.211
LN_V10	2152.664	5.920	2	.052
LN_IA_V5	2147.838	1.094	2	.579
LN_IA_V9	2147.872	1.128	2	.569
LOCATION	2148.741	1.997	2	.368

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

Note: The adjusted significance level is .002 (= .05/25).

APPENDIX E

STATISTICS OF MULTINOMIAL LOGISTIC REGRESSION FOR THE FULL MODEL WITHOUT MULTIVARIATE OUTLIERS

Table E1. Summary of the statistics of model fit for the full model (Model 2) of studied hospitals without multivariate outliers

N = 1,069	Model 2	$X^2_{reduced}$	*df*
X^2_{total} (*df*)	194.227 (26)*		
Deviance	.730		
R^2_{CS} (R^2_N)	.166 (.189)		
Location		9.848*	2
Environmental Munificence		15.529§*	6
Unemployment rate		6.936*	2
# Specialists		9.806*	2
% Aged population		.694	2
Environmental Uncertainty		35.396£*	8
HMO penetration rate		10.371*	2
HospHHI		.000	0
Nursing home competition		5.652	2
Location*HospHHI		8.933*	2
Organizational Resources		90.950Ψ*	10
# Hospital beds		34.228***	2
# RNs		.810	2
Occupancy		.000	0
Community orientation		32.622***	2
Location*Occupancy		11.147***	2

* $p < .05$; *** $p < .004$ (adjustment at $\alpha = .05$)

Note: R^2_{CS} (by Cox and Snell) and R^2_N (by Nagelkerke) indicate pseudo R-square. Location means hospital setting, HospHHI means hospital competition, and Occupancy means occupancy rate.

Note: § indicates the improvement in the chi-square value due to the addition of environmental munificence variables, and is equal to the difference between X^2_{total} (26) and X^2_{EU+OR} (20). £ indicates the improvement in the chi-square value due to the addition of environmental uncertainty variables, and is equal to the difference between X^2_{total} (26) and X^2_{EM+OR} (18). Ψ indicates the improvement in the chi-square value due to the addition of variables of organizational resources, and is equal to the difference between X^2_{total} (26) and X^2_{EM+EU} (16).

Note: X^2_{EU+OR} (20) is the chi-square value of multinomial logistic regression on hospital setting, environmental uncertainty variables, variables of organizational resources, and two interaction effects (including Location*HospHHI and Location*Occupancy). X^2_{EM+OR} (18) is the chi-square value of multinomial logistic regression on hospital setting, environmental munificence variables, variables of organizational resources, and one interaction effect (Location*Occupancy). X^2_{EM+EU} (16) is the chi-square value of multinomial logistic regression on hospital setting, environmental munificence variables, environmental uncertainty variables, and one interaction effect (Location*HospHHI).

Table E2. Parameter estimates of multinomial logistic regression for the full model (N = 1,069)

Model 2	Network vs. Freestanding			System vs. Freestanding			Network vs. System	
Variable	Hypothesis	*β*	OR	Hypothesis	*β*	OR	*β*	OR
Intercept		-1.606*			-2.248***		.642	
[Location = 0]		2.262***	9.603		-.048	.954	2.310*	10.071
[Location = 1]		0			0		0	
Environmental Munificence	H1			H2				
Unemployment rate	H1a	.046	1.047	H2a	.088*	1.092	-.042	.959
# Specialists	H1b	.425*	1.530	H2b	.511***	1.667	-.086	.918
% Aged population	H1c	-1.450	.235	H2c	-2.003	.135	.553	1.738
Environmental Uncertainty	H3			H4				
HMO penetration rate	H3a	-2.025***	.132	H4a	-.666	.514	-1.360*	.257
HospHHI	H3b	.489	1.631	H4b	-.238	.788	.727*	2.070
Nursing home competition	H3c	.844	2.325	H4c	1.065*	2.901	-.221	.801
[Location = 0]*HospHHI		-1.317*	.268		1.221	3.391	-2.538*	.079
Organizational Resources	H5			H6				
# Hospital beds	H5a	.004***	1.004	H6a	.004***	1.004	.000	1.000
# RNs	H5b	-.194	.824	H6b	-.084	.920	-.110	.895
Occupancy	H5c	1.548*	4.704	H6c	1.713*	5.543	-.164	.849
Community orientation	H5d	-1.440***	.237	H6d	-1.097***	.334	-.343	.709
[Location = 0]*Occupancy		-2.793***	.061		-2.670*	.069	-.123	.884

* $p < .05$; *** $p < .004$ (adjustment at $\alpha = .05$)

Note: Location means hospital setting, HospHHI means hospital competition, and Occupancy means occupancy rate. OR means the odds ratio, and is equal to Exp(*β*). Network indicates health care networks, and System means health care systems.