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THE EFFECTS OF PHYSICIAN-HOSPITAL ORGANIZATION ON THE FINANCIAL PERFORMANCE OF SYSTEM HOSPITALS: AN EMPIRICAL INVESTIGATION OF VERTICAL INTEGRATION STRATEGIES

By

RICHARD P. SILKOFF

A dissertation submitted in partial fulfillment
of the requirements for the degree of

DOCTOR OF SCIENCE IN MANAGEMENT SYSTEMS

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APPROVED BY:

Sanja Grubacic, Ph.D.
Committee Chairperson

Zeljan Schuster, Ph.D.
Committee Member

Kamal Upadhyaya, Ph.D.
Committee Member

Anshuman Prasad, Ph.D.
Director of the Doctoral Program

Linda M. Martin, Ph.D.
Dean of the School of Business

Ira H. Kleinfeld, Sc.D.
Dean of the Graduate School

Date: _____ December, 2001
University of New Haven
West Haven, Connecticut

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CHAPTER 1

INTRODUCTION AND BACKGROUND

1.1. General Background

The perspective of hospital organization in the 1980s stands in sharp contrast to that of the 1990s. By the end of the 1990s, hospitals continued to face constant pressure from managed care providers such as health maintenance organizations (HMOs) and preferred provider organizations (PPOs) to keep medical costs low while continuing to provide high-quality health care services.

Financial demands brought about by the Medicare Prospective Payment System, coupled with competition among healthcare providers, have forced hospitals to engage in consolidation and merger activities to increase chances of survival in an increasingly hostile business and economic environment (Finkler and Horowitz 1985). Thus, consolidation and merger among hospitals under one system of control has formed the basis of dealing with this type of business climate.

Figure 1 shows the relationship between hospital system consolidation and physician participation in this segment of the health care market over a 15-year period from 1980 to 1995. An increase in physician participation in management mirrors an increase in hospital merger and consolidation efforts since the advent of the Prospective Payment System.

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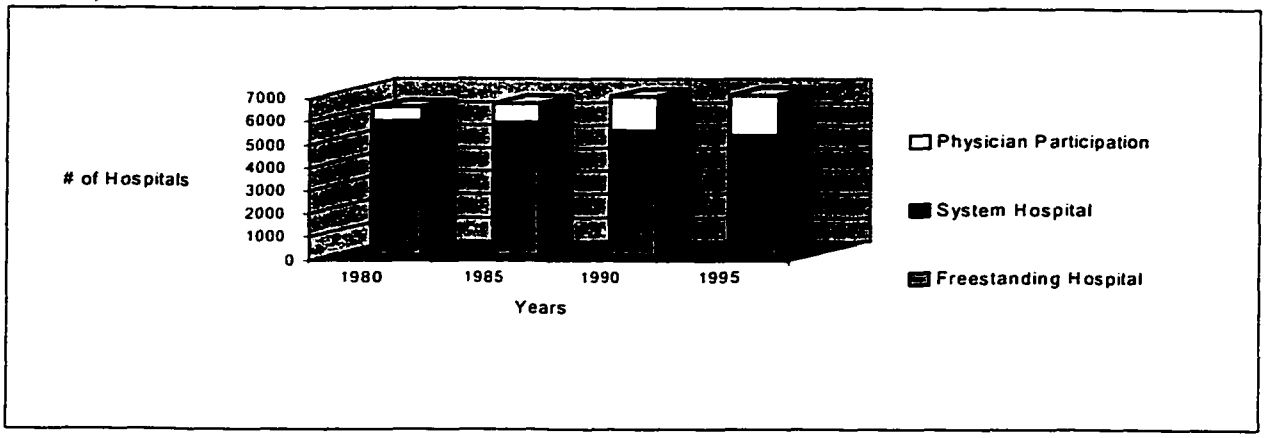
Figure 1. System Hospital vs. Physician Participation (1980 - 1995)



In 1980, system hospitals made up less than 30% of all community hospitals in the U.S., the majority existing as freestanding institutions. By 1996, the number of hospitals belonging to multi-hospital systems doubled making up approximately 60% of all community hospitals in the U.S., with integrated healthcare systems comprising more than 65% of all healthcare system providers combined. Notable has been the increase in the existence of physician participation in the management and governance of these hospitals and hospital systems.

The trend toward consolidation and merger has demonstrated that hospitals, especially over the past decade, have continued to form alliances with physicians. In order to forge new alliances, hospital administrators and managers found it necessary to combine health services and service functions under one form of control. The presence of formalized Physician-Hospital Organizations (PHO) has reflected this

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trend. The outcome has resulted in a three-fold increase in the number of physician managers in hospital systems.

Administrators of hospital systems have come to realize that the providers of services, like the suppliers of product who also own the processes in the chain, are able to exert more control and obtain greater economies of scale, than if those same activities were to act apart from each other (Dychtwald and Zitter 1986).

To date, research conducted on these emerging physician organizations has relied heavily on case studies. Case studies have provided a better understanding of the strategies and objectives of these structures. However, little broad-based empirical analysis has occurred with regard to how physician organizations affect the financial performance of these hospital systems.

In fact, past studies have limited the assessment of hospital performance to the effects of managed care contracting strategies (Morrisey et al 1996)- without looking at overall hospital integration efforts - including those that involve hospital administration and physician management issues. Thus, the influence of formal physician organizations on the financial performance of system hospitals has not been studied intensively.

New, evolving health organizations make possible managed care efficiencies by combining large groups of common

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providers. This is accomplished by linking hospitals, physicians, outpatient facilities, skilled nursing facilities, and insurance groups into one network.

Attempts by hospital managers to maximize performance of these systems by controlling costs and increasing productivity - while improving medical care quality across the entire continuum of care - has proven to be a difficult and complex issue. Given the increased availability of data from the American Hospital Association and the Health Care Financing Administration, the lack of research and absence of a unifying framework in this area is especially troublesome.

1.2. Purpose of the Study

With the number of physicians participating in hospital organizations increasing, the question of how physicians will fit into the overall scheme envisioned by hospital managers and managed care firms continues to remain open. Studies suggest that physician affiliation is a key factor influencing acceptance and involvement in management, since healthcare managers often lack direct control over the incentives and work conditions that affect physician behavior (Blumenthal and Edwards 1995).

Physician affiliations with system hospitals represent a deeper commitment among physicians as to how they will manage and govern, and how revenues will be split. One way in which

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physicians may exercise leadership for quality is by participating in strategic planning, policymaking, and related governance activities. Through involvement in management and governance, physician leaders can not only shape the hospital's quality vision, but also influence decisions about implementation and cost-quality trade-offs.

Most studies done to date on the impact of physician participation on hospital financial performance have focused solely on the effect environmental factors, primarily managed care and market influences, have had on hospital resources. This study focuses on the effect organizational factors, specifically the implementation of hospital care strategies, have on hospital stakeholders.

As such, we have chosen to assess performance by using cost and productivity rate as determinants of hospital system efficiencies and quality. Operating expenses per admission was used as a basis for cost. The measurement of direct patient care in hours (called full-time equivalents) for each occupied hospital bed was used as a proxy of productivity rate. These measures have been suggested by recent literature as an effective means of assessing overall system performance (Goes and Zahn 1995), especially in hospital systems.

This dissertation is an empirical assessment of the influence of physician participation in the management and governance of hospital systems, and the effect this

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participation has on the financial performance of system hospitals. The research respects the process of hospital care strategies commonly employed by managers in hospital systems. These strategies are included as variables in the model used for our study. The focus of the study is on the relationship between physician participation in the management and governance of multi-hospital systems, and the financial performance of hospital systems.

1.2.1. Statement of the Problem

Over the past decade, a number of major environmental conditions have been impacting hospitals, making the need for change important. The effect that has initiated the greatest challenge for hospital management has been the complete phase-in of the Medicare Prospective Payment System (PPS) during much of the 1990s.

Prior to 1983, any uncertainty in the amount of health service costs that were required to treat a patient would primarily affect the payer, which included the insurance company or Medicare. If a patient required more units of health services than average to improve health status, Medicare or the insurance companies were responsible for the additional payments.

Since 1983, however, Medicare payments to hospitals for inpatient care have been primarily made on a per case basis.

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Private payers and state governments soon followed the lead of the federal government, which introduced a prospective payment system. Under this system of payment, the reimbursement amount for each patient is currently predetermined and identical for each patient. The amount of reimbursement is an estimate based on the nature of the patient care, with the nature of care defined using a set of Diagnostic Related Groups (DRGs) or treatment categories.

In effect, this system establishes a "market price," and the hospitals strive to provide the care at a cost that is within a predetermined reimbursement amount (Smith and Fottler 1985). Although the third party payers can drive the prices upward or downward, once the price is established, the system remains a very competitive one.

The PPS system places health providers (hospital and physicians) at risk for above-average costs of treating a patient in that the actual cost of inpatient care may be greater than the standardized prospective payment. This shift in reimbursement leaves providers of healthcare services vulnerable to the chance that a group of high-cost patients could present financial problems for the hospital and physicians affiliated with the hospital.

Environmental factors have forced hospitals to consider the need for organizational change. Pressures from managed care organizations regarding the means of financing these hospital

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systems, combined with concern over quality medical care delivery to the community, have left hospitals and physicians in a quandary over costs, compensation and the appropriate clinical procedures to use.

One of the areas under scrutiny concerns physician managers, and how they can be used to make decisions regarding hospital management and policy issues. Much of the difficulty in structuring integration efforts, such as this, originates from the inherent conflict between physicians' motivation to work in their own self-interest and any unselfish motivations to work in the hospital's interest. Partly to account for this concern has been the need for managers of hospital systems to satisfy their stakeholders without sacrificing quality medical care delivery.

With respect to this study, four main problems are addressed with regard to hospital system financial performance, making the need for organizational change in the hospital industry significant. These include: (1) dealing with an increasing need for outpatient services and the shrinking use of inpatient hospitalization, (2) handling greater patient expectations for access and resources by streamlining activities and eliminating duplicate services and technology, (3) managing the increasing administrative burden and financial risk placed on the main providers of healthcare services, namely physicians and hospitals, and (4) coping with ongoing

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cost pressures from third-party payers, which includes the increasing demand for discounted fees for services and prospective payments.

Since 1990, hospital systems have seen a steady drop in inpatient census. Technology advances, further changes in the way hospitals are reimbursed, and managed care have all led to a drop in patient length of stay in the hospital and a shifting of hospital care business to an ambulatory (one day or less) setting (Cleverley 1990).

Moreover, duplication of services and technology exists at many hospital sites. Facilities compete for the same patients, leading to underutilization of services and technology in some areas. Expansion is needed in certain geographic locations to meet community needs and demands. Excess capacity in the system provides the opportunity to consolidate inpatient services and reduce the number of facilities (Ketchen et al 1993). This type of structure streamlines the process and shortens the time frame, allowing the hospital system to manage its resources from a "systems-thinking" perspective. It also prevents the unnecessary closing of facilities.

1.2.2. Significance of the Research

The need to undertake research that categorizes and classifies newly emerging healthcare organizations is great. Policymakers need to determine the responsibilities of

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different organizations to match insurance, antitrust, and other regulatory policies to the specific operations of these organizations. In addition to the requirements of policymakers, researchers in this area need a better system to identify groups of health organizations with common features so that they can conduct focused data collection and analysis. Health executives and practitioners need a better understanding of the current and evolving structure of their organizations to better articulate strategic direction and to identify potential partners for collaboration.

Several trends appear likely to carry on. Physicians will continue to form networks for managed care. Many of these will be in cooperation with hospitals. More group practices will form, since groups have a hefty advantage over alliances and networks. They act as one economic unit, sharing risk, and can deal with environmental pressures as a unit without the restrictions that are inherent to independent economic units.

This study is an empirical investigation that identifies the underlying factors that cause one type of hospital system organization to perform better than another. Industrial economics provides the basis for identifying key configurations and characteristics for meaningful differentiation of underlying strategies and structures of professional organizations (Chandler 1981). The focus is primarily on describing the formal structures of different physician-

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hospital organizational arrangements and assessing their prevalence (Alexander et al. 1996; Morissey et al 1996). In addition, identifying the various processes imbedded in different structural models is essential for a complete understanding of these complex arrangements.

Management systems theory, on the other hand, provides a basis for choosing whether to offer professional services through direct ownership in the organization or through contractual participation with others (i.e. integration). The basis of choice provides the organization with a mode of making important strategic decisions for the healthcare organization (Zajac and D'Aunno 1994).

As mentioned above, hospitals face several implicit challenges specific to their environment. In hospital systems, physicians exercise significant influence over organizational costs by deciding which patients will be admitted, which services they will receive, and how long they will be hospitalized. These dimensions of hospital system structure can be grouped into specific relationships involving (1) hospital mergers, (2) hospital ownership, and (3) participation in hospital management.

Results of our study are, therefore, likely to have important implications both for hospital administrators considering closer ties with their medical staff and for policy makers concerned with containing health care costs.

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1.2.3. Structure of Healthcare Delivery Systems

The structure of healthcare delivery systems is changing. The existence of many freestanding hospitals, individual physician practices and small, independent auxiliary healthcare providers is giving way to fewer but larger, integrated healthcare systems that provide a wider range of healthcare bbservices. As a result, hospitals must be defined and categorized in terms of whether they share strategic or structural characteristics.

An integrated hospital system can be described as a consolidation of three or more unaffiliated hospitals or a merger of hospitals owned and controlled by a single corporate entity. Strategic characteristics are determined by the degree of integration sought by hospital management, whereas structural characteristics determine the type of ownership desired (Conrad 1993; Gillies et al. 1993). Regardless of the organization's specific structure - the decision to integrate, add new units or eliminate old ones - depends on the form of ownership involved (Mick and Conrad 1988).

Since 1983 and the advent of the Prospective Payment System, healthcare service providers have pursued both horizontal and vertical forms of integration. Horizontal integration of hospitals, for example, has resulted in multi-hospital chains. They have been defined as hospital systems

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where the total number of hospitals is greater than the components in the system. Components of the system include physician organizations, managed care arrangements, skilled nursing facilities and outpatient service facilities. The purpose of horizontal integration is to create greater growth and expand market share.

Vertical integration combines different healthcare services under one control – for example, a hospital that opens an outpatient clinic and then buys a physician group practice. It is characterized by hospital systems in which the total number of hospitals is less than the number of components.

The emphasis of this kind of integration is on creating efficiencies and economies of scale rather than growth or expansion into more services. Thus, the purpose of vertical integration is to make hospital admissions more predictable and allow costs to be spread across a greater number of cases. For purposes of this dissertation, performance was assessed in those hospital systems that are defined as vertically integrated.

There are two (2) major types of organizational ownership and control classifications that define a hospital system's structure: for-profit (FP) and non-profit (NP) system characteristics. Many observers expect NP and FP hospitals to play different roles in the healthcare system.

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The ability of FPs to distribute their current earnings and profits to investors create incentives to organize production efficiently and maximize profits. In contrast, NPs are expected to spend any surplus in pursuit of broad objectives that benefit the community, such as maximizing the number of patients treated or the quality of care.

In the absence of a general, unifying model, the organization must analyze specific choices and constraints faced by all system hospitals. These choices include having the capability to raise capital in order to invest in new technologies (Pauly 1987). This consists of expanding the number of medical services offered and exerting leverage over managed care payors to resist additional price discounts. Thus, the type of ownership defines the mission of the organization and has an effect on the strategies a hospital system will most likely employ to fulfill that mission.

For-profit hospitals are more likely to employ business strategies that maximize return on profits and compete for customers in the managed care area. Non-profit hospitals, on the other hand, are more likely to employ business strategies in order to maximize the degree in which to pursue quality and the effort devoted to physician recruitment and satisfaction.

Historically, involving physicians in governance and policy level decision making has been thought to bring many benefits to hospitals for several reasons. First, by bringing a

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clinical perspective to board decisions, physician involvement can improve the quality of strategic planning and capital expansion activities (Morlock, Alexander, and Hunter 1985). Second, involving physicians in hospital governance helps to blend physician and management cultures (Montague 1993), creating a cooperative decision-making environment and building physician commitment to the hospital (Smith, Reid, and Piland 1990). Third, as board members, physicians carry a fiduciary responsibility, and should gain a greater appreciation for the strategic perspective on financial decisions.

As methods for achieving integration between hospitals and physicians develop, experts in this area have put forth a variety of common strategies. One of these strategies has been the implementation and development of physician-hospital organizations. These organizations generally include physician group involvement in the management, governance and financial aspects of the hospital organization and are identified as being open or closed types of system relationships.

An open physician-hospital system is a joint venture between the hospital and all non-staff physicians who wish to participate. There is a high degree of risk sharing but a low degree of exclusivity. Thus, affiliation is open to participation at the hospital system level, whereby physicians can influence both managerial and governance issues on a system-wide basis.

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Alternatively, a closed physician-hospital system is a joint venture between hospital and non-staff physicians who have been selected on the basis of cost-effectiveness and/or quality. There is a low degree of risk sharing but a high degree of exclusivity. Physician participation is generally limited to the hospital level and restricted to managerial decision making and governance involvement at the local hospital level only.

For purposes of this analysis, system participation relates to the type of non-staff physician affiliation with the hospital in the system. It is defined as those structural mechanisms that make it easier for physicians to participate in hospital management, governance activities, and administration in the management of clinical-medical staff activities.

1.3. Research Questions

Transition in the hospital industry raises many questions about the organizational character of system hospitals, especially regarding structure. Conceptually, different structural forms have different objectives, including those relationships that involve physician participation.

Theoretically, this suggests that there may be variations in the resulting outcomes between different forms of structure and control (Goes and Zahn 1995). The resulting effect from these different combinations casts a relevant question to this

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study: Do system hospitals that use physician participation strategies exhibit better financial performance outcomes than those system hospitals that don't use physician participation strategies?

This question leads to an additional premise: Does open physician participation in a system hospital affect hospital system financial performance more than closed physician participation in a system hospital?

The objective of this paper is to develop a model that can be used to assess the financial performance of a system hospital when physician participation in the management of the hospital is present. In the physician-hospital organization (PHO), the physician may be given the opportunity to participate in the management and governance of the organization at the systems level, or may be limited to participation at the hospital level.

Specifically, this study explores the effects of physician participation in the management and governance of system hospitals on hospital system financial performance at both levels of participation. It is expected that the type of affiliation and degree of participation by physicians in administrative policy and decision-making will have an impact on the financial performance of the organization.

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1.4. Scope of the Study

This study is an attempt to investigate the popularity and performance implications of physician participation in system hospitals. However, several brief caveats are in order.

The findings generalize only to the strategies that can be measured in the data. More sophisticated integration strategies involving joint ownership, shared services, and managed care contracting found in management services organization (MSO) and independent physician organization (IPO) arrangements may yield stronger effects on hospital system performance. For purposes of this study, physician participation was limited to the level of the physician-hospital organization because of its specificity and the consistency of obtaining comparable data.

Studies on the effects of age on hospital performance have been conducted in the past (Levitz and Brooke 1985) and all have found the results non-generalizable due to small sample sizes, typically limited to older facilities. Research in this thesis is intended to obtain a sufficiently large sample size from the population of U.S. community hospitals in a healthcare system. A selection of a sample based on age of facilities would have left the study too incomplete for further analysis.

The measures of integration and performance are limited in scope by the nature of the secondary data. For example, the physician participation variable is limited to the type of physician participation found (open or closed), not to the

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number of physicians that participate in hospital management activities. This may only capture a portion of physician interest in hospital systems. A survey conducted by the American Hospital Association was used to identify each system hospital as open or closed respective to physician-hospital integration organization, but did not capture the extent of participation.

The unique characteristics of the geographic location of each hospital are important to recognize and may limit the generalizability of results. The regulation of system hospitals has undergone dramatic change in the last decade, especially at the state level. For example, the regulation of California hospitals has undergone major changes in the past decade, including selective contracting for both Medicare and Medicaid patients and eliminating certificate of need in many instances. This has created a desire for greater managed care penetration with incentives to control costs, which in turn has lead to a greater interest in increased physician participation.

As a result of these differences in approach taken by different healthcare systems; market share, market orientation and market power measures have been left out of this study. These effects have been indirectly included through the control of size, location and profit orientation measures.

Finally, it is important to note that there is a potential for endogeneity in the model. That is, rather than physician

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participation affecting costs, hospitals with higher costs may have adopted and encouraged physician participation as a means to control these costs. This suggests that mechanisms may have already been in place for a long enough period of time to have had an effect on costs.

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CHAPTER 2
LITERATURE REVIEW

2.1. Introduction

The literature review will begin with a profile of hospital system ownership and physician participation in the hospital system. This is followed by an exploration of the incentives for using vertical integration strategies, and the association between physician-hospital organizations and vertical integration strategies with hospital financial performance.

2.1.1. Hospital System Ownership

Based on a review of the health care strategy literature (Fottler, 1987; Alexander and Morrisey, 1988), four ownership criteria specific to the hospital industry keep emerging. These are:

1. size of the system hospital,
2 profit orientation of hospital system
3 location of the system hospital, and
4 age of the hospital.

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The size of a hospital may help it obtain economic advantage in those activities positively affecting financial performance (Burns and Thorpe, 1993). Differences in size make possible consolidation and integration between merging entities based on unequal power distribution. The more powerful hospital will be in a position to exercise greater financial leverage and gain better advantages for making operational changes (Alexander et al. 1996). These advantages may appear attractive to those physicians wanting to affiliate with the hospital.

In addition, larger system hospitals have had the greatest success with managed care. They have included those organizations that have experienced a strong share in the market, making it possible to compete with other managed care organizations without losing business (Walston et al. 1996). This ability normally requires considerable market share and a reputation among consumers that make it necessary for all or most managed care organizations to contract with them to attract major business clients for their products.

Research findings regarding profit orientation (Fottler et al 1989) have indicated that management functions vary widely between for-profit and not-for-profit hospitals, affecting the manner in which hospitals consolidate to form systems. Profit orientation affects the ability of the hospital to obtain resources (Fottler 1987). This is important in determining

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whether the hospital has the appropriate resource capabilities of, and the correct reasons for, pursuing various vertical integration strategies. For example, while for-profit hospitals can obtain capital from the public, not-for-profit hospitals have a more restricted set of sources of capital.

The location of a hospital may have an impact on the nature of the competitive environment being faced by different hospital systems. Competitive rivalry may be more intense in larger, urban locations, which could affect the performance of hospitals in these areas. Furthermore, hospitals in smaller, rural areas may have no competition, which in turn could contribute to the better performance by these hospitals (Narver and Slater 1990).

The health care strategy literature (e.g., Topping and Hernandez 1991; Zallocco and Joseph 1991) identifies age of facilities as a factor that influences the type of strategies that are used by a hospital organization. Since the extent of integration determines the degree of strategic intervention of an organization (Pegels and Rogers 1988), it appears that it is necessary to control for the age of hospitals in examining the hospital system ownership-strategic performance relationship.

However, older facilities may have lower costs because depreciation of assets does not fully measure the replacement cost of those assets. Thus, it is difficult to determine if age is measured in terms of the assets' economic life, the number

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of years the hospital has been in the system, or the total number of years the hospital has been in existence. Whether the hospital is a new or old member of a system is different from the age of the facility itself. This is likely to be reported differently among system hospitals, creating difficulty in making data comparisons. Therefore, age is disregarded as a control variable in this study.

2.1.2. Physician-Hospital Integration

A vertically integrated organization is regarded as an "open system" when interaction with the environment becomes essential to its functioning (Scott, 1992; Ackoff 1994). A changing environment makes necessary a redefining of the relationship between physicians and hospitals. Hospitals face growing threats to their market share from other hospitals and, increasingly from physicians. The progressive shifting of financial risk from insurer and patient to the providers of healthcare services (i.e. the hospital and physician) has led to an increase in the need for hospitals to form vertically integrated organizations for two reasons.

First, hospitals have to deal with uncertain revenue streams due to changes in reimbursement policy and increased administrative demands as a result of managed care contracting. Second, physicians have to "take up the issue of increased administrative intensity due to managed care and the rising

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demands for new technology on account of increased specialization" (Shastri and Goldenschuh, 1996. p.6).

The literature suggests a number of methods for structuring and managing physician behavior in hospitals. Scott (1982) has identified three models for integrating physicians into the management and policymaking structure of hospitals: autonomous, heteronomous, and conjoint.

The autonomous model of physician integration in a hospital system is characterized by sharp differences between professional and administrative areas of control and the existence of a separate professional staff. Here, the physician is primarily responsible for establishing management decision policies and implementing various strategies used. The physician is not constrained by managerial control and supervision. This model is characteristic of most system hospitals in the United States.

The second model, heteronomous professional organizations, involves structures where physicians are subordinate to the administration and must comply with managerial control and supervision. In this case, patient care policies are influenced more by organizational issues and concerns that prevent individual physician autonomy.

Scott's third model, the conjoint professional organization, is one in which physicians and mangers are roughly equal in power and in the importance of their

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functions. Neither manager nor physician dominates the other. Because of the potential for conflicts between clinical and managerial priorities and approaches to health care delivery, the conjoint model makes necessary the use of conflict resolution and considerable interdependence among those responsible for the two types of care.

The autonomous standard permits a relationship between physicians and hospitals that can be characterized as symbiotic - each dependent on the other - but emphasizes physician autonomy and independence (Harris, Hicks and Kelly 1992). Proponents of this model believe that physician-hospital integration enables hospitals to exercise greater control over costs by giving physicians more control over management decision making.

Since physicians control so many patient care decisions that influence costs, hospitals that achieve strong integration of medical and administrative goals in continuous quality improvement should receive greater physician cooperation in containing costs (Shortell, O'Brien et al 1995). This can boost productivity by changing the way managers respect physician involvement in management decision-making policy and by limiting expensive and time-consuming procedures.

Earlier research focused on the segment of the range of healthcare services that involved "tighter coupling" of hospitals and physicians through a combination of employer-

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employee relationships as well as direct participation in the management and policymaking structure of the hospital. Under these arrangements, it was found that hospital managers "want direct control and responsibility over how physicians utilize resources when treating patients" (Alexander and Morissey 1988). However, it was also found that physicians "need direct access to and involvement in decision-making activities that affect resource use and allocation in the hospital" (Glandon and Morrisey 1986).

In their studies of physician participation in hospital administration, Smith, Reid and Piland (1990) argued that involving physicians in hospital governance and management at a "systems level" increases their exposure to tough financial or administrative decisions. These experiences will likely increase physician sensitivity to hospital costs and financial performance.

As further conceptualized by Shortell, Gillies and Anderson (1993), vertical integration establishes the degree to which hospitals involve physicians in management and policy-making activities, and the extent to which physicians identify with and use hospitals. As to the degree to which physicians identify with and use system hospitals, Devers et al. (1994) were the first to operationalize previous work in the area of physician-hospital integration by classifying and measuring physician-hospital organization along four criteria:

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1. Economic involvement as measured by the average percentage of physicians admitting 10 or more patients or receiving management services across hospitals in a system,
2 Administrative involvement as measured by the average percentage of physicians paid for administrative roles in system hospitals,
3 Group involvement as measured by the average percentage of physicians practicing in groups and accounting for 75 percent or more of admissions across hospitals in a system, and,
4 Shared accountability as measured by the percentage of hospitals in a system sharing a common medical staff organization or physician credentialing process.

The above was the capstone study conducted on hospitals in order to successfully quantify the effects of physician participation in hospital system management and governance. By taking into consideration specific strategies common to most hospitals that can boost productivity and contain costs, Devers (1994) was able to develop concrete dimensions of integration: functional, physician-system, and clinical. This allowed researchers in the area of financial management to measure the degree in which each system hospital shared the same policies and procedures as other system hospitals.

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2.1.3. The Physician-Hospital Organization

Physician-hospital organization is of particular interest and relevance to this study. Currently, the growth of incentives to receive maximum reimbursement from Medicare, combined with the need to develop specific strategies that will contain costs and increase productivity, are factors compelling hospitals and physicians to align their interests (Burns and Thorpe 1995; Harris, Hicks and Kelly 1992).

In most cases, physicians are not hospital employees. Rather, they play a role more similar to that of independent contractors who choose a production facility at which to perform their services. One consequence of their status as a "non-employee" is that the hospital very often has no recourse with which to provide the physician appropriate financial incentives to control the consumption of hospital resources.

Until recently, the hospital industry has appeared to be relatively indifferent to modifying physician behavior to achieve cost-effective care (Shortell, Gillies and Anderson 1996). In response to this absence of explicit incentives, hospitals have had to resort to other management control features to provide appropriate incentives for physicians. One such approach was the creation of the physician-hospital organization.

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Physician-hospital organizations have a number of advantages for the providers of healthcare: First, they increase negotiating power with managed care organizations. Second, they act as facilitator for administrative functions. Third, they provide financial incentives to align hospitals with physicians through risk-sharing and salaried arrangements. Ultimately, they represent one of the best approaches for hospitals and physicians to work together to provide quality health care (Alexander et al 1996).

Earlier studies from the 1980s reported that hospitals had begun to formally integrate physicians through involvement in governance, capital planning, and the provision of practice management services (Alexander, Morrisey and Shortell 1986; Shortell et al. 1985). These studies, however, were limited to simple counts, trends and profiles of the number of physicians actively engaged in each of these activities. This research did not attempt to find relationships between physician integration activities and hospital performance.

Dynan, Bazzoli and Burns (1998) found that past studies of physician integration activities would have carried greater weight had the previous studies included two empirical measures: clinical integration and economic integration. By including these dimensions, Dynan, Bazzoli and Burns (1998) postulated that the findings in these studies could have demonstrated that specific strategies, made available to

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hospital organizations, could bring about positive behavioral change.

In professional organizations, such as hospitals, however, the task becomes much more difficult given differences in professional-management orientation, as well as the unique role of the physician in the hospital organization. Critics have questioned the necessity of physician-hospital organizations. Gill and Meighan (1988) argued that "organizational restructuring techniques will not by themselves guarantee more effective governance or transform unresolved conflicts in the past."

The bigger problem is that there has been little empirical research available regarding hospital restructuring issues, particularly since PPS implementation. Moreover, most studies have used cross-sectional data from pre-PPS periods, and focused exclusively on hospital admission and patient discharge data.

One post-PPS study found that physician-hospital organization integration actually increased hospital costs (Alexander and Morrisey 1988), but much of the effect was attributed to differences in hospital type. Alternatively, physician-hospital integration was found to positively affect hospital output and productivity, but only in nonurban settings (Morrisey, Alexander, and Ohsfeldt 1990). By controlling for hospital location, as well as hospital size and ownership type,

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post-PPS results might differ, as may assessing the effects of hospital integration strategies utilized by most system hospitals.

In this study, the physician-hospital organization (PHO) has been selected to represent the structural model employed to integrate physicians and hospitals. It is used to analyze its effect on financial performance of system hospitals, and it is the form used most often in establishing a link between hospital and physician within the system. Furthermore, the PHO shares economic risk between physician and hospitals only for the specific projects and activities of the PHO, especially regarding the negotiation of managed care contracts.

Since the PHO typically has fewer but more diverse managed care contracts (Bazzoli, Dynan and Burns 1997) which involve little, direct capital investment by physicians, an understanding of the relationship between physician participation in the management of a system hospital and hospital financial performance can be made clearer.

2.2. Hospital System Performance

Performance of hospitals has been historically a difficult concept to measure. Earlier empirical research in this area has largely concentrated on analyzing financial measures to determine differences in performance between different types of hospitals.

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Both Coyne (1982) and Levitz and Brooke (1985) were among the first researchers to elicit the differences in financial performance between system and freestanding hospitals. The majority of their studies matched particular financial ratios by comparing differences in costs between system and freestanding hospitals. Given the small sample sizes used, the "matched-pair" approach to their analyses was restricted to a select group of financial ratios, limiting model specification flexibility and introducing statistical bias towards finding "no differences" (McCue 1987).

Moreover, interpretation of the results of their studies yielded conflicting results. Little attention was given to adjusting the statistics for hospitals that had "sicker" patients, a procedure known as case-mix adjustment. Although these studies differentiated hospitals along ownership characteristics such as for-profit and non-profit, they largely ignored the inherent differences in size and location of these hospital organizations (Flood and Scott 1994).

Prior research findings suggest that greater administrative participation by physicians in hospital management was consistently linked to higher costs and that the use of hospital integration strategies was linked with higher productivity, especially in system hospitals (Alexander and Morrisey 1988; Sloan and Becker 1981). The higher costs associated with system hospitals demonstrates an urgent need

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for research aimed at empirically testing evidence that managers of system hospitals possibly do not seek to minimize costs, but rather seek to maximize productivity.

Goes and Zahn (1995) investigated the longitudinal relationships between three hospital performance measures and three types of hospital-physician integration strategies: physician involvement in hospital governance, physician involvement in hospital management, and the integration of hospital-physician financial relationships. Hospital performance was measured using operational profitability, occupancy, and costs.

Results of these studies contradicted previous research in this area. The findings by Goes and Zahn (1995) now supported the validity that physician involvement in governance was found to be associated with higher profitability and occupancy, wheras financial integration efforts was related to lower operating costs. The results, however, provided considerable less support for strategies built around increasing productivity and more toward finding incentives for minimizing costs.

2.3. Vertical Integration Strategies and Hospital Performance

When studying system hospitals, it is necessary to consider that not only do hospitals provide health care to their populations, but they are also a major economic,

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emotional and symbolic community element (McDermott et al 1991). Thus, there are generally three reasons which motivate an organization to pursue integration strategies: cost containment (Coyne 1982) by reducing expenses for affordable health care, increased productivity (Mick and Conrad 1988) by providing more medical care over a shorter time period, and revenue maximization by facilitating control over prices (Finkler 1983; Shortell et al 1993).

Changes in the healthcare sector, especially after the implementation of the Medicare Prospective Payment System (PPS) in 1983, have required hospitals to focus attention on cost containment and productivity in the hospital system. Vertical integration strategies have been used as a means of achieving these results.

The majority of references to vertical integration in healthcare are concerned with the growing ties between physicians and hospital systems (Gorey 1993; Devers et al 1994; Shortell 1990) and the combination of hospital, physician, and managed care functions under the same management system (Burns and Thorpe 1993). Thus, a healthcare organization's primary motivation for undertaking vertical integration is to increase benefits to the organization's stakeholders by streamlining the physician-hospital-managed care link (Sherlock 1990).

Presently, there are three groups of hospital integration strategies that are common to most healthcare systems. The

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purpose of these strategies is to align physicians with hospital management at a minimum cost per patient admission and a maximum productivity level. The strategies include:

1. the deployment of managed care arrangements through contracts with health maintenance organizations (HMO) and preferred provider organizations (PPO),
2. the use of non-hospital based staff physicians, and
3. the decision to make use of same-day outpatient services rather than admit patients to long-term care and skilled nursing facilities.

2.3.1 Managed Care Strategies

The deployment of managed care arrangements through hospital systems are believed to have cost savings possibilities because of fixed payment for care and the resulting pressures for responsible spending. There is a broad literature suggesting that managed care organizations have the potential to reduce the overall costs of patient care and deliver effective and efficient health care (Conrad et al. 1996; Miller and Luft 1994; Wallack 1991).

This study uses decisions to contract with an HMO and PPO as an element of hospital integration strategy employed by the hospital system to maximize financial performance. Figure 2 shows the range of managed care strategies ranging from fee-

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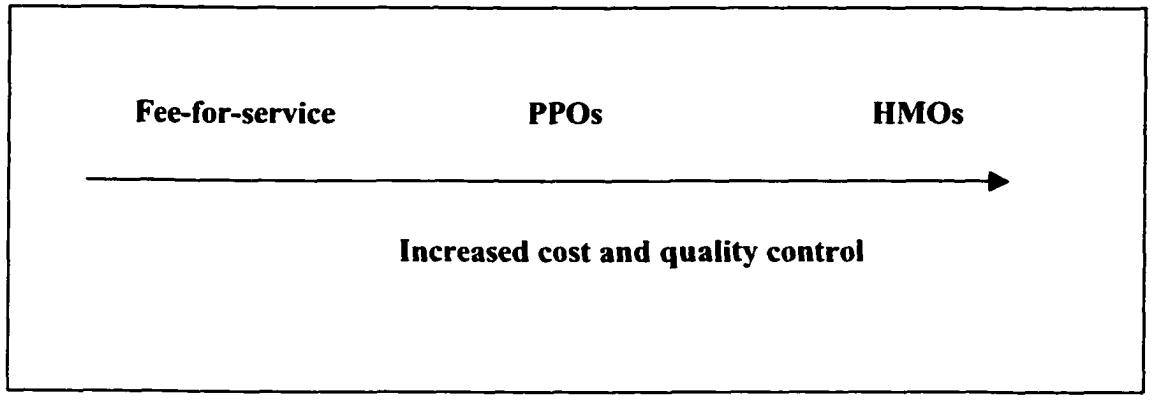
for-service plans with a low degree of cost and quality control to HMOs with a high degree of cost and quality control. PPOs lie somewhere in the middle of the spectrum.

Figure 2. Range of Managed Care Strategies



An HMO is a contractual responsibility to provide health care services to a defined population on a voluntary basis - in exchange for a fixed annual or monthly payment. The HMO assumes financial risk for the provision of services and is responsible for both the financing and delivery of the medical care (Wagner 1996).

Preferred Provider Organizations (PPOs), on the other hand, are entities that "arrange for the delivery of specified health care services at a negotiated price to an identifiable group of subscribers or clients" (Long 1994). PPOs exist as a means of providing an alternative to the HMO.

The main advantage of the PPO over the HMO lies in the area of choice to the client, since PPOs allow the use of non-PPO providers (Wagner 1996) at the same or lower cost per

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patient. The main drawback is the transfer of financial risk to the hospital and physician.

Much research has provided a link between managed care and hospital performance, linking the existence of PPO and HMO penetration in a market to hospital expenses (Gaskin and Hadley 1997; Zwanziger and Melnick 1996), and to the number of hospital beds (Chernew 1995). Results have been sufficiently convincing to include managed care strategies as an important variable for consideration in this study.

2.3.2 Hospital Care Strategies

Hospital care strategies include the effects of increased dependence on non-hospital based staff physicians and the decision to make use of short-stay, hospital-based outpatient sevices rather than long-term inpatient and skilled nursing services. In assessing California hospitals from 1983 to 1990, Cody (1996) noted that pre-hospital strategies (e.g., using oupatient services and staff physicians) could be distinguished from post-hospital strategies (e.g. inpatient and skilled nursing care) by their effects on hospital revenue. The study concluded that most hospitals became involved in a mix of pre-hospital and post-hospital care.

The results of Cody's (1996) empirical analysis confirmed that pre-hospital strategies were successful in generating income by preventing further decreases in Medicare revenues -

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and that post-hospital strategies were less successful in enhancing overall revenues. However, the effects of these decisions on hospital cost and productivity were not included as part of the study. Furthermore, the effects of physician participation in the management or governance of these hospitals were not considered.

Thus, the primary objective of this examination is to extend the research of Cody (1996), but in a different direction. Results from previous study in this area were sufficiently compelling to include hospital care strategies as important predictors of financial performance.

However, in order to further expand on past research, our effort seeks to determine the effects of physician-hospital organization on cost and productivity by including the impact of certain hospital care strategies that are in common use by most system hospitals.

2.4. Contributions of Management Systems Theory

Systems theory supports the idea that organizations make choices in response to a changing environment in order to survive and prosper. Decisions made that affect only a part of the organization will, in time, affect the entire organization and its stakeholders.

Much research in this area has focused on agency theory (Jensen and Meckling 1976), resource dependence (Pfeffer and

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Salancik 1978) and stakeholder theory (Donaldson and Preston 1995; Ansoff 1984) as a basis for explaining choices organizations make in order to endure in an increasingly hostile business climate. Stakeholder theory has been widely used to explain options taken by hospitals in response to challenges presented by changes in the health care environment (Ansoff 1984).

Organizations cannot act alone, they are not self-sufficient. They become interdependent with the stakeholders. A high level of dependence of the stakeholder on the firm means that the welfare of the stakeholder is closely tied to the welfare of the firm. The stakeholder, then, does not wish to see the firm's success threatened and, therefore, will not choose to withhold a critical resource from the firm; rather, the stakeholder tends to focus on strategies as its means of influence (Mullner et al. 1989).

Stakeholder theory supports three basic assumptions:

1. organizations are affected by external associations all competing for the same resources (Gamm et al., 1996);
2. the environment contains resources that are scarce and needed by the organization (Pfeffer 1982), and
3. management of resources lessens the dependency on other organizations

Organizations depend on stakeholders to provide resources in exchange for wealth maximization. However, growing

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competition from less costly and more convenient alternative delivery modes, the increasing use of medical purchasing power by third-party payers, and the increasing fiscal cutbacks and regulatory intervention into hospital operations by state and local government are among environmental changes which threaten the continued survival of many hospitals as autonomous institutions (Byrne and Ashton 1999).

Changes in the health care environment focus on strategies used by hospitals to adapt to the environment. These strategies include the effect structural factors have on ownership characteristics (e.g. hospital system characteristics, physician-hospital organization), and the use of specific processes such as the employment of integration strategies (managed care and hospital care strategies). Since financial performance of hospital systems is a function of both organizational and environmental influences, an analysis of hospital performance must consider both structural and process factors (Donabedian 1980).

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CHAPTER 3
MODEL OF HOSPITAL SYSTEM PERFORMANCE

3.1. Theoretical Summary

While the conceptual framework for this study is grounded in management systems theory, the theoretical foundation is developed from a combination of two economic models (Robinson 1997). The groundwork for this model has been useful in hospital management study to gain an understanding of assessing financial performance in a healthcare environment from the stakeholder point of view (Freeman 1994).

The cost-minimizing model asserts that the hospital's main objective is to maximize profit and return the profit to the hospital, community or physician. The hospital is expected to offer only those services that are profitable. Hospital managers are expected to reduce costs and are rewarded on the basis of the hospital's ability to increase ready access to care while lowering the cost of care (Pauly 1987; Herzlinger and Krasker 1987).

The utility-maximizing model argues that the hospital's main objective is to maximize productivity by increasing the quantity of both hospital and physician services rendered. Hospital managers are expected to increase productivity by reducing capacity (number of beds, average length of stay, number of medical procedures) and are rewarded on the basis of

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the hospital's ability to achieve equilibrium between supply of patient services and demand for those services provided (Newhouse 1970).

No single model is general enough to describe the differences between non-profit (NP) and for-profit (FP) motivations for providing healthcare services. Most non-profit models are empirically indistinguishable from the profit-maximizing model, since they usually include the same measurable explanatory variables (Pauly 1987).

The ability of FPs to distribute their retained surplus to investors creates incentives for FPs to organize production efficiently in order to maximize profits. In contrast, NPs are expected to spend surplus in pursuit of broad objectives that benefit the community, like maximizing the number of patients treated or the quality of care (Newhouse 1970).

One question researchers have posed is whether or not ownership forms other than the for-profit form are more efficient ones for the hospital sector. The answer depends on much more than technical efficiency in choice or inputs. Seen in such narrow terms, the for-profit form performs about as well as private not-for-profits.

The utility-maximization model predicts that hospitals seek to maximize productivity subject to budgetary constraints, whether non-profit or for-profit in ownership form. It is expected that many of the vertical integration strategies are implemented in response to the Medicare Prospective Payment

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System. While some hospitals already had vertically integrated services prior to 1982, falling admission rates and average length of stay prompted hospitals to diversify services and enter other markets as the demand for outpatient and post-hospital care rose (Neu and Harrison 1988).

Economic theory suggests that NP and FP prices may be similar, even though the motivations of the ownership types are different. Productivity in NPs and FPs may be alike where 1) NPs maximize free care for patients who cannot pay, or 2) greater competition has increased the prices NPs must charge to break even.

These effects could operate at the same time that FPs lower their prices to compete with NPs. Thus, it is necessary to examine hospital productivity in light of possible differences between the non-profit and for-profit forms of hospital organization.

3.2. Empirical Model

Our model (Figure 3) combines the above conceptual arrangement into a framework that incorporates both structure and process components. The assumption is that multi-hospital systems in this type of environment need to be productive service providers (utility maximizers) and cost efficient (cost minimizers).

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According to Donabedian (1980), it is argued that by using hospital and managed care strategies (process), and by engaging in physician-hospital integration organizations (structure), the hospital system can adapt to a changing healthcare environment while increasing wealth (outcome) to its stakeholders. Furthermore, participation in physician-hospital organizations are seen as ways the hospital can link with vital resources and involve stakeholders in decision making and managerial activities.

In the past, hospitals were organized along two lines of authority: one administrative, operated by professional managers, and the other clinical, operated by physicians and the medical staff of the hospital. Physicians were protected from the impact of their decisions on the hospital's financial position (Young and Saltman 1983). Because of the nature of health care reimbursement in this medium, which principally covered hospital costs for all services provided, such an arrangement had been acceptable.

With changes in government and third-party payment methods, hospitals have been forced to improve organizational efficiency and establish new perspectives for hospital-physician relationships (Begun 1985). Although there is much support that integration is occurring with increasing frequency, there has been little research up to this point that

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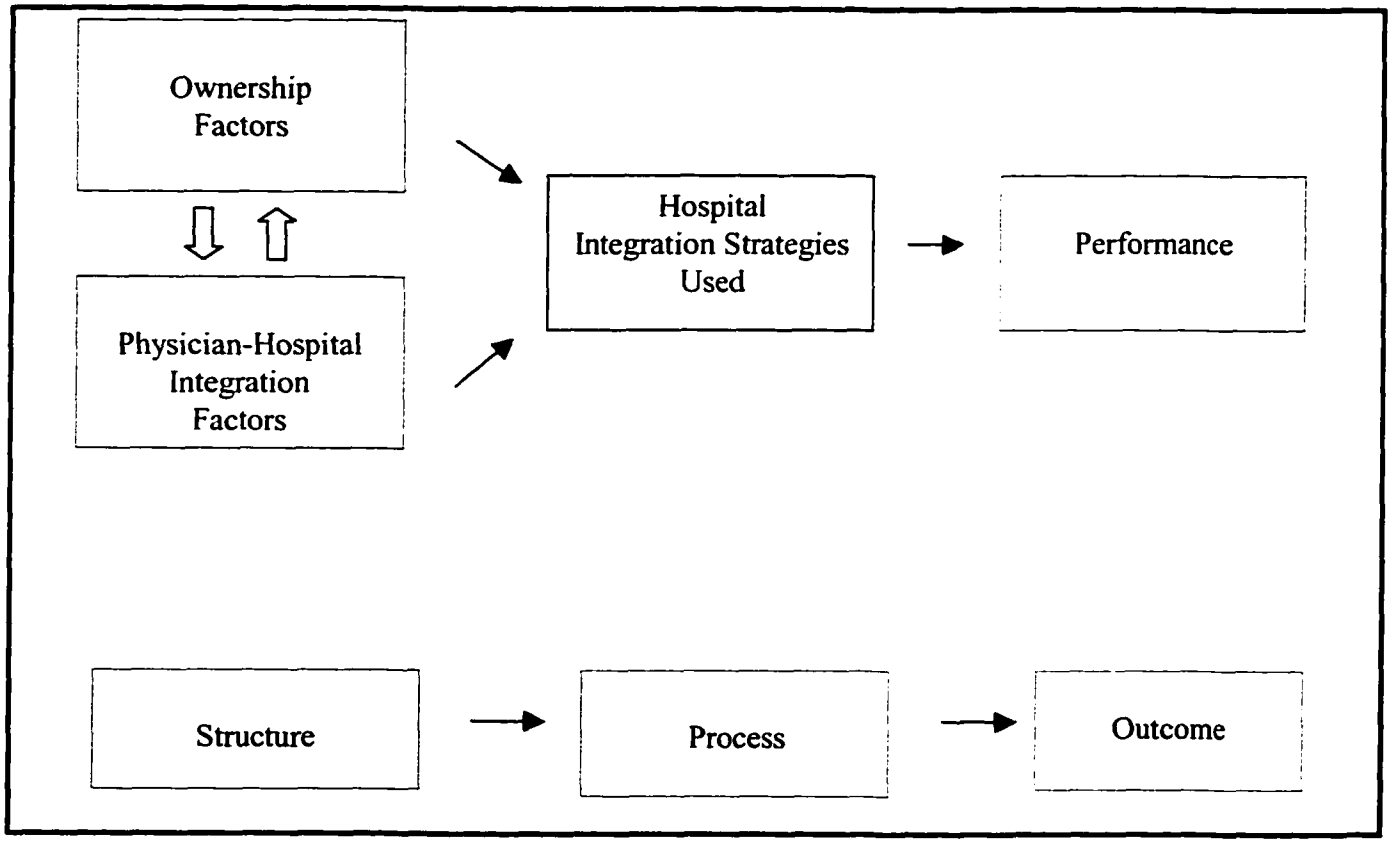
determines how these new structures affect hospital system performance (Burns and Thorpe 1995).

Figure 3. The Model



Our analysis tests whether physician-hospital integration, in general, has a significant effect on multi-hospital system performance. As such, the research includes variables that identify which mechanisms of hospital-physician integration are more or less costly, and which ones are more or less productive. The theory can be expressed in an empirical model that is summarized by:

$$C_i P_i = f(Q_i, W_i, X_i)$$

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where C_i is the adjusted expenses per admissions in hospital i; P_i is adjusted full-time employee equivalents per occupied beds; Q_i is a vector of hospital integration strategies used; W_i is a vector of hospital ownership factors - notably profit orientation, size and location; and X_i is a vector of hospital-physician integration factors - notably the existence and extent of physician participation in hospital management present.

3.3. Hypotheses

A general hypothesis can be derived from our research question: Does ownership in system hospitals that implement physician participation strategies exhibit better performance outcomes? Our empirical model will address this research question by using two subsequent testable hypotheses. That is,

Hypothesis 1 (H1): Controlling for ownership factors -

H_0: Hospital systems that use physician participation as a strategy do not perform better than hospital systems that do not use physician participation as a strategy.

H_a: Hospital systems that use physician participation as a strategy perform better than hospital systems that do not use physician participation as a strategy.

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A second hypothesis can be stated as follows: Does open physician participation in a system hospital affect hospital system performance more than closed physician participation in a system hospital?

That is,

Hypothesis 2 (H2): Controlling for ownership factors -

H_0: Hospital systems that use open physician participation as a strategy do not perform better than hospital systems that use closed physician participation as a strategy.

H_a: Hospital systems that use open physician participation as a strategy perform better than hospital systems that use closed physician participation as a strategy.

3.4. Summary of Expected Results by Hypothesis

The first hypothesis relates to the question: Does the relative frequency with which physician participation strategies are used by hospitals affect the financial performance? It gives the researcher a way to determine if the existence of physician-hospital integration will affect the financial performance of the system hospital. The implication is that the larger the number of affiliations a hospital maintains with physician managers, the stronger the effect on hospital cost and productivity.

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The second hypothesis relates to the question: Do hospitals that adopt specific physician integration strategies exhibit better performance outcomes? This provides the researcher a means of determining whether the extent of physician participation in the management of hospitals - closed or open system - has a stronger effect on financial performance outcomes.

Both hypotheses are tested in terms of cost and productivity, which are used as relative measures of hospital financial performance. In the area of cost, performance is defined as providing more care for the same cost or the same care for less cost. Thus, cost is measured by using hospital operating expenses per patient admission. This allows the research to measure the effects physician participation in the management of a system hospital has on patient admissions and the expenses incurred as a result.

The productivity issue is addressed through use of a widely used statistic in the hospital industry: FTEs per occupied beds. Per findings from background literature investigation, the assignment of specific variables used to assess hospital financial performance, and which have been regarded as representative of cost and productivity, have been verified, through current studies, to produce mixed results in each major category tested (Burns and Thorpe 1993). This makes the analysis of the financial performance measures used in our

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study a way of evaluating the effect physicians have on hospital financial performance when participating in hospital management.

Tables 1 and 2 summarize the two hypotheses that were tested in this research.

Table 1. Summary of Effects of Physician Participation on Hospital System Performance

Hypothesis	Description	Expected Results
H1a.	H0: THERE IS NO DIFFERENCE IN COST BETWEEN SYSTEM HOSPITALS THAT UTILIZE PHYSICIAN PARTICIPATION AS A STRATEGY VS. SYSTEM HOSPITALS THAT DON'T UTILIZE PHYSICIAN PARTICIPATION AS A STRATEGY. HA: THERE IS A DIFFERENCE IN COST BETWEEN SYSTEM HOSPITALS THAT UTILIZE PHYSICIAN INTEGRATION PARTICIPATION AS A STRATEGY VS. SYSTEM HOSPITALS THAT DON'T UTILIZE PHYSICIAN PARTICIPATION AS A STRATEGY.	THERE IS A DIFFERENCE IN COST BETWEEN SYSTEM HOSPITALS THAT UTILIZE PHYSICIAN PARTICIPATION AS A STRATEGY VS. SYSTEM HOSPITALS THAT DON'T UTILIZE PHYSICIAN PARTICIPATION AS A STRATEGY.
H1b.	H0: THERE IS NO DIFFERENCE IN PRODUCTIVITY BETWEEN SYSTEM HOSPITALS THAT UTILIZE PHYSICIAN PARTICIPATION AS A STRATEGY VS. SYSTEM HOSPITALS THAT DON'T UTILIZE PHYSICIAN PARTICIPATION AS A STRATEGY. HA: THERE IS A DIFFERENCE IN PRODUCTIVITY BETWEEN SYSTEM HOSPITALS THAT UTILIZE PHYSICIAN PARTICIPATION AS A STRATEGY VS. SYSTEM HOSPITALS THAT DON'T UTILIZE PHYSICIAN PARTICIPATION AS A STRATEGY.	THERE IS A DIFFERENCE IN PRODUCTIVITY BETWEEN SYSTEM HOSPITALS THAT UTILIZE PHYSICIAN PARTICIPATION AS A STRATEGY VS. SYSTEM HOSPITALS THAT DON'T UTILIZE PHYSICIAN PARTICIPATION AS A STRATEGY.

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Table 2. Summary of Effects of Extent of Physician Participation on Hospital System Performance

Hypothesis	Description	Expected Results
H2a	H_0: THERE IS NO DIFFERENCE IN COST BETWEEN SYSTEM HOSPITALS THAT UTILIZE OPEN PHYSICIAN PARTICIPATION AS A STRATEGY VS. SYSTEM HOSPITALS THAT UTILIZE CLOSED PHYSICIAN PARTICIPATION AS A STRATEGY. HA: THERE IS A DIFFERENCE IN COST BETWEEN SYSTEM HOSPITALS THAT UTILIZE OPEN PHYSICIAN PARTICIPATION AS A STRATEGY VS. SYSTEM HOSPITALS THAT UTILIZE CLOSED PHYSICIAN PARTICIPATION AS A STRATEGY.	THERE IS NO DIFFERENCE IN COST BETWEEN SYSTEM HOSPITALS THAT UTILIZE OPEN PHYSICIAN PARTICIPATION AS A STRATEGY VS. SYSTEM HOSPITALS THAT UTILIZE CLOSED PHYSICIAN PARTICIPATION AS A STRATEGY.
H2b	H_0: THERE IS NO DIFFERENCE IN PRODUCTIVITY BETWEEN SYSTEM HOSPITALS THAT UTILIZE OPEN PHYSICIAN PARTICIPATION AS A STRATEGY VS. SYSTEM HOSPITALS THAT UTILIZE CLOSED PHYSICIAN PARTICIPATION AS A STRATEGY. HA: THERE IS A DIFFERENCE IN PRODUCTIVITY BETWEEN SYSTEM HOSPITALS THAT UTILIZE OPEN PHYSICIAN PARTICIPATION AS A STRATEGY VS. SYSTEM HOSPITALS THAT UTILIZE CLOSED PHYSICIAN PARTICIPATION AS A STRATEGY.	THERE IS A DIFFERENCE IN PRODUCTIVITY BETWEEN SYSTEM HOSPITALS THAT UTILIZE OPEN PHYSICIAN PARTICIPATION AS A STRATEGY VS. SYSTEM HOSPITALS THAT UTILIZE CLOSED PHYSICIAN PARTICIPATION AS A STRATEGY.

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CHAPTER 4
DATA AND METHODOLOGY

The chapter begins with a descriptive analysis of the study population and data sources of system hospitals used in this study. The sample selection procedures are then summarized. This is followed by a description of the dependent variables-strategic performance measures-used in the study (See Table 3). Next, the independent variables, predictors and controls, used in the analysis, are described and explained (See Table 4 and Table 5). Finally, the statistical procedures and methods used in the analysis are depicted.

4.1. Study Population

The study population consists of all community general, nongovernmental system hospitals in continuous operation from 1993-1997. It includes hospitals located throughout Florida, California, Texas, Tennessee and Georgia as well as other states having a relatively high distribution of multi-system hospitals. The systems from which the hospitals were selected were among the largest in each ownership type classification. "Large" is differentiated as those hospital systems having the greatest proportion of revenues from Medicare reimbursement to total revenues from all sources.

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Government hospitals and health maintenance organization hospitals (HMOs) were excluded from the study, as the reporting requirements are different and the data not comparable. Thus, hospitals which reported state or federal ownership, or which classify themselves as other than short-term or acute care, were excluded from the analysis.

There were a number of hospital mergers and closures during the study period. Hospitals that closed or no longer provided medical services were, thus, not included in the sample. In addition, hospitals that had reporting periods of less than 335 days were also deleted from the sample, as they were not considered a fair representative of the total population of system hospitals.

4.2. Data Sources

The majority of the data for this study was obtained from three sources: 1) the 1997 American Hospital Association (AHA) Annual Survey of Hospitals, (2) the 1997 Medicare Case Mix Index developed by the Health Care Financing Administration (HCFA), and (3) the 1998 American Hospital Association Survey of Hospital Medical Staffs. The medical staff survey provided information on the type and presence of physician-medical staff integration in the hospital.

The survey and guide provided information on the two performance measures used (operating expenses, full-time

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employee equivalents) as proxies for cost and productivity; and on the number of managed care contracts with HMOs and PPOs. The survey supplied data on hospital characteristics such as occupied beds, number of staff physicians employed by the hospital, multi-hospital system membership, inpatient admissions, as well as other measures. The annual hospital survey was used to obtain data on selected hospital control characteristics such as hospital bed size, location, and profit orientation.

Any information that could not be obtained by the above sources was found through or corroborated by the American Hospital Directory internet search instrument (American Hospital Directory). This was used, for example, to obtain information on such hospital characteristics as skilled nursing facilities and inpatient bed availability.

The Medicare Case Mix Index was used to measure the complexity of the patient mix in hospitals and was obtained from the Health Care Financing Administration (HCFA) files. Because the case-mix measure is based only on Medicare patients, there is a question of how accurate a proxy it is for overall hospital case mix. Since the population in this study consists of hospitals from those systems that receive the largest reimbursements from Medicare, it appears that this measure is appropriate for this study.

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An examination was made in 1983 that assessed the correlation between the Medicare Case-Mix Index and the Resource Need Index derived from all hospital patients by the Commission on Professional and Hospital Activities. A sample of 608 community hospitals in 1983 yielded a correlation of .88 between the two indices. This was further supported in work by Sloan and Valvona (1988) where the Resource Need Index has been shown to correlate highly with other broad case-mix measures. Thus, the Medicare measure of patient mix and severity apperars to be a reasonable proxy for overall hospital case-mix.

In this study, the data were secondary and treated as cross-sectional. Most of the data were collected in 1997. However, data for the existence and extent of physician-hospital integration came from the 1998 American Hospital Association Survey of Hospital Medical Staffs. The analysis assumes that this characteristic was stable over the time frame of the study.

4.3. Sample Design

The sample unit for this study is the system hospital. Data available and reported from 41 multihospital system managers to the American Hospital Association provided a listing of about 30 potential study systems. Using the most comprehensive list of systems available, compiled through the

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1997 AHA's Annual Survey, a final sample of 23 systems was selected.

4.3.1. Hospital System Selection

The general criteria used for multi-hospital system selection were:

1. The study system must satisfy the general definition of a multi-hospital system as used in this study: that is, having three or more separate and distinct hospitals under one controlling management and ownership (AHA 1997, B2).

2. The study system must vary in terms of the three independent variables of ownership type (size, profit orientation, existence of physician-hospital organization), management structure (open versus closed physician-hospital integration), and geographic location of hospital units.

3. The study system must be privately owned, non-governmental and community based.

4. The study system must include all hospitals that reported to the AHA Annual Survey of Hospitals for 1997.

5. The study system must be among the largest in terms of Medicare revenue reimbursements, since those systems that receive their majority of payments from Medicare are required to report data consistent with federal regulations.

The first criterion provided the boundaries for the system hospitals studied. The second and third criteria insured that

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the study systems were sufficiently different so that they could provide a representative sample of system hospitals. The last two criteria made certain that the appropriate data was available for testing the research hypotheses.

This study was based on 3,804 potential general community hospitals that were members in the total population that did not include federal or state hospitals. Of these, 1,343 hospitals were in a population of hospitals that were members of a multi-hospital system.

4.3.2 Hospital Sample Selection

The initial population included 1,343 hospitals that were members of a multi-hospital system from the period 1992 to 1996, inclusive. The sample for this investigation consisted of 400 system hospitals - 200 non-profit and 200 for-profit hospitals that were in the sampling frame of the 1997 AHA Annual Survey of Hospitals.

There were three phases in the selection of the study sample of system hospitals from the initial population: a 25% random selection of short-term acute care hospitals; 25% of the remaining hospitals in the 22 states having strict Medicare rate-setting programs; and a stratified random selection of remaining hospitals in states with weak or no Medicare rate-setting programs.

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The above stratification scheme was designed to oversample for-profit hospitals, which historically have had a lower response rate to hospital surveys (Shortell et al 1985). Furthermore, hospitals in the sample are more likely to be religious and involved in teaching activities, and are less likely to be investor-owned relative to the population of general community hospitals from which the study sample was drawn. The latter condition was obtained in spite of efforts to oversample the for-profit group.

This research reports the results of a cross-sectional study of multi-system hospitals that use vertical integration strategies - and the effects of physician participation, in particular - on hospital performance. In the analysis, it is assumed that the characteristics of the explanatory variables remain stable over the time frame of the study.

4.4 Dependent Variables: Measures of Financial Performance

Two measures of financial performance were analyzed in this study: (1) case-mix adjusted operating expenses per admission as a measure of cost, and (2) case-mix adjusted employee full-time equivalents (FTEs) per 100 occupied beds as a measure of productivity (Table 3). These measures were selected based on their ease of use in assessing financial performance since they have been consistently utilized by hospitals and applied in past studies.

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Operating expenses included both payroll and nonpayroll expenses incurred by the hospital except for clinical physician salaries. The latter component was excluded from the calculation because its inclusion would artificially inflate hospital expenditure figures relative to the hospitals that did not employ physicians in a clinical capacity.

Table 3. Dependent Variables - Financial Performance

Construct	Variables	Measure	Data Source
Performance	Cost	Case mix-adjusted operating expenses per admission	Expenses:1997 AHA Annual Survey Case-mix:HCFA 1997
	Productivity rate	Case-mix adjusted full-time employee equivalents (FTEs) per occupied bed	FTEs:1997-1998 AHA Guide Beds:1997 AHA Annual Survey

In order to be successful, vertical integration requires changes in both physician and hospital cultures. Thus, vertical integration strategies may take several years to implement and a long period of time to have any measurable effect on financial performance in physician-hospital organizations.

To capture the longitudinal effect of these variables, the case-mix index is not entered as a control variable, but used as a direct adjustment to the performance measures that affect operational costs and organizational productivity. In this manner, outcomes can be adjusted for severity and acuity without affecting overall results.

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4.4.1 Costs: Case-Mix Adjusted Expenses per Admission

Cost is important when assessing financial performance since it is an indicator of the long-term efficiencies of the healthcare organization. A number of different variables from the health care management literature have been chosen to measure cost with respect to system hospitals. Among those measures used most frequently from previous studies have been operating expenses per admission (Friedman and Shortell 1988; Chien et al 1995), operating profitability (Glandon and Morrisey 1986; Valvona and Sloan 1988; Mick et al. 1993) and added-value (Lagasse 1996; McCue 1997).

Each measure describes a different aspect of financial performance. However, of the three measures, and for purposes of this study, operating expenses per admission is considered to be the more appropriate metric of hospital costs since it has been the most consistently applied measure used over the period since implementation of the Prospective Payment System.

Research has demonstrated that operating expenses per admission is the best indicator of the hospital's facility to contain costs and is, thus, an appropriate measure of effective cost management for both hospital and physician services (Chien et al 1995; Friedman and Shortell 1988). The most relevant and sensitive indicators use hospital admissions data to adjust inpatient to outpatient volume differences. Moreover, operating

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expenses have been touted in previous studies as indicators of efficient production of healthcare delivery in hospital systems (Goes and Zahn 1995).

Recent studies have supported the use of added-value rather than operating profitability as a measure of the financial performance of a hospital (Lagasse 1996; McCue 1997). However, added-value is best provided by analyzing cash flow and other financial measures of quality (Kane 1991). Due to the unavailability of cash flow data and the inability to relate appropriate quality measures to financial performance from the results of past research, case-mix adjusted operating expenses per admission was used as the financial performance measure in this study.

Case-mix is entered as a direct adjustment to operating expenses. In this way, outcomes can be adjusted for patient severity and acuity without tarnishing results (Ermann and Gabel 1985). This is accomplished by dividing operating expenses per admission by the related case-mix index provided by HCFA for each applicable system hospital as follows:

$$\frac{\text{Operating Expenses}}{\text{Admissions} * \text{Case-Mix Index}}$$

The expected average cost per case is affected by both case-mix index and the volume of patient admissions for

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inpatient care. The assumption is that for costs to be minimized then either operating expenses must decrease or admissions to hospital inpatient facilities must increase.

4.4.2. Productivity: Case-Mix Adjusted Full-Time Equivalents Per Occupied Bed

Productivity is a critical component of financial performance and an important factor when analyzing organizational activity because it is an indicator of the short-term efficiencies of the healthcare organization. From past studies, different variables have been chosen to measure productivity or occupancy rates from the health care management literature.

Three important measures from past research that have been found to be representative in assessing productivity in hospitals have been admissions per available bed , FTE's (full-time employee equivalents) per occupied bed, and average daily occupancy (Coyne 1982; Goes and Zahn 1995; Friedman and Shortell 1988; Gapenski 1996). All measures of productivity illustrate the use of occupancy rate as an appropriate estimate of short-term efficiency.

Of the three measures, FTE's per occupied bed is considered to be the more relevant metric of occupancy rate. The number of direct employee labor hours best indicates the ability of hospital managers to utilize minimum available human resources with the purpose of increasing bed occupancy. This

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alternative is used to pinpoint efficient operation of both hospital and physician services (Conrad and Shortell 1996).

A measure of productivity can be provided by dividing full-time employee equivalents per 100 occupied beds by the related case-mix index provided by HCFA for each applicable system hospital as follows:

$$\frac{\text{Full-Time Employee Equivalents (FTEs)}}{\text{100 Occupied Beds * Case-Mix Index}}$$

Productivity is affected by both case-mix index and the number of inpatient beds occupied throughout the measurement period. The assumption is that in order for productivity (utility) to be maximized then either full-time employee equivalents must decrease or the number of occupied beds must increase.

4.5 Independent Variables: Evidence for Vertical Integration Strategies

Implementing vertical integration strategies by hospital systems is seen as a way of allocating resources equitably between patients and the healthcare services provided to them by physicians and hospitals. The question becomes a challenge in determining how to provide both quality care to patients across the entire continuum of care while minimizing the risk

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inherent when a hospital agrees to discounted (lower) charges or capitation (fixed payment in advance) demanded by the managed care organization.

There are three groups of non-controlled integration strategies addressed in this research that are used as predictor variables: (1) use of pre-hospital care strategies, (2) post-hospital care strategies, and (3) physician integration strategies (Table 4).

Table 4. Independent Variables - Vertical Integration Strategies and Physician Participation Variables

Construct	Variables	Measures	Data Source
NONCONTROLLED:			
(A) Pre-Hospital Strategies	HMO contracts	# of contracts	1997 AHA Annual Survey
	PPO contracts	# of contracts	
	Outpatient services	# of visits	
	Staff physicians	# of MDs on staff	
(B) Post-Hospital Strategies	Inpatient hospital	# of beds available	1997 AHA Annual Survey
	Skilled nursing	# of beds available	
(C) Physician-Hospital Strategies	Participation in open PHO	Dummy (0=no;1=yes)	1998 AHA Annual Survey of Hospital Medical Staffs
	Participation in closed PHO	Dummy (0=no;1=yes)	
	Existence of PHO	# of PHO affiliations	1997 AHA Annual Survey

4.5.1. Measures of Pre-Hospital Care Strategies

Pre-hospital care strategies involve decisions made by hospital management prior to admitting a patient to long-term, inpatient care. These choices include contracting with managed care organizations, specifically PPOs and HMOs; utilizing the

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services of non-hospital based staff physicians (called admitting physicians); and making use of outpatient services.

Contracting with managed care organizations gives hospitals the chance to address the risk of declining and uncertain admissions. Managed care contracts lessen uncertainty since the managed care organization supplies a larger base of outpatient clients to the hospital and rewards hospital inpatient care at a lower cost per patient.

It is expected that a hospital that utilizes a larger number of admitting physicians will make use of a greater number of outpatient services. The number of non-hospital based staff physicians affiliated with a hospital, particularly if associated with one hospital, has been found to increase that hospital's share of patient admissions through referrals (Erickson and Finkler 1985; Pegels and Rogers 1988).

Making use of hospital-based outpatient services, which include ambulatory (short-stay) surgeries, tends to be a profitable strategy (Alexander 1990). Most surgeries previously carried out on an inpatient basis have now moved to outpatient settings (HCFA 1995). These services provide hospitals with a means of capturing possible admissions and are less costly since they are mostly available on a short-term basis.

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4.5.2. Measures of Post-Hospital Care Strategies

Post-hospital care strategies, in contrast, are implemented by hospital managers in order to avoid the loss of inpatient admissions. Third party payors and managed care organizations encourage greater use of less expensive alternatives than acute inpatient hospitalization.

However, competition from other multi-hospital systems for inpatient clients has created an unwillingness among hospital managers to allow that segment of care to diminish. Robinson (1994) postulated that post-hospital care acts to decrease the cost of keeping patients in high-cost beds by supplying established subacute capacity in the form of skilled nursing and inpatient beds.

4.5.3. Measures of Physician Integration Strategies

The goal of physician-hospital alignment is to provide hospitals and physicians with a means to negotiate with managed care organizations from a stronger position. Thus, it is expected that a hospital system with a PHO (physician-hospital organization) will possess better performance capabilities in terms of higher productivity and cost minimization than a hospital system without a PHO.

The physician-hospital participation variables were derived from the 1997 AHA Annual Survey. Two variables - capturing participation in open and closed PHOs - were used

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(Table 4). It is expected that a hospital with an open PHO will perform better than one with a closed PHO since the open system allows for a more seamless affiliation of physician with hospital management.

An additional variable capturing the existence or number of physician-hospital organizations is provided.

4.6 Controls: Influence of Ownership Factors

The ownership of the hospital in a system is best described by the following variables: size of the hospital, location of the hospital, and the profit orientation of the hospital (Table 5).

Table 5. Independent Variables - Ownership Factors

Construct	Variables	Measures	Data Source
CONTROLLED:			
Ownership factors	Size of hospital	# of beds available	1997 AHA Annual Survey
	Profit orientation	Dummy variable (0=non-profit 1=for-profit)	1997-1998 AHA Guide
	Location	Dummy variable (0=rural area 1=urban area)	1997 AHA Annual Survey

4.6.1. Influence of the Size of System Hospital

Size is specified as a continuous variable and is operationalized as the average number of beds available for use in the year of study. The capacity of a system hospital may

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affect production costs if economies of scale can be attained. Since the size of a system hospital may be associated with risk of closure and changes in service mix, this can cause diseconomies of scale (Gapenski et al. 1993).

Bed size is generally an indicator of service mix since larger hospitals have the capacity to provide a larger mix of services. In addition, larger hospitals generally tend to locate in urban centers where there is a larger population that will make use of healthcare services. Thus, larger hospitals can be expected to experience lower costs as a result.

Size was operationalized by the number of hospital beds set up and staffed for use by the end of the reporting period (Alexander et al 1996; Gamm et al 1996). Data for this variable came from the 1997 AHA Annual Survey.

4.6.2. Influence of the Location of System Hospital

Location of the hospital is depicted as a dichotomous variable and entered as a dummy variable representing location of the system hospital in either a rural or urban population center. In addition to identifying the potential demand for health services (Mick et al 1993), location is also a proxy for the number of physicians in an area that can potentially participate in a PHO, which is of special interest to this study since our research is concerned with physician participation in hospital systems.

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4.6.3. Influence of the Profit Orientation of System Hospital

The profit orientation of the system hospital is specified as a dichotomous variable and represented by a dummy variable as being either for-profit or not-for-profit. The evidence on the relationship between ownership type, as represented by the profit orientation of the system, and its effect on vertical integration strategies is somewhat mixed.

Valvona and Sloan (1988) found no differences between for-profit and not-for-profit hospitals in regard to the degree of efficiency and productivity, but for-profit hospitals had higher operating profit margins than not-for-profit hospitals (Lynch and McCue 1990). This difference in profitability was attributed mainly to the ability of a hospital to manage its revenue and not to cost or productivity management (Shukla et al 1997). There was no suggestion that efforts to minimize costs were directly responsible for corresponding increases in profitability.

Effects on operating revenues have not yet been conclusively determined, as well. Research in this area from past studies have included only freestanding hospitals and not system hospitals, the crux of the current examination.

4.7. Methodology

Statistical analysis was performed using the software package SPSS 8.0. (SPSS, Inc. 1996). Descriptive statistics

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(mean, standard deviation, minimum and maximum) are presented for all independent and dependent variables in order to detect univariate outliers, skewness and kurtosis, and to test for normality of the dependent variables (Table 6). In addition, multivariate outliers, i.e. outliers common to all variables included in the model for testing, were detected and removed through linear regression using Mahalonhobis distance.

Dependent and independent variables were each graphed by scattergraph plot. Nonlinear variables are not expected to be present. If the dependent variables deviated substantially from a normal distribution, transformations of the dependent variables as suggested by the literature were considered (Tabachnick and Fidell 1996).

Bivariate correlations between independent and dependent variables and between the independent variables were explored to describe the relationships between those variables. Correlations between the independent variables were also used to examine the data for multicollinearity. Highly correlated independent variables are considered for removal from the model.

After data screening there were only 310 observations available for analysis, 8 independent variables and 3 control variables - profit orientation, size and location - suggested for inclusion in the regression analysis. As a result, principal component analysis was used to determine whether the

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independent variables could be further grouped into pre-hospital and post-hospital care integration strategies per Cody (1996). If principal component analysis indicates the presence of other possible factors than those previously mentioned, then measures are constructed accordingly.

Hypothesis 1 (page 45) was tested using ordinary least squares (OLS) regression analysis. One regression equation was run for each of the dependent variables (case-mix adjusted operating expenses per admission, case mix adjusted full-time employee equivalents per occupied bed) first using the hospital care strategy variables (pre-hospital and post-hospital care) as predictors and then using the existence of physician-hospital participation variable as predictor.

The variables were then entered blockwise into the regression equation starting with the hospital care strategies and then the existence of physician-hospital participation variable to test for the independent explanatory power of each of the variable blocks. The final regression model included all physician-hospital participation and pre-hospital or post-hospital care variables as applicable. F-tests were used to test the explanatory power of the blocks of variables using R^2 to determine significance of relationships.

Hypothesis 2 (page 45) was tested using regression analysis in order to determine which interactions between open and closed physician-hospital integration organizations and

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dependent variables were significant. Methodology was the same as for Hypothesis 1 above except for the additional use of an analysis of variance model (MANOVA) to extract interactions - hospital size, location and profit orientation.

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Chapter 5
RESULTS

The chapter presents the outcome of the statistical analysis. The first part describes the examination done to ensure that the assumptions for using regression are met. The second part explains the techniques used to group and reduce the number of independent variables in the regression analysis. Descriptive analysis for the data set are then presented. This is followed by a description of the associations among independent and dependent variables. The analysis is necessary to detect multicollinearity. The fourth part presents the results of the regression analysis for both sets of hypotheses.

5.1. Assumptions Regarding Regression Analysis

For purposes of this study, multiple regression is based on three assumptions: linearity, normality and homoscedasticity (Tabachnick and Fidell 1998). The first assumption, linearity, states that "there is a straight line relationship between two variables where one or both of the variables can be combinations of several variables" (Tabachnick and Fidell 1996, pg. 78). The second assumption, normality, states that the dependent variable is normally distributed for all fixed combinations of independent variables. Finally, the assumption of homoscedasticity states that the error terms in the

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regression equation has equal variance. (Tabachnick and Fidell 1996, pgs. 71,80).

5.1.1. Linearity of Variables

Scattergraph plots of independent against dependent variables were used to examine the nature of the relationship between dependent and independent variables. None of the plots suggests a nonlinear relationship.

5.1.2. Normality of Data Distribution

Data for each variable was screened by detecting cases with both univariate and multivariate outliers. Univariate detection of outliers was performed by plotting histograms and removing those cases that appeared to be unattached to the rest of the distribution or that remained fully outside of the normal curve.

The remaining data for each variable were then converted to standardized z-scores. Those cases with standardized z-scores in excess of 3.29 (representing $p<.001$, two-tailed test) were left out of the analysis. As a result of univariate detection and screening, 85 cases were removed leaving 315 cases for analysis.

Detection and removal of multivariate outliers were performed next using Malanhobis distance technique. When two or more variables are considered together, they may become

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"discrepant" and produce skewed results. Malanhobis distance detects those remaining cases where a central point is created by the means of all the variables. Cases are separated and removed based on scores that have a mean value statistically significant ($p<.001$, two-tailed test) from the central point of the rest of the cases. As a result of this analysis, 5 cases were removed leaving a sample set of 310 system hospitals.

Normal distribution was then checked for each dependent variable used in the analysis. Several transformations of variables - as suggested by Tabachnick and Fidell (1996, pgs 81-84) - were explored and are presented in Table 6.

Although square root transformations of both dependent variables produced favorable results, the case-mix adjusted operating expenses per admission (proxy for cost) and case-mix adjusted full-time employee equivalents per occupied beds (proxy for productivity) as originally suggested were used since they, too, were considered statistically significant. Any violation of a regression assumption has to be taken into consideration when interpreting the results of regression analysis.

Normality is only necessary for supporting or not supporting the underlying hypotheses used in the study. Evidence shows that only extreme departures from normal distribution can yield results that are inconsistent or

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spurious and require transformation (Nachmias and Nachmias 1987).

Table 6. Analysis of Skewness and Kurtosis on Dependent Variables

Dependent Variables	Skewness	Kurtosis	Shapiro-Wilk Statistic Ho:Normality	Pr<W	
Case-mix adjusted full-time Equivalents, 1000 hours	1.308	0.691	0.804	0.010	**
Log (Case-mix adjusted full-time equivalents)	0.145	-1.014	0.948	0.058	
Square root (Case-mix adjusted full-time equivalents)	0.774	-0.470	0.895	0.010	**
1/Case-mix adjusted full-time Equivalents	1.281	1.262	0.954	0.061	
Case-mix adjusted expenses per admission, $1000	1.103	0.473	0.879	0.010	**
Log (Case-mix adjusted expenses per admission)	0.537	-0.402	0.948	0.055	
Square root (Case-mix adjusted expenses per admission)	0.827	-0.038	0.918	0.010	**
1/Case-mix adjusted expenses per admission	0.069	-0.535	0.973	0.487	

** considered statistically significant ($p<.01$)

The results of the Shapiro-Wilk regression of transformed dependent variables yield an outcome very similar to that of the non-transformed variables. The effects that are significant with the original model are also significant with the

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transformed dependent variables. Thus, results from the original model will be retained and used.

5.1.3. Homoscedasticity

Standardized residuals were produced for the dependent variables and plotted as a function of standardized predicted values for the independent variables. Regression residuals were then plotted. An examination of the residuals yielded no patterns that would suggest the presence of heteroscedasticity. Therefore, regression analysis can be used.

5.2. Reduction and Grouping of Variables - Factor Analysis

Principal components analysis (PCA), rather than principal factor analysis (PFA), was performed in order to group the number of independent variables as common components for the regression equations. The goal of PCA is to extract the maximum variance using the least number of factors or variables (Tabachnick and Fidell 1996, pg 664), yet retain the individual nature of each variable.

In this study, it was necessary to group a smaller number of common variables rather than combine large groups of variables into a smaller number of factors, such as with principal factor analysis. Thus, the analysis was performed using the principal components method with diagonal (Verimax) rotation.

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Two composite measures for vertical integration strategies were identified by the principal components analysis (Table 7). The first aggregate measure groups inpatient beds and skilled nursing beds. Both variables are positively related to the underlying factor in the analysis. The composite measure is the sum of the Z-scores of the underlying variables. This measure is labelled "post-hospital strategies."

...Table 7. Principal Component Analysis - Rotated Factor Pattern for Independent Variables Using Standardized Regression Coefficients (Varimax)

Independent Variables	Component	
	1	2
Inpatient beds	.748	.366
Skilled nursing beds	.758	-.406
Outpatient visits/1000	.251	.705
HMO contracts	.406	.678
PPO contracts	.514	.686
FTE Physicians	.235	.472

The second aggregate measure groups HMO contracts, PPO contracts, full-time physicians on staff and outpatient visits. The composite is, once again, computed as the sum of the Z-scores of the underlying measures. This measure is labelled as "pre-hospital strategies."

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5.3. Descriptive Statistics

5.3.1. Dependent Variables

Table 8 presents the descriptive statistics for the sample of hospitals used in this study. Mean operating expenses per adjusted admissions were $5,147. The hospital with the highest expenses ($19,803) had approximately nine times the expenses of the hospital with the lowest expenses ($2,280). Full-time equivalents per adjusted occupied bed range from 1.5 to 29.07 direct care hours with an average of 16.37 contact hours of direct patient care for each bed occupied.

5.3.2. Independent Variables

Open PHOs are more common than closed PHOs (Table 9). 28.4 percent of hospitals participate in the former while only 14.2 percent participate in the latter. More for-profit hospitals (31.4 percent) engage in open PHO integration than nonprofit hospitals (24.8 percent). The extent of closed PHO integration among nonprofit and for-profit hospitals is the same.

More urban hospitals (36.1 percent) engage in open PHO integration than rural hospitals (26.5 percent) (Table 34, Appendix E). Furthermore, the extent of closed PHO integration is greater among urban hospitals (19.7 percent) than among rural hospitals (12.9 percent).

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The mean number of PPO contracts for hospitals is 4.42 with a range of 1 to 9 (Table 8). Contracts with PPOs are the most common arrangement - approximately 80.3 percent of hospitals in the sample have PPO contracts (Table 9). Nonprofit hospitals are more likely to utilize PPO contracts than for-profit hospitals. Urban hospitals are more likely to contract with PPOs than their rural counterparts (Table 34, Appendix E).

The average number of HMO contracts is 2.79 with a range of 0 to 7 (Table 8). Less than half of all hospitals in our sample have HMO contracts (41.6 percent)(Table 9). For-profit hospitals are more likely to utilize HMO contracts than nonprofit hospitals. Rural hospitals are more likely to contract with HMOs than their urban counterparts (Table 34, Appendix E).

For the remaining independent variables, nonprofit hospitals have a greater number of outpatient visits and full-time physicians on staff than for-profit hospitals (Table 9). However, for-profit hospitals have greater capacity for inpatient and skilled nursing bed availability than nonprofit hospitals.

Urban hospitals have a greater number of outpatient visits than rural hospitals (Table 34, Appendix E). They also have greater capacity for inpatient and skilled nursing bed availability than rural hospitals. Rural hospitals, however,

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make greater use of non-hospital based staff physicians on staff than urban hospitals.

Table 8. Descriptive Statistics

	Minimum	Maximum	Mean	Std. Deviation
FTE physicians on staff	0	40	3.523	6.707
Outpatient visits/1000	1.370	239.011	53.912	8.063
Number of HMO contracts	0	7	2.786	1.391
Number of PPO contracts	1	9	4.416	1.771
Participation in open PHO	0	1	.284	.453
Participation in closed PHO	0	1	.142	.356
Number of skilled nursing beds available	0	50	10.340	12.630
Number of inpatient beds available	13	433	148.081	6.898
Case-mix adjusted expenses per admission ($1,000)	2.280	19.803	5.147	2.080
Case-mix adjusted full-time equivalents per occupied bed	1.50	29.07	16.3705	4.5637

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Table 9. Prevalence and Distribution of Hospital Care Strategies and Participation in Physician-Hospital Organizations by Profit Orientation

	Participation in open PHO		HMO contracts
	N	%	Mean
Nonprofit	35/141	24.8%	2.61
For profit	53/169	31.4%	2.93
Total	88/310	28.8%	2.79
	Participation in closed PHO		PPO contracts
	N	%	Mean
Nonprofit	20/141	14.2%	4.49
For profit	24/169	14.2%	4.35
Total	44/310	14.2%	4.42
			FTE physicians on staff
			Mean
Nonprofit			4.18
For profit			2.96
Total			3.52
			Outpatient visits/1000
			Mean
Nonprofit			57.61
For profit			50.84
Total			53.91
			Inpatient beds available
			Mean
Nonprofit			144.48
For profit			151.04
Total			148.08
			Skilled nursing beds available
			Mean
Nonprofit			10.11
For profit			10.54
Total			10.34

5.4. Bivariate Analysis

5.4.1. Associations Between Pre-Hospital Care or Post-Hospital Care Strategic Variables

Correlation coefficients among pre-hospital integration variables alone are smaller than .300 (Table 10). Correlations between the number of PPO contracts, the number of HMO

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contracts, and the number of outpatient visits are evident, although to a lesser extent. Having a contract with an HMO is positively correlated to having a contract with a PPO. This correlation is one of the strongest (.188). The number of outpatient visits is positively correlated with the number of PPO contracts (.160). This suggests that hospitals that have more outpatient visits are more inclined to engage in contracting with PPOs than with HMOs. These associations indicate that certain combinations of arrangements are implemented by hospitals.

Table 10. Partial Correlations Between Pre-Hospital Care Variables

	FTE physicians on staff	Outpatient visits/1000	HMO contracts	PPO contracts
FTE physicians on staff	1.000	.070	.016	.076
Outpatient visits/1000	.070	1.000	.060	.160**
HMO contracts	.016	.060	1.000	.188**
PPO contracts	.076	.160**	.188**	1.000

** Correlation is significant at the 0.01 level (2-tailed).

Correlations between post-hospital integration factors, on the other hand, yield associations greater than .300 (Table 11). This implies that hospitals are more apt to utilize post-

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hospital care strategies more than pre-hospital care strategies.

Hospitals that make use of outpatient services can still admit patients to inpatient and skilled nursing care if the need for longer term hospitalization arises. However, when patients are admitted directly to inpatient or skilled nursing care, they are no longer in need of outpatient sevices.

Table 11. Partial Correlations Between Post-Hospital Care Variables

	Skilled nursing beds available	Inpatient beds available
Skilled nursing beds available	1.000	.340**
Inpatient beds available	.340**	1.000

** Correlation is significant at the 0.01 level (2-tailed).

5.4.2. Associations Between Pre-Hospital Care and Post-Hospital Care Variables

In Table 12, moderate correlations can be found between the number of skilled nursing beds available and the number of oupatient care visits (.305). This indicates that there is some substitution of services taking place for inpatient care.

Patients utilizing outpatient care services may increase inpatient admissions as they may require additional hospitalization in subacute or skilled nursing facilities. This is further substantiated by a corresponding positive

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correlation between the number of inpatient beds available and the number of oupatient visits (.340).

Table 12. Partial Correlations Between Post-Hospital Care and Pre-Hospital Care Variables

	Skilled Nursing Beds Available	Inpatient beds available	FTE physicians on staff	Outpatient visits/1000	Number of HMO contracts	Number of P contracts
Skilled nursing beds available	1.000	.240**	-.070	.305**	-.019	.072
Inpatient beds available	.240**	1.000	-.015	.340**	.105	.118*
FTE physicians on staff	-.070	-.015	1.000	.070	.016	.076
Outpatient visits/1000	.305**	.340**	.070	1.000	.060	.160
Number of HMO contracts	-.019	.105	.016	.060	1.000	.188**
Number of PPO contracts	.072	.118*	.076	.160**	.188**	1.000

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

The number of skilled nursing beds available is positively correlated with the number of inpatient beds available (.240). This correlation signifies that hospitals may

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find it necessary to develop additional capacity in order to accommodate increases in longer term hospital stays. Thus, an increase in inpatient admissions will reflect a corresponding increase in demand for skilled nursing facilities.

Multicollinearity does not appear to present a problem among independent variables.

5.4.3. Associations Between Physician-Hospital Integration Variables, Pre-Hospital Care, and Post-Hospital Care Variables

Partial correlations between physician-hospital integration variables and pre-hospital care and post-hospital care integration variables are presented in Table 13. Participation in an open PHO is positively associated with the number of outpatient visits (.159), and negatively related to the number of full-time physicians on staff (-.121).

Open (system-wide) participation in hospital management by physicians rises as the number of outpatient visits increases, and falls as the number of full-time physicians on a hospital's staff increases. This implies that hospitals with more outpatient services are more likely to have physician participation operated and controlled at the system level than at the local hospital level, but less likely to have participation when there is an associated decrease in the number of staff physicians.

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Table 13. Partial Correlations Between Physician-Hospital Integration Variables, Pre-Hospital Care, and Post-Hospital Care Variables

	Participation in open PHO	Participation in closed PHO
Participation in open PHO	1.000	-.087
Participation in closed PHO	-.087	1.000
FTE physicians on staff	-.121*	-.058
Outpatient visits/1000	.159**	.108
Number of HMO contracts	.014	-.105
Number of PPO contracts	-.081	-.080
Skilled nursing beds available	.047	.125*
Inpatient beds available	.038	.142**

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed).

Participation in a closed PHO is positively associated with the number of inpatient beds available (.142) and to a lesser degree with the number of skilled nursing beds available (.125). Participation in a closed PHO increases as the number of both inpatient and skilled nursing services increases. This indicates that hospitals with more inpatient and skilled nursing services are more likely to participate in closed (hospital-based) physician-hospital integration.

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5.4.4. Associations Between Ownership Control Variables, Pre-Hospital Care, and Post-Hospital Care Variables

Partial correlations between ownership control factors and pre-hospital care and post-hospital care integration variables are summarized in Table 14.

Table 14. Partial Correlations Between Ownership Control Variables, Pre-Hospital Care, and Post-Hospital Care Variables

	Location	Profit orientation	Size
FTE physicians on staff	-.076	-.090	-.075
Outpatient visits/1000	.150**	-.083	.530**
HMO contracts	-.007	.117*	-.055
PPO contracts	.044	-.041	.116*
Skilled nursing beds available	.153**	.017	.419**
Inpatient beds available	.138*	.052	.609**
Participation in open PHO	.084	.072	.162**
Participation in closed PHO	.083	-.008	.140*

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Location of the hospital is positively correlated with the number of outpatient visits (.150) and the number of skilled nursing beds available (.153). This signifies that hospitals located in urban areas are more likely to have a larger number of outpatient visits and skilled nursing beds available than hospitals located in rural areas. In addition, inpatient beds

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available is also positively associated with hospital location, although to a moderate extent. This suggests that hospitals located in urban areas are more apt to have a larger probability of incurring inpatient hospitalizations.

Profit orientation is positively associated with the number of HMO contracts with a hospital (.117). This reflects a trend that for-profit hospitals are more likely to engage in HMO contracting than non-profit hospitals.

Size of hospital is significantly and positively correlated with outpatient visits (.530), skilled nursing beds available (.419), and inpatient beds available (.609); and only moderately and positively associated with the number of PPO contracts (.116), participation in an open PHO (.162), and participation in a closed PHO (.140). This signifies that hospitals that are larger - which can offer additional services - are more likely to utilize hospital care and implement physician-hospital integration strategies.

5.4.5. The Relationship Between Financial Performance Variables and Pre-Hospital Care, Post-Hospital Care, Physician-Hospital and Ownership Control Variables

The relationships between the financial performance variables (dependent) and pre-hospital care, post-hospital care, physician-hospital integration and ownership control variables (independent) are presented in Table 15. The larger number of and more significant correlations between independent

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and dependent variables when compared with the number and significance of associatons between independent variables alone suggests that there is no tendency of multicollinearity of variables. This provides strength to our model used in this study.

Table 15. Zero-Order Correlations Between Dependent and Independent Variables

	Dependent Variables	
Independent Variables	Case-mix adjusted expenses per admission	Case-mix adjusted full-time equivalents per occupied bed
FTE physicians on staff	.045	-.042
Outpatient visits/1000	-.372**	.702**
Number of HMO contracts	.020	.037
Number of PPO contracts	-.163**	.126*
Skilled nursing beds available	.177**	.351**
Inpatient beds available	.318**	.538**
Existence of PHO	-.060	.114*
Participation in open PHO	-.122*	.178**
Participation in closed PHO	-.033	.175**
Location	-.038	-.217**
Profit orientation	-.203**	.017
Size	-.510**	746**

**Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

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One managed care variable, the number of PPO contracts, is negatively correlated with case-mix adjusted expenses per admission (-.163). One of the physician-hospital integration variables, participation in an open PHO, is also negatively correlated with expenses (-.122); although to a lesser degree. Additionally, outpatient visits are negatively and strongly associated with expenses. This suggests that the use of pre-hospital care strategies plays an important part in minimizing cost in the hospital organization, especially when an open PHO is present.

On the contrary, case-mix adjusted expenses per admission are positively correlated with both inpatient (.318) and skilled nursing beds available (.177), indicating that post-hospital care strategies may not act to decrease costs. This is consistent with prior research on a similar sample of hospitals (Gillies et al. 1993).

Case-mix adjusted expenses per admission are negatively correlated with hospital size - consistent with the existence of economies of scale discussed previously - and also negatively correlated with profit orientation. This implies that ownership control factors may provide inducements for the hospital organization to reduce costs.Only one of the managed care variables - the number of PPO contracts - shows marginally significant and positive correlation with case-mix adjusted

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full-time equivalents (FTE) per occupied bed. Participation in an open and closed PHO are both positively correlated with FTE per occupied bed - a proxy for productivity.

The hospital productivity rate is positively correlated with outpatient visits indicating higher productivity in hospitals with a greater number of outpatient services. This effect is consistent based on a significant and positive association with the number of both inpatient and skilled nursing beds available.

Only two of the ownership control variables are correlated with productivity: hospital location and size. No effect is due to profit orientation. Productivity is positively correlated with size, but negatively correlated with location. The negative association between productivity and location is likely due to the fact that hospitals in rural areas have less occupied beds or are more liable to over-utilize hospital personnel.

5.5. Summary of Correlation Results

The use of post-hospital care integration strategies appears to have a greater effect on hospital productivity than pre-hospital care factors. On the contrary, the use of pre-hospital care integration strategies appears to have a greater effect on cost reduction than post-hospital care factors.

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This appears to be consistent with the notion that pre-hospital integration strategies do not promote increases in direct hours of patient contact as post-hospital strategies do, nor do they encourage the use of bed capacity (Glenesk 1990).

Participation in an open PHO appears to have a greater effect on cost reduction than participation in a closed PHO. However, participation in both open and closed PHOs seem to have significant effects on productivity gains in system hospitals.

Profit orientation and size of hospital both have a positive effect on cost reduction. Location of hospital has no effect on reduction of costs. Hospital location and size, however, both have a positive effect on productivity rate. Profit orientation appears to have no effect on hospital productivity.

5.6. Regression Analysis

In order to examine the contribution and significance that each variable and group of variables (pre-hospital integration, post-hospital integration, physician-hospital integration, and ownership control variables) has on the two financial performance measures, blockwise regression is used. First, the effect of pre-hospital integration factors on each of the two financial performance measures is analyzed, followed by the specific effects of the post-hospital integration factors.

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Then, the specific effects of physician-hospital integration on case-mix adjusted expenses per admission, and case-mix adjusted FTEs per occupied bed are analyzed.

Finally, the blocks of variables are entered sequentially one after the other into the regression equation beginning with pre-hospital integration variables, followed by post-hospital integration variables and physician-hospital integration variables. All variables from the different blocks are retained in the analysis - not just the significant ones - in order to distinguish the specific effects of participation in open and closed PHO.

Regression results are presented in Table 16 to Table 23.

5.6.1. Analysis of Case-Mix Adjusted Expenses per Admission - Hospital Cost Measure

Pre-hospital integration variables account for the largest proportion of variance in expenses. Alone, they explain 15.91 percent of the variance (Table 16). Two pre-hospital variables maintain a significant negative association with expenses: outpatient visits per thousand and the number of PPO contracts (Table 30, Appendix D).

Post-hospital care integration variables alone explain 10.62 percent of the variation in case-mix adjusted expenses per admission (Table 16). Both the inpatient beds and skilled

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nursing beds variables sustain a significant positive association with expenses (Table 30).

The existence of physician-hospital integration alone accounts for 1.16 percent of the variance in case-mix adjusted expenses per admission (Table 16). This contribution is not significant since it did not reliably improve R^2. Furthermore, the physician-hospital integration variable in this case had no significant association with expenses (Table 30).

The full regression model for the effect of physician-hospital participation costs while controlling for pre-hospital and post-hospital care explains 26.08 percent of the variance in cost (Table 17).

Table 16. Regression Analysis: Effects of Physician-Hospital Participation on Hospital Costs

Step	Variables	R^2 alone (block variables entered first)	Specific R^2 (block variables entered last	R^2 difference	Cumulative R^2 total
1	Pre-hospital variables	.1591**	.0944***	-	.1591**
2	Post-hospital variables	.1062**	.1883*	.0821 *	.2412**
3	Physician-hospital Integration variables	.0116	.0196	.0196	.2608**

* significant change in R^2 ($p < .05$)

** F-test for overall model significant at $p < .05$

*** significant change in R^2 ($p < .10$)

Pre-hospital variables explain a marginally significant 9.44 percent of the variance in expenses when the other independent variables are controlled for (Table 16). Outpatient visits and the number of PPO contracts remain the two most

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important factors among pre-hospital variables (Table 17). They both have negative associations with expenses. The outpatient visits variable has the largest standardized parameter estimate among all independent variables in the full regression model. Thus, it is the single most important factor among the pre-hospital integration variables.

Post-hospital variables as a block describe the largest part of the variance in expenses. When entered into the regression model that controls for pre-hospital integration and physician-hospital integration variables, post-hospital variables account for an additional 18.83 percent of the variance in expenses (Table 16).

Although both factors (skilled nursing and inpatient beds available) indicate significant correlations with expenses, only one remains significant in the full model: inpatient beds available (Table 17). The number of inpatient beds available maintains a significant positive association with expenses. Thus, a one unit increase in the number of inpatient beds available is associated with a $3,600 increase in expenses per admission. However, in the full model, the skilled nursing beds variable no longer shows a significant relationship with expenses (Table 30).

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Table 17. Regression Analysis: Effects of Physician-Hospital Participation on Hospital Cost (Parameter Estimates)

	FULL MODEL		
	Parameter Estimate *b*	Standardized parameter *(B)*	Partial correlation coefficient (Table 13)
Intercept	3.085 *		
Physician-hospital integration:			
Existence of PHO	-.021	-.037	-.060
Pre-Hospital Factors:			
FTE staff physicians	.044	.067	.045
Outpatient visits	-.043**	-.284**	-.372**
HMO contracts	.025	.078	.020
PPO contracts	-.029*	-.117*	-.163**
Post-Hospital Factors:			
Inpatient beds	.036**	.214**	.318**
Skilled nursing beds	.000	.002	.177**
F-value	10.785		
R^2	.2608		
Adjusted R^2	.2241		
df	7,302		

Two-tailed tests ** $p < .01$ * $P < .05$

The effect of the extent of physician-hospital integration, i.e. participation in a closed or open physician-

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hospital organization, on costs was also examined. The results are presented in Tables 18 and 19.

Table 18. Regression Analysis: Effects of Extent of Physician-Hospital Participation on Hospital Costs

Enter	Variables	R^2 alone (block variables entered first)	Specific R^2 (block variables entered last)	R^2 difference	Cumulative R^2 total
1	Pre-hospital variables	.1594***	.0868**	-	.1594**
2	Post-hospital variables	.1058***	.1462*	.0404*	.1998**
3	Physician-hospital integration variables	.0162****	.0121	.0121	.2053 **

* significant change in R^2 ($p < .05$)

** significant change in R^2 ($p < .10$)

*** F-test for overall model significant at $p < .05$

**** F-test for overall model significant at $p < .10$

In the full model, which includes open and closed PHO as independent variables, the extent of physician-hospital integration explains an additional 1.21 percent of the variance in expenses when pre-hospital and post-hospital care variables are controlled for (Table 18), this is not significant. However, participation in an open PHO shows a negative and moderately significant association with expenses in all cases of the model tested (Table 31, Appendix D).

The association between expenses and physician participation in a closed PHO, though, is not significant. The relationships between expenses and pre-hospital and post-hospital care variables remain essentially the same as in the previous model (Table 30).

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Table 19. Regression Analysis: Effects of Extent of Physician-Hospital Participation on Hospital Costs(Parameter Estimates)

	FULL MODEL		
	Parameter Estimate *b*	Standardized parameter (*B*)	Partial correlation coefficient (Table 13)
Intercept	4.802*		
Physician-hospital integration:			
Participation in open PHO	-.078*	-.080*	-.122*
Participation in closed PHO	.003	.002	-.033
Pre-Hospital Factors:			
FTE staff physicians	.005	.068	.045
Outpatient visits	-.043**	-.277**	-.372**
HMO contracts	.026	.082	.020
PPO contracts	-.030*	-.120*	-.163**
Post-Hospital Factors:			
Inpatient beds	.036**	.214**	.318**
Skilled nursing beds	.000	-.001	.177**
F-value	9.696*		
R^2	.2053		
Adjusted R^2	.1478		
Df	8,301		

Two-tailed tests ** p <.01 * P <.05

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5.6.2. Analysis of Case-Mix Adjusted Full-Time Equivalents per Occupied Bed - Hospital Productivity Rate Measure

The effect of physician-hospital integration alone on hospital productivity rate accounts for 6.53 percent of the variance in case-mix adjusted full-time equivalents per occupied bed (Table 20). This contribution is considered significant, and explains the moderately substantial proportion of variance in productivity added by the physician-hospital integration variables to hospital productivity rate (Table 32, Appendix D).

Pre-hospital integration variables by themselves account for the largest proportion of variance in hospital productivity. Alone, they explain 50.22 percent of the variance (Table 20). Only one pre-hospital care variable explains the significant variation in hospital productivity when the other pre-hospital variables are controlled for. Outpatient visits per thousand exhibits a positive association with productivity (Table 32). However, the number of PPO contracts also shows a moderately significant and positive association with productivity when entered into the regression model alone.

Post-hospital care integration variables by themselves explain a significant 32.16 percent of the variation in productivity rate (Table 20). Both of the post-hospital variables - skilled nursing and inpatient beds available - have significant positive associations with productivity rate (Table 32).

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Table 20. Regression Analysis: Effects of Physician-Hospital Participation on Hospital Productivity Rate

Step	Variables	R^2 alone (block variables entered first)	Specific R^2 (block variables entered last	R^2 difference	Cumulative R^2 total
1	Pre-hospital variables	.5022**	.2561*	-	.5022**
2	Post-hospital variables	.3216**	.4227*	.1011*	.6033**
3	Physician-hospital integration variables	.0653**	.0138	.0138	.6281**

* significant change in R^2 ($p < .05$)

** F-test for overall model significant at $p < .05$

The complete regression model for the effect of physician-hospital integration on productivity rate while controlling for pre-hospital and post-hospital care variables explains 62.81 percent of the variance in productivity rate (adjusted R^2=.6102) (Table 21).

The existence of physician-hospital integration contributes an additional 1.38 percent of the variation in productivity when entered into the model that controls for pre-hospital and post-hospital care variables. Although this change in R^2 does not explain a significant variation in hospital productivity, the existence of physician participation in a PHO remains significant in the full model (Table 32, Appendix D).

Pre-hospital variables explain a largely significant 25.61 percent of the variance in productivity rate when the other independent variables are controlled for (Table 20). When entered as a block, pre-hospital variables explain the largest

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part of the variance in hospital productivity rate and have the largest explanatory power in the regression model. Outpatient visits is still the most important factor among pre-hospital variables (Table 21). It retains a positive association with productivity rate and continues to have the largest standardized parameter estimate among all independent variables (Table 32).

Staff physicians variable, which was not significant when entered into the model alone, now shows a moderately significant and negative association with productivity rate when post-hospital and the extent of physician-hospital participation variables are controlled for across the complete regression model (Table 21). Conversely, the PPO contracts variable, which was moderately significant when entered into the model alone, no longer maintains an association with productivity rate when post-hospital factors and the extent of physician-hospital integration are controlled for in the full model (Table 32).

Post-hospital variables, when entered as a block in the regression model that controls for pre-hospital integration and the existence of physician-hospital integration variables, account for an additional 42.27 percent of the variance in expenses (Table 20). Although both factors (skilled nursing and inpatient beds available) indicate significant positive correlations with productivity rate when considered alone, only

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one remains significant in the full model: inpatient beds available (Table 21).

Table 21. Regression Analysis: Effects of Physician-Hospital Participation on Hospital Productivity Rate (Parameter Estimates)

	FULL MODEL		
	Parameter Estimate *B*	Standardized parameter (*B*)	Partial correlation coefficient (Table 13)
Intercept	2.510**		
Physician-hospital integration:			
Existence of PHO	.704**	.122**	.114*
Pre-Hospital Factors:			
FTE staff physicians	-.046*	-.067*	-.042
Outpatient visits	.898**	.558**	.702**
HMO contracts	-.074	-.023	.037
PPO contracts	.047	.018	.126*
Post-Hospital Factors:			
Inpatient beds	.564**	.324**	.538**
Skilled nursing beds	.017	.048	.351**
F-value	10.004**		
R^2	.6281		
Adjusted R^2	.6102		
Df	7,302		

Two-tailed tests ** $p < .01$ * $P < .05$

Alone, the number of inpatient beds available exhibits a positive association with productivity rate; in the total model it continues to demonstrate a significant positive

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relationship. Conversely, the skilled nursing variable, which was significant alone, is no longer significant in the full model.

The effect of the extent of physician-hospital integration - participation in a closed or open physician-hospital organization- on case-mix adjusted full-time employee equivalents per occupied bed was also examined. The results are presented in Tables 22 and 23.

Table 22. Regression Analysis: Effects of Extent of Physician-Hospital Participation on Hospital Productivity Rate

Enter	Variables	R^2 alone (block variables entered first)	Specific R^2 (block variables entered last)	R^2 change	Cumulative R^2 total
1	Pre-hospital variables	.5352**	.2531*	-	.5352**
2	Post-hospital variables	.3316**	.4178*	.0862*	.6214**
3	Physician-hospital integration variables	.0831**	.0443*	.0443*	.6657**

* significant change in R^2 ($p < .05$)

** F-test for overall model significant at $p < .05$

In the complete regression model, when including open and closed PHO as independent variables, the physician-hospital integration variables explain 4.43 percent of the variance in productivity rate when pre-hospital and post-hospital care variables are controlled for (Table 22), which is significant.

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Table 23. Regression Analysis: Effects of Extent of Physician-Hospital Participation on Hospital Productivity Rate(Parameter Estimates)

	FULL MODEL		
	Parameter Estimate *b*	Standardized parameter (*B*)	Partial correlation coefficient (Table 13)
Intercept	2.499**		
Physician-hospital integration:			
Participation in open PHO	.854	.055	.178**
Participation in closed PHO	1.293**	.098**	.175**
Pre-Hospital Factors:			
FTE staff physicians	-.046*	-.168*	-.042
Outpatient visits	.895**	.557**	.702**
HMO contracts	-.078	-.024	.037
PPO contracts	.050	.019	.126*
Post-Hospital Factors:			
Inpatient beds	.564**	.324**	.538**
Skilled nursing beds	.017	.048	.351**
F-value	13.349**		
R^2	.6657		
Adjusted R^2	.6478		
Df	8,301		

Two-tailed tests ** $p < .01$ * $P < .05$

Only participation in a closed PHO, however, shows a positive and significant association with the productivity rate. Participation in an open PHO, which was significant alone, is no

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longer significant in the complete regression model (Table 33, Appendix D).

The relationships between expenses and pre-hospital and post-hospital care variables remain essentially the same as in our previous model (Table 21), except for the relationship between the number of staff physicians and productivity rate (Table 23). Unlike the previous model, the number of staff physicians now has a positive and significant effect on productivity (Table 33).

5.7 Interpretation of Results

5.7.1. Hospital Costs: Case-Mix Adjusted Expenses per Admission

The following hypothesis (H1) was tested with respect to hospital costs i.e. case-mix adjusted expenses per admission: Controlling for hospital ownership characteristics, hospital systems that use physician participation as a strategy perform better than hospital systems that do not use physician participation as a strategy (p.45).

Specifically, hypothesis H1a (p.48) was tested to determine whether the existence of physician organizations that participate in hospital management activities affects hospital cost. Regression analysis does not support this hypothesis in our complete regression model (Table 17). Nor, does the physician-hospital integration variable as a block add

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significantly to the explanatory power of the equation (Table 16).

We expected that the effects of physician integration on hospital costs might differ across hospital ownership status i.e. profit orientation, location and size. Only in larger hospitals did the frequency of physician participation have any effect on costs (Table 28, Appendix C). This was an expected result. This is most likely due to the fact that larger hospitals can integrate a greater number of physician-hospital organizations. Hence, bigger hospitals have additional need for physician involvement in management.

More important for our purposes, three of the hospital integration coefficients continue to exercise their magnitude and statistical significance across the complete regression model of the cost equation (Table 30, Appendix D). Specifically, outpatient visits and the number of PPO contracts continue to be related to lower hospital costs, whereby the number of inpatient beds available continues to be related to higher hospital costs when the other cost function variables are held constant.

Conversely, the physician-hospital integration coefficient in the partial regression model is reduced in magnitude and rendered statistically insignificant over the complete regression model of the cost equation (Table 30, Appendix D). These findings provide strong support for the argument that greater frequency of physician involvement in the formal

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management structure of the hospital, at least through administrative positions, has no affect on hospital costs. This is contrary to the hypothesis and an unexpected result.

The next hypothesis (H2) was tested with respect to case-mix adjusted expenses per admission: Controlling for hospital ownership characteristics, hospital systems that use physician participation in an open physician-hospital organization as a strategy perform better than hospital systems that use physician participation in a closed physician-hospital organization as a strategy (p.45).

Specifically, hypothesis H2a (p.49) was tested to determine whether the extent, or type, of physician participation in hospital management activities affects hospital cost. Although regression analysis does support the hypothesis in the full model (Table 19), the physician-hospital integration variable as a block does not add significantly to the explanatory power of the equation (Table 18).

Underlying the above result is the assumption that considerable variation in the type of physician integration on hospital costs may be masked by the fact that hospitals in our sample of 310 system hospitals can have more than one type of physician-hospital organization associated with them.

The regression models using extent of physician-hospital integration variables indicate a significant negative association between participation in an open PHO and hospital

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cost. No association between hospital cost and participation in a closed PHO was found (Table 31, Appendix D).

We expected that the effects of the extent of physician integration on hospital costs might differ across hospital ownership status i.e. profit orientation, location and size. There were some notable differences.

Physician participation in a closed PHO has a significant negative effect on costs in non-profit hospitals. Conversely, physician participation in an open PHO has a significant negative effect on costs in for-profit hospitals (Table 25, Appendix A). This finding is contrary to what was expected.

Although it is tempting to speculate that for-profit hospitals utilize physicians in management positions different from nonprofit hospitals, caution is warranted in making this interpretation. For-profit hospitals tend to be smaller, located in rural areas. This may make it easier for physicians to participate in management activities at the system level.

In contrast, nonprofit hospitals are generally larger organizations located in urban areas. For physician managers, this may create more conflicts with hospital managers making it difficult to participate in management activities at the system level.

In urban hospitals, participation in an open PHO has a significant negative association with hospital costs (Table 27, Appendix B). The same effect can be seen with participation in

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an open PHO in larger hospitals as well (Table 29, Appendix C). This was an expected result.

Three of the hospital integration coefficients in the partial model continue to exercise their magnitude and statistical significance in the full model of the cost equation (Table 31, Appendix D). Outpatient visits and the number of PPO contracts are still associated with lower hospital costs; inpatient beds available is still associated with higher hospital costs when the other cost function variables are held constant.

The coefficient representing physician participation in an open PHO in the partial model continues to remain the same in magnitude and statistical significance in the full model of the cost equation (Table 31, Appendix D). However, the coefficient representing physician participation in a closed PHO in the partial model is reduced in magnitude and rendered statistically insignificant in the full model of the cost equation. These findings provide support for the argument that participation in an open PHO has a statistically significant and negative affect on hospital costs.

Overall, the analysis supports the hypothesis that there is a difference, in the effect on hospital cost, between hospitals that use participation in an open PHO as a strategy and hospitals that use participation in a closed PHO as a strategy.

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5.7.2. Hospital Productivity: Case-Mix Adjusted Full-Time Equivalents per Occupied Bed

Hypothesis H1 was tested with respect to case-mix adjusted full-time equivalents per occupied bed: Controlling for hospital ownership characteristics, hospital systems that use physician participation as a strategy perform better than hospital systems that do not use physician participation as a strategy (p.45).

Specifically, hypothesis H1b was tested to determine whether physician organizations that participate in hospital management activities affect hospital productivity. Regression analysis does support the hypothesis in the complete model (Table 21). The contribution of the physician-hospital integration variable blocks to the explanatory power of the model remains insignificant, however (Table 20).

The above analysis suggests that the effect of PHOs on hospital productivity may not only depend on the frequency of participation in a physician-hospital organization, but may also be associated with other productivity factors as well. The physician-hospital integration variable, when considered without inclusion of the hospital integration strategies in the equation, has a significant effect on productivity (Table 32, Appendix D). Furthermore, the variable that measures the effect of the physician-hospital variable remains positive and significant in all the models tested.

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We expected that the effects of physician participation on hospital productivity might differ across hospital ownership status i.e. profit orientation, location and size. There were some notable differences.

In nonprofit hospitals, the frequency of physician participation in a PHO is positively linked with hospital productivity. (Table 24, Appendix C). This was an expected result since nonprofit hospitals are generally larger and can create economies of scale.

Similarly, in rural hospitals, the frequency of participation in a PHO was found to have a significant and positive association with hospital productivity (Table 26, Appendix B). Furthermore, the same effect could be seen with smaller hospitals (Table 28, Appendix C). This was an unexpected result.

It is expected that larger, urban hospitals have greater hospital productivity due to size and location advantages; the above results seems contradictory to our expectations. Given the limitations of this study and the significant statistical differences between each ownership group, this relationship should be studied further.

Three of the hospital integration coefficients in the partial model continue to exercise their magnitude and statistical significance in the full model of the productivity equation (Table 32, Appendix D). Inpatient beds available and outpatient visits are positively related with hospital

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productivity rate. Non-hospital based physicians on staff is associated with lower hospital productivity when the other cost function variables are held constant.

The last hypothesis (H2b) was tested with respect to case-mix adjusted full-time equivalents per occupied bed: By including hospital integration strategy factors and controlling for hospital ownership characteristics, the extent of participation in physician-hospital integration organizations is related to hospital productivity rate.

Hypothesis H2b was tested to determine whether the extent, or type, of physician participation in hospital management activities affects hospital productivity. Regression analysis supports the hypothesis in the full model (Table 23). In addition, the physician-hospital integration variable as a block adds significantly to the explanatory power of the equation (Table 22).

We expected that the effects of the extent of physician integration on hospital productivity might extend across hospital ownership status i.e. profit orientation, location and size. There were some notable differences.

Physician participation in a closed PHO had a significant positive effect on hospital productivity in for-profit hospitals. Conversely, physician participation in an open PHO had a significant positive effect on costs in nonprofit hospitals (Table 25, Appendix A). This finding was expected

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based on past empirical studies (Goes and Zahn 1995; Shortell et al 1988).

In urban hospitals, physician participation in an open PHO has a significant positive association with hospital productivity. In rural hospitals, physician participation in a closed PHO has a significant positive association with hospital productivity (Table 27, Appendix B). This was an expected result.

In large hospitals, physician participation in an open PHO has a significant positive association with hospital productivity. In small hospitals, physician participation in a closed PHO has a significant positive association with hospital productivity (Table 29, Appendix C). Again, this was an expected result.

The coefficient representing physician participation in a closed PHO in the partial model continues to remain the same in magnitude and statistical significance in the full model of the productivity equation (Table 33, Appendix D). However, the coefficient representing physician participation in an open PHO in the partial model is reduced in magnitude and rendered statistically insignificant in the complete regression model.

Overall, the analysis supports the hypothesis that there is a strong difference between hospitals that use participation in an open PHO as a strategy and hospitals that use participation in a closed PHO as a strategy.

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Chapter 6
CONCLUSIONS

6.1. Discussion of Results

The results of this study suggest that integration of physicians into hospital management and policy-making structure may do little to affect hospital costs. In fact, certain integration strategies are actually associated with higher costs in these organizations. The arrangements in our study served to increase costs, particularly for non-profit and large hospitals. Where Sloan and Becker found lower costs associated with physician participation in hospital management, we found either no effect or higher costs, depending on the size and profit orientation of the hospital. This evidence should send a signal to hospital managers considering tighter integration of hospital and physician as a strategy for cost reduction.

Our findings suggest that strategies for integrating a larger number of physicians in hospital management and policy-making structures do not affect hospital costs. Regression analysis does not support the hypothesis (See Hypothesis 1.a.). The physician-hospital participation variable as a block did not add significantly to the explanatory power of the equation, and the physician-hospital integration variable alone did not have a significant affect on hospital costs. This was an unexpected finding and contrary to the hypothesis.

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Ironically, physician-hospital integration continues to increase at a time where it may no longer be an effective cost management strategy. Our findings do, however, suggest that specific strategies for integrating physicians in hospital management activities to achieve cost control can differ across the type of physician-hospital participation strategy employed.

The extent of physician participation in hospital management was unexpectedly associated with hospital costs. This outcome may explain why physician-hospital integration has increased in popularity after implementation of the Prospective Payment System in 1983. The regression model using participation in an open PHO and closed PHO showed a negative association between hospital costs and participation in an open PHO. Moreover, this strategy was the only one that was significantly associated with lower hospital costs.

Physician participation in an open PHO appears to have significant effects on reducing costs in for-profit hospitals. In contrast, physician participation in a closed PHO appears to have some effect in reducing costs of nonprofit hospitals. However, in order to ensure that significant cost savings strategies can be implemented, the hospitals must be large and located in urban areas.

Results of our research suggests that hospital managers may continue to trade off further physician participation in hospital management and policy-making with the desire to maintain administrative control over policy decisions. This

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finding suggests that some hospitals seeking greater control over their costs, and less managerial conflict, may be migrating from participation in management at the hospital level to physician participation at the system level.

Substantial differences in the collective effect of physician-hospital participation strategies on hospital productivity rate were also evident. Our findings suggest that strategies for integrating a greater number of physicians in hospital management and policy-making structures affect hospital productivity rate. Regression analysis supports the hypothesis (See Hypothesis 1.b.). The physician-hospital participation variable as a block does add significantly to the explanatory power of the equation, and the physician-hospital integration variable alone has a significant affect on hospital costs. This was an expected finding and supports our hypothesis.

The findings of this study suggest that the integration of physicians into the hospital management structure may have more to do with maximizing productivity than with minimizing costs. Certain integration strategies are actually associated with higher productivity by increasing direct patient care for each bed occupied.

The results of this study propose that the frequency of integration of physicians into the hospital management structure will increase hospital productivity. Thus, an increase in integration strategies are associated with higher

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productivity in these organizations. Thus, productivity rate is most consistently affected by physican-hospital integration strategies, while the effects of integration on hospital costs are less robust.

Our study concludes that specific strategies for integrating physicians in hospital management activities to achieve maximum productivity should differ across different types of hospitals. For example, physician participation in an open PHO appears to have a significant positive association with hospital productivity in nonprofit hospitals. In order to assure that productivity gains are realized, the hospitals should be small and located in urban areas. Alternatively, physician participation in a closed PHO appears to have a significant positive association with productivity in for-profit hospitals. In thiscase, to assure productivity gains are realized, the hospitals should be large and located in rural areas.

In contrast, physician participation in a closed PHO appears to have significant effects on increasing hospital productivity of for-profit hospitals. In this case, in order to assure that significant productivity gains are realized, the hospitals should be large and located in rural areas.

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6.2 Conclusions

The results indicate very moderate associations between participation in physician-hospital organizations and performance, some of which are in opposite direction to the hypotheses. Generally, hospital productivity is influenced by the frequency or number of physician-hospital organizations, and not by the type of physician participation present. Conversely, hospital costs are associated with the type of physician participation, and not by the number of physician-hospital organizations affiliated with the hospital.

Given these general findings, the questions become: Why are some participation mechanisms associated with lower hospital costs wheras others have no impact? And, what accounts for the difference in effects of physician participation across hospital types? Let us consider the mechanism that consistently affected hospital costs: participation in an open PHO.

It appears that the participation of physicians in management and policy-making capacities does not equate with the control of physicians for cost containment purposes. Participation in the management and policy-making structure of the hospital may have the effect of enhancing physician autonomy in those areas of resource utilization without attention to cost containment.

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However, system-wide participation of physicians in hospital management and policy-making activities may reduce, rather than increase, conflict within the hospital. Such situations may increase organizational efficiency as expressed by lower costs. Findings suggest that physician participation on a system-wide basis may actually help overcome agency problems inherent in physician-hospital relations (Gregory 1992), thereby bringing physician and hospital goals into greater alignment.

Our results imply that involving physicians in hospital management and policy-making activities may have the greatest influence on physicians' admitting patterns, rather than on costly practice choices or expensive technologies or procedures.

6.3. Suggestions for Future Research

The data has not proven that participation in a physician-hospital organization can provide better performance over and above other types of organization, nor does it conclude that any one organizational type of structure (open, closed, location, size, or profit orientation) outperforms the rest.

There are several areas for future research. First, involvement by physicians in a system hospital's strategic planning, policy making, and related governance activities needs to be explored further. Physicians are in a position to

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take a formal leadership role by becoming more involved in hospital management. They are also in a position to influence the strategic direction of the hospital system. Future research might examine whether open and closed physician organizations play equally important roles in promoting managerial, clinical, and operational involvement by physicians in these organizations.

Second, there is a need for longitudinal research that can specify the direction of statistical associations observed in this study. For example, does physician participation in hospital management promote the implementation of vertical integration strategies, or does the implementation of vertical integration strategies promote physician participation in hospital management? Additional information may be gained from a smaller longitudinal study that compares the different performance effects physician participation has on older, stable and mature system hospitals.

Third, additional research in the areas of geographic or local differences, patient or payer mix differences, competition, and an expanding look at hospital financial performance in light of the cash-flow concept will provide guidance to those in hospital administration. In the area related to patient satisfaction, further research and testing to define variables related to perception of quality by the patient is needed. This type of research could provide

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important insight into the relationship between patient values and physician-hospital integration.

Finally, there is a need for a better understanding of the internal processes by which system hospitals appear to achieve more effective pricing policies and standardization in implementing cost allocation. Further research could seek evidence aimed at empirically testing the existence of specific procedures which may be treated differently in physician-hospital organizations compared to other types of physician-hospital arrangements.

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Glossary of Terms

TERMS	DEFINITIONS
Acute Care	A hospital facility that provides care for treatment over a short term length of stay period(1-7 days)
Case-Mix Index	A national measure used to determine the severity of patient illness (how sick a patient is) at the time the patient is admitted to the hospital
Closed PHO	A joint venture between the hospital and physicians who have been selected to participate in management at the hospital level only
Freestanding Hospital	A hospital that is not a member of a system or network of hospitals operating under one system of ownership or control
Full-Time Employee Equivalents (FTE)	The number of hours worked by hospital care employees on direct patient care relative to 2080 hours
Health Maintenance Organization (HMO)	A health care organization that provides a range of medical services to a specified group of patients on a fixed periodic prepaid basis
Inpatient Care	Treatment provided to patients who remain in the hospital for more than overnight care
Occupied Beds	Number of inpatient beds in use by the end of the reporting period
Open PHO	A joint venture between the hospital and physicians who have the opportunity to participate in management at the hospital system level
Outpatient Care	Treatment provided to patients who do not remain in the hospital for overnight care
Preferred Provider Organization (PPO)	A group of specified physicians and hospitals who agree to provide care to a group of patients at a negotiated fee
Prospective Payment System (PPS)	A payment method in which what the rate providers will receive is set in advance
Subacute Care	A hospital facility that provides care for treatment over a longer period of stay (8-15 days)
System Hospital	A hospital that is a member of a system or network of hospitals operating under one system of ownership or control
Urban Hospital	A hospital located inside a large Metropolitan Statistical Area (MSA)

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APPENDIX A - PHYSICIAN-HOSPITAL INTEGRATION AND HOSPITAL PROFIT ORIENTATION

Table 24. Regression Analysis: Effects of Physician-Hospital Integration on Cost and Productivity (Parameter Estimates)

	Hypothesis H1a		Hypothesis H1b	
	Cost		Productivity	
	Nonprofit	For-Profit	Nonprofit	For-Profit
Intercept	3.187**	3.023**	3.435**	2.087
Physician-hospital integration:				
Existence of PHO	-.033	-.092	1.092**	.463
Pre-Hospital Factors:				
FTE staff physicians	.011*	-.088	-.059	-.018
Outpatient visits	-.043**	-.059**	.998**	.730**
HMO contracts	.028	.032	-.037	-.085
PPO contracts	-.035	-.025	.089	.052
Post-Hospital Factors:				
Inpatient beds	.037*	.031**	.379**	.693**
Skilled nursing beds	-.007	-.000	.068	.042*
F-value	2.984**	3.591**	18.144**	18.017**
R^2	.2363	.2511	.6561	.6102
Adjusted R^2	.1966	.2184	.6383	.5938
df	7,134	7,162	7,134	7,162

Two-tailed tests ** $p < .01$ * $P < .05$

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Table 25. Regression Analysis: Effects of Extent of Physician-Hospital Integration on Hospital Cost and Productivity (Parameter Estimates)

	Hypothesis H2a		Hypothesis H2b	
	Cost		Productivity	
	Nonprofit	For-Profit	Nonprofit	For-Profit
Intercept	3.187**	3.035**	3.436**	2.110
Physician-hospital integration:				
Participation in open PHO	-.024	-.084*	1.613**	.300
Participation in closed PHO	-.091*	.075	1.077	1.901**
Pre-Hospital Factors:				
FTE staff physicians	.011*	-.082	-.057	-.017
Outpatient visits	-.044**	-.059**	.881**	.730**
HMO contracts	.028	.033	-.049	-.082
PPO contracts	-.035	-.025	.101*	.051
Post-Hospital Factors:				
Inpatient beds	.037*	.030**	.379**	.693**
Skilled nursing beds	-.000	-.000	.083	.042*
F-value	2.749**	3.848**	15.941**	18.017**
R^2	.2363	.2511	.6599	.6117
Adjusted R^2	.1906	.2184	.6383	.5912
df	8,133	8,161	8,133	8,161

Two-tailed tests ** $p < .01$ * $P < .05$

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APPENDIX B - PHYSICIAN-HOSPITAL INTEGRATION AND HOSPITAL LOCATION

Table 26. Regression Analysis: Effects of Physician-Hospital Integration on Cost and Productivity (Parameter Estimates)

	Hypothesis H1a		Hypothesis H1b	
	Cost		Productivity	
	Rural	Urban	Rural	Urban
Intercept	3.017**	3.438**	3.663**	.471
Physician-hospital integration:				
Existence of PHO	-.020	-.038	.906**	.310
Pre-Hospital Factors:				
FTE staff physicians	.004	.009	-.058*	.070
Outpatient visits	-.045**	-.036*	.904**	.875**
HMO contracts	.017	.055	-.215	-.329
PPO contracts	-.029	-.035	-.004	.171
Post-Hospital Factors:				
Inpatient beds	.030**	.064**	.489**	.681**
Skilled nursing beds	-.002	-.005	.029	-.010
F-value	3.231**	2.945*	26.143**	8.897**
R^2	.1586	.4392	.6033	.7012
Adjusted R^2	.1345	.3656	.5917	.6625
df	7,240	7,53	7,241	7,53

Two-tailed tests ** $p < .01$ * $P < .05$

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Table 27. Regression Analysis: Effects of Extent of Physician-Hospital Integration on Cost and Productivity (Parameter Estimates)

	Hypothesis H2a		Hypothesis H2b	
	Cost		Productivity	
	Rural	Urban	Rural	Urban
Intercept	3.016**	3.534**	3.661**	-.0497
Physician-hospital integration:				
Participation in open PHO	-.058	-.208*	.857	1.228**
Participation in closed PHO	-.010	.037	1.851**	.014
Pre-Hospital Factors:				
FTE staff physicians	.004	.009	-.058*	.071
Outpatient visits	-.044**	-.035*	.905**	.871**
HMO contracts	.018	.063	-.214	.283
PPO contracts	-.029*	-.048	-.004	.238
Post-Hospital Factors:				
Inpatient beds	.030**	.066**	.489**	.691**
Skilled nursing beds	.002	-.005	.030	-.092
F-value	2.861**	2.960*	22.783**	8.007**
R^2	.1604	.4772	.6033	.7123
Adjusted R^2	.1322	.3964	.5902	.6688
df	8,240	8,52	8,240	8,52

Two-tailed tests ** $p < .01$ * $P < .05$

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APPENDIX C - PHYSICIAN-HOSPITAL PARTICIPATION AND HOSPITAL SIZE

Table 28. Regression Analysis: Effects of Physician-Hospital Participation on Cost and Productivity (Parameter Estimates)

	Hypothesis H1a		Hypothesis H1b	
	Cost		Productivity	
	Small	Large	Small	Large
Intercept	2.573**	2.353**	5.080**	14.909**
Physician integration:				
Existence of PHO	.006	-.060*	.489*	.101
Pre-Hospital Factors:				
FTE staff physicians	.007	-.011	-.030	-.135
Outpatient visits	-.038*	-.064*	.842**	.542**
HMO contracts	.017	-.031	-.208	.073
PPO contracts	-.040	-.034	-.099	-.148
Post-Hospital Factors:				
Inpatient beds	.019	.042**	.276**	.138
Skilled nursing beds	.098*	-.004	-.072	-.007
F-value	2.036*	2.044*	15.585**	3.485**
R^2	.1270	.1250	.5271	.3238
Adjusted R^2	.0650	.0552	.4933	.2311
df	7,98	7,51	7,98	7,51

Two-tailed tests ** p <.01 * P <.05

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Table 29. Regression Analysis: Effects of Extent of Physician-Hospital Integration on Hospital Cost and Productivity (Parameter Estimates)

	Hypothesis H2a		Hypothesis H2b	
	Cost		Productivity	
	Small	Large	Small	Large
Intercept	2.566**	2.390**	5.159**	14.940
Physician-hospital integration:				
Participation in open PHO	-.038	-.092*	1.054*	.073
Participation in closed PHO	-.082*	-.102	.096	.217*
Pre-Hospital Factors:				
FTE staff physicians	.007	-.013	-.028	-.134*
Outpatient visits	-.037*	-.066*	.836**	.541*
HMO contracts	.019	-.028	-.236	.074
PPO contracts	-.044	-.037*	-.094	-.151
Post-Hospital Factors:				
Inpatient beds	.013	.051	.275**	.137
Skilled nursing beds	.112*	-.004	-.006	-.007
F-value	1.801*	1.933*	14.027**	2.990*
R^2	.1293	.1300	.5362	.3241
Adjusted R^2	.0566	.0652	.4983	.2155
df	8,97	8,50	8,97	8,50

Two-tailed tests ** $p < .01$ * $p < .05$

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APPENDIX D - SUPPLEMENTARY TABLES

Table 30. Regression Analysis: Effects of Physician-Hospital Participation on Hospital Cost - All Models

	Hypothesis H1a						
Model	1	2	3	4	5	6	7
Intercept	2.299**	2.743**	2.894**	3.074**	2.754**	2.911 **	3.085*
Physician-hospital integration:							
Existence of PHO	-.055***				-.021	-.040	-.021
Pre-Hospital Factors:							
FTE staff physicians		.052		.046	.050		.044
Outpatient visits		-.056**		-.045**	-.055**		-.043**
HMO contracts		.020		.025	.019		.025
PPO contracts		-.031*		-.028*	-.032*		-.029*
Post-Hospital Factors:							
Inpatient beds			.049**	.036**		.049**	.036**
Skilled nursing beds			-.003	-.004		-.002	.000
F-value	2.986	14.429**	18.255**	12.525**	11.625**	12.781**	10.785
R^2	.0116	.1591	.1062	.1998	.1612	.1111	.2608
Adjusted R^2	.0060	.1482	.1001	.1832	.1475	.1038	.1641
df	1,308	4,305	2,307	6,303	5,304	3,306	7,302

Two-tailed tests ** $p < .01$ * $P < .05$ *** $p < .10$

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Table 31. Regression Analysis: Effects of Extent of Physician-Hospital Participation on Hospital Cost - All Models

Hypothesis H2a

Model	1	2	3	4	5	6	7
Intercept	2.311**	2.743**	2.894**	3.074**	2.757**	2.920**	4.802*
Physician-hospital integration:							
Participation in open PHO	-.123*				-.176*	-.107*	-.078*
Participation in closed PHO	-.056				-.018	-.027	.003
Pre-Hospital Factors:							
FTE staff physicians		.005		.046	.051		.005
Outpatient visits		-.056**		-.045**	-.054**		-.043**
HMO contracts		.025		.025	.021		.026
PPO contracts		-.028*		-.028*	-.033**		-.030*
Post-Hospital Factors:							
Inpatient beds			.049**	.045**		.048**	.036**
Skilled nursing beds			-.003	-.004		-.002	.000
F-value	2.610	14.429**	3.211**	12.525**	9.971**	10.225**	9.696*
R^2	.0167	.1594	.1058	.1998	.1653	.1488	.2053
Adjusted R^2	.0101	.1481	.1000	.1831	.1483	.1172	.1478
df	2,307	4,305	2,307	6,303	6,303	4,305	8,301

Two-tailed tests ** p <.01 * P <.05

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Table 32. Regression Analysis: Effects of Physician-Hospital Participation on Hospital Productivity - All Models

	Hypothesis H1b						
Model	1	2	3	4	5	6	7
Intercept	15.550**	8.093**	5.651**	2.903**	7.707**	5.149**	2.510*
Physician-hospital integration:							
Existence of PHO	1.462**				.741**	1.176**	.704**
Pre-Hospital Factors:							
FTE staff physicians		-.064*		-.050*	-.058*		-.046*
Outpatient visits		1.135**		.935**	1.091**		.898**
HMO contracts		-.028		-.101	.014		-.074
PPO contracts		.056		.048	.099		.047
Post-Hospital Factors:							
Inpatient beds			.823**	.560**		.818**	.564**
Skilled nursing beds			.069**	.022		.059**	.017
F-value	21.241**	16.931**	12.763**	17.298**	15.269**	18.021**	10.004**
R^2	.0653	.5022	.3216	.6051	.5188	.3634	.6281
Adjusted R^2	.0612	.4966	.3175	.5974	.5102	.3562	.6102
df	1,308	4,305	2,307	6,303	5,304	3,306	7,302

Two-tailed tests ** $p < .01$ * $P < .05$

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Table 33. Regression Analysis: Effects of Extent of Physician-Hospital Participation on Hospital Productivity - All Models

	Hypothesis H2b						
Model	1	2	3	4	5	6	7
Intercept	15.462**	7.864**	5.353**	2.903**	7.702**	5.081	2.499
Physician-hospital integration:							
Participation in open PHO	1.963**				.525	1.668**	.854
Participation in closed PHO	2.532**				1.418**	1.965**	1.293**
Pre-Hospital Factors:							
FTE staff physicians		-.064*		-.053*	-.058*		-.046*
Outpatient visits		1.135**		.935**	1.089**		.895**
HMO contracts		-.028		-.101	-.008		-.078
PPO contracts		-.056		.048	.201*		.050
Post-Hospital Factors:							
Inpatient beds			.823**	.560**		.816**	.564**
Skilled nursing beds			.069**	.021		.060**	.017
F-value	11.221**	16.931**	12.763**	17.298**	14.234**	14.031**	13.349*
R^2	.0831	.5352	.3313	.6055	.5186	.3666	.6657
Adjusted R^2	.0622	.4961	.3171	.5973	.5080	.3581	.6478
Df	2,307	4,305	2,307	6,303	6,303	4,305	8,301

Two-tailed tests ** p <.01 * P <.05

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APPENDIX E - DESCRIPTIVE STATISTICS: PHYSICIAN-HOSPITAL ORGANIZATIONS BY HOSPITAL LOCATION

Table 34. Prevalence and Distribution of Hospital Care Strategies and Participation in Physician-Hospital Organizations by Hospital Location

	Participation in open PHO		HMO contracts
	N	%	Mean
Rural	66/249	26.5%	2.79
Urban	22/61	36.1%	2.77
Total	88/310	28.4%	2.78
	Participation in closed PHO		PPO contracts
	N	%	Mean
Rural	32/249	12.9%	4.38
Urban	12/61	19.7%	4.57
Total	44/310	14.2%	4.47
			FTE physicians on staff
			Mean
Rural			3.77
Urban			2.49
Total			3.13
			Outpatient visits/1000
			Mean
Rural			50.87
Urban			67.24
Total			59.06
			Inpatient beds available
			Mean
Rural			143.76
Urban			166.41
Total			155.09
			Skilled nursing beds available
			Mean
Rural			9.39
Urban			14.25
Total			11.82

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