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The Relationships Among External Environments, Organizational Structures, and Performance in Pursuit of the Clinical and Academic Missions at Academic Health Centers

Eric J. Strucko

THE RELATIONSHIPS AMONG EXTERNAL ENVIRONMENTS, ORGANIZATIONAL STRUCTURES, AND PERFORMANCE IN PURSUIT OF THE CLINICAL AND ACADEMIC MISSIONS AT ACADEMIC HEALTH CENTERS

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

by

Eric John Strucko
Master of Public Health, University of Virginia, 2012
Associate of Applied Science, Piedmont Virginia Community College, 2007
Master of Public Policy, Georgetown University, 1995
Master of Public Administration, George Washington University, 1992
Bachelor of Arts, Vanderbilt University, 1987

Director: Jan P. Clement, Ph.D.
Professor, Department of Health Administration, College of Health Professions

Virginia Commonwealth University
Richmond, Virginia
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Acknowledgments

> The face of academic medicine in the United States has evolved significantly since its inception in the late 19th and early 20th centuries. Among the substantive shifts have been changes in the internal organization and configuration of AHCs. These have sometimes been guided by responses to institutional planning and initiatives, but perhaps more frequently they have been the result of accommodations and adjustments to various controllable as well as uncontrollable external changes, pressures, and other phenomena (Pizzo, 2008, p. 867).
>
> Philip A. Pizzo, M.D.
> Dean, Stanford University School of Medicine

Since the beginning of my dissertation journey in 2012, I have lived this research as a professional experiencing what Pizzo describes above, working to help align the academic health centers at the University of Virginia and Penn State University. Compiling the literature review, learning structural contingency theory, and analyzing AHCs over a decade has made me a more effective executive manager of hospitals, physician group practices, and medical schools. I owe a great deal to the faculty and administration of Virginia Commonwealth University (VCU) who conceived of this doctorate program and made the curriculum a reality. A special thank you to Jim Cotter, Ph.D. and both Diane Dodd-McCue, D.B.A. and Michael McCue, D.B.A.

No one at VCU has shaped my thinking more than Professor Jan Clement who, after so many years of effort, was careful to keep me grounded on process by stating in October 2019, “We want to produce knowledge in the right way.” Her patience, persistence, and adherence to research standards will never leave me.

Jan needed to make sure that I met these standards. During the fits and starts of this research effort I, like others who engage in this work, had moments of disillusionment. The results were not what I expected, and so I would clear my thinking by retreating to off-topic books, or so I thought. Walter Isaacson (2017), in his biography of Leonardo da Vinci, criticized the master for entering into an ultimately inaccurate study of human blood flow failing to proceed “without pre-conceptions” (p. 420). Producing knowledge the right way can elude minds infinitely better than mine. Jan, thank you for keeping me disciplined.

Every doctorate student who is later in life creates enduring sacrifices for family. My son David and my daughter Claire have spent half of their lives under the shadow of this dissertation. I can only imagine how my solitude in a far corner of a house has shaped their attitudes, views, and relationships with their father. This dissertation has occupied a third of my 27-year marriage with Laurie. How do I attempt an expression of gratitude for her endurance and support? I do know that Laurie understands the importance of this work to me, striving to fulfill a pursuit of knowledge instilled in me by Connie Strucko (my mother), John Strucko (my father), David C. Strucko (my brother), and John Lebischak (my grandfather) who said, “Without an education, you’re nothing”. My accomplishments as a chief financial officer, vice president, paramedic, elected official, and graduate student are results of their influence.

I want to express my appreciation to the Association for American Medical Colleges (AAMC) and Merle Haberman, MHA, Senior Director for Health Systems Economics, Data, and Analysis who, on May 24, 2018 granted me permission to use the Council of Teaching Hospitals and Health Systems Survey of Hospital Operations and Financial Performance data for this research. The agreement is as follows:

The “AAMC grants this permission with the following conditions:

- The AAMC is authorizing use of the data only for the purposes of the dissertation;
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Table of Contents

List of Tables

List of Figures

List of Formulas

Abstract

THE RELATIONSHIPS AMONG EXTERNAL ENVIRONMENTS, ORGANIZATIONAL STRUCTURES, AND PERFORMANCE IN PURSUIT OF THE CLINICAL AND ACADEMIC MISSIONS AT ACADEMIC HEALTH CENTERS

By Eric John Strucko, Ph.D., M.P.H., M.P.P., M.P.A.

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Director: Jan P. Clement, Ph.D.
Professor, Department of Health Administration, College of Health Professions

Clinical and academic missions place Academic Health Centers (AHCs) at the center of the American health care system, and the future viability of these institutions requires successful performance in competitive environments. AHCs are organizations involving hospitals, physician group practices, and medical schools, and treat patients with complex conditions, conduct bio-medical and health science research, and educate future physicians and health professionals. AHCs account for 20% or $540 billion of national health care expenditures, conduct over 80% of all heart, liver, and lung transplants, utilize over $27 billion in annual sponsored research funding, and graduate approximately 17,300 medical doctors annually. Financial management at AHCs is intricate, where the clinical enterprises ideally generate surplus funds to sustain the hospital and physician group practice while subsidizing the operations of the medical school and investing in research. This funds flow is dependent on AHCs successfully competing in health care markets and contending for external research grants. As competitive environments change, AHCs respond by restructuring the organizational arrangements among the hospital, physician group practice, and medical school to gain

operational efficiencies or market advantages. What does not exist is consensus on what type of organizational structure is effective given certain environmental conditions. The literature contains mostly case studies of individual AHCs or empirical research on the clinical mission only. A gap in the literature is a comprehensive, multivariate, empirical study of the relationship among environments, organizational structures, and performance at AHCs involving both the clinical and academic missions.

The objective of this study is to conduct research on AHCs that fills the gap using a theoretical framework that addresses these relationships. This study uses the primary proposition of structural contingency theory, which states that certain organization structures align with specific environmental conditions, and this fit leads to successful performance. This research investigates the relationship between environmental-structural fit and performance among a sample of 79 AHCs.

This study analyzes data that reflects patient care and research environmental conditions, organizational structure types, and performance in pursuit of the clinical and academic missions from 2007 to 2016. The methods involve calculating environmental–structural fits and misfits, and testing whether those AHCs in fit arrangements perform better than AHCs in misfit arrangements. The analyses involve multivariate regression equations using rates of change in hospital market share and total margin as dependent variable measures for the clinical mission, and rates of change in medical school NIH R01 funding, the percentage of medical school faculty with NIH R01 funding, and the number of interns and residents as dependent variable measures for the academic mission.

The results of this research support the proposition that AHCs in a fit arrangement perform better in growing hospital market share, medical school NIH R01 funding, and the percentage of medical school faculty with NIH R01 funding. The outcomes offer insights as to how AHCs can organize the hospital, physician group practice, and medical school to fit environmental conditions, and how this fit relates to measures of success in the clinical and academic missions.

Chapter 1: Introduction

The Study Problem

Academic health centers (AHCs) play a central role in the American health system, and the economic viability of these institutions is essential for the continuity of progressive bio-medical research and discovery, medical education, and care delivery within the United States. AHCs simultaneously pursue the clinical and academic missions. AHCs typically are the venue for the treatment of complex conditions, offering tertiary and quaternary levels of care. These institutions are also at the nucleus of clinical and basic science research that yield insights and discoveries to prevent or treat disease, improve patient care processes, and advance the condition of human health. AHCs educate, train, and ultimately produce the physicians that render medical care. If AHCs fail to adapt to the changing clinical and academic environmental conditions then the future of advanced care services, treatment innovations, and the physician supply is at risk.

AHC economic viability relies on financial success and funds flows from the clinical operations to the academic missions. Patient care at AHCs offers teaching opportunities, serves as a source of research information, and generates payments or reimbursements for the clinical services. The goal of resource management is to produce financial surpluses from patient care to generate and supplement funding for the research and education operations. Changes in health care markets such as competition for patients with other providers or the growth of capitated reimbursements through managed care coverage can disrupt the economic viability of AHCs and hinder the simultaneous pursuit of the clinical and academic missions (Karpf, Schultze & Levey, 2000; Sabeti, Kahn & Sachs, 2015; Stimpson, Li, Shiyanbola & Jacobson, 2014). Similarly, downward trends in funding for research and education can upset the financial balance within AHCs. According to multiple scholarly and professional perspectives, an effective way AHCs can respond to the threats of market and other environmental conditions is to reorganize internal structural arrangements to operate more strategically and efficiently (Barrett, 2008; Stimpson et al., 2014; Wartman, 2010).

Fulfilling the multi-faceted clinical and academic missions requires AHCs to function as elaborate organizations. AHCs characteristically involve inter-relationships among various entities including a university, a medical school, a hospital, and a physician group practice (Kastor, 2004). AHCs can adopt one of several organizational forms, where the medical school, hospital, and physician group practice operate as loosely affiliated independent entities such as the University of Cincinnati, a highly integrated single corporation such as the University of Pennsylvania, or a partially integrated arrangement such as the University of Virginia (Barrett, 2008). Multiple case studies assert that AHC organizational changes occur when environmental pressures threaten the economic viability necessary to pursue simultaneously the clinical and academic missions (Barrett, 2008; Kastor, 2004; Mallon, 2003; Pizzo, 2008).

Responding to market and environmental conditions with an appropriate organizational alignment should produce positive economic outcomes for the AHC, establish viability, and ensure ongoing efforts to pursue the missions (Luke, Walston, & Plummer, 2004). The challenge facing AHCs is to understand which organizational arrangement is appropriate for the prevailing environmental conditions to improve economic performance. What is missing from the literature is a systematic and multivariate analysis of associations among environmental conditions, AHC organizational structures, and institutional performance in pursuing the clinical and academic missions. This dissertation considers the following research questions:

1. Do AHCs adopt organizational structures appropriate to environmental conditions?
2. Do AHCs that have organizational structures that fit environmental conditions experience better performance in pursuing the clinical mission than AHCs with structures that do not fit the environment?
3. Do AHCs that have organizational structures that fit environmental conditions experience better performance in pursuing the academic mission than AHCs with structures that do not fit the environment?

This study explores the impacts of clinical success measures that have a relationship to environmental-structural fit on academic performance. If financial surpluses from patient care operations are necessary to produce and support research and education operations, then the third research question above involves measures of the munificence of the clinical environment that result from the second research question. A corollary to the third research question is do measures of clinical success that have an association with AHC environmental-structural fit impact academic performance? A fourth research question acknowledges the importance of organizational adaptation to changing environments:

4. Is environmental-structural fit in a dynamic environment more impactful to AHC performance than fit in a stable environment?

Finally, a fifth research question continues the focus on the clinical operations:

5. Is fit to the clinical environment alone more impactful to AHC performance than fit to a combined clinical-academic environment?

Background

AHCs operate at the center of the American health system, educating and training physicians, engaging in research and clinical investigations, and providing complex care for high acuity patients (Dunn, 2014; Shi & Singh, 2008; Stein, Chen & Ackerly, 2015). Each year, AHCs graduate approximately 17,300 medical doctors and grow the number of physicians by 2%, utilize over $27 billion in sponsored research funding, represent 22% of national hospital admissions and outpatient visits, conduct over 80% of all heart, liver, and lung transplants, and represent 20% of health care spending in the United States (PricewaterhouseCoopers, 2012; Rowe & Wisniewski, 2013; Sabeti et al., 2015).

The AHC is an effective setting for the concurrent operations of medical education, bio-medical and health research, and clinical care (Dzau, Cho, ElLaissi, Yoediono, Sangvai, Shah, Zaas & Udayakumar, 2013). The typical AHC involves the participation of a graduate medical school, a hospital (or multiple hospitals), and a multi-specialty physician group practice (Kastor, 2004). The professional physicians of the group practice generally serve as faculty of the medical school and the clinical staff of the hospital, thus creating the interrelationships among the operations of the three entities (Kastor, 2004). This arrangement facilitates the simultaneous pursuit of clinical and academic missions. The teaching and research in the medical school lead to innovations that translate to the clinical environment of physician practices and hospitals for testing and application on complex patients (Beller, 2000; Dzau et al., 2013). Medical research has a higher probability of producing knowledge in a setting where physicians participate in the effort or have close interactions with the primary investigators, and such relationships exist naturally at AHCs (Blumenthal, Campbell & Weissman, 1997). Furthermore, imparting knowledge to an eventual medical professional requires a wide range of specialized education and practical experience with patients, creating the need for an institution that treats a variety of conditions at different levels of complexity (Stimpson et al., 2014). A hospital, physician group practice, and medical school thus become contributing organizational components for an AHC to pursue the clinical and academic missions.

The financial structure of AHCs is delicate. The teaching mission makes the clinical environment costly, where faculty and students take longer with patients than private practice physicians and utilize more diagnostic and therapeutic procedures (Blumenthal et al., 1997). AHCs provide a disproportionate share of complex services including the treatment of rare diseases and patients with multisystem organ failures (Blumenthal et al., 1997). A large portion of the AHC patient population has no health insurance coverage or are enrollees of the lower reimbursement Medicare or Medicaid programs, requiring AHCs to offset the financial losses by attracting commercially insured patients, who generate as much as fifty percent more in reimbursements than the other patients (Rothman, Miller, King & Gibson, 2015; Stimpson et al., 2014).

AHCs also consume resources when conducting biomedical research. Typically, the funding for research from government agencies such as the National Institute of Health, cover only a portion of the costs to conduct the work (Dorsey, de Roulet, Thompson, Reminick, Thai, White-Stellato, Beck, George & Moses III, 2010). For every dollar in external funding for research, AHCs invest $0.53 to cover the costs of the necessary infrastructure and support services (Association of American Medical Colleges, 2015).

AHCs strive to balance the clinical and academic cost structures with multiple sources of recurring funding to maintain and advance patient care, research, and teaching operations. Financial surpluses typically result from patient care operations to flow into and support the academic enterprises (Kennedy, Johnston & Arnold, 2007; Miller, Andersson, Cohen, Cohen, Gibson, Hindery, Hooven, Krakower & Browdy, 2012; Rothman et al., 2015). Sponsorship grants from organizations external to the AHC are the primary source of funding for biomedical and clinical research, and student tuition and fees, federal programs for undergraduate and graduate medical education, and other sources such as investment interest from gifts and endowments pay for educational operations (Clarke, Crooke & Federoff, 2015; Johnson, Chisholm & Neilson, 2015; Stimpson et al., 2014). As noted earlier, however, the costs of the research and teaching efforts exceed the revenues from academic sources, creating a reliance on clinical funds (Kastor, 2004).

Environmental conditions can threaten the balance between the high cost operations and multiple revenue sources necessary for AHC funding sustainability (Karpf et al., 2000; Stimpson et al., 2014). These exogenous forces involve competition from other health care provider institutions for patient care market share and revenues (Alexander, Davis & Kohler, 1997; Daniels & Carson, 2011). The growth of managed care and capitated or fixed payment policies also places downward pressure on clinical revenue and eventually the operating surpluses necessary to fund the academic missions (Mallon, 2003; Thorpe, Seiber & Florence., 2001). Competition also exists for academic funds. Reductions in government financial support for biomedical and health research and education intensify the competition for grant funding, deepen the reliance on patient care proceeds, and exacerbate the impacts of growing market rivalries and capitated approaches to health care financing (Stimpson et al., 2014).

An effective way AHCs can respond to the financial challenges of changing environmental conditions is to reorganize the internal structural arrangements among the hospital, physician group practice, and medical school. The degree of integration or autonomy among the three entities varies among AHCs, and the selected structure could create competitive capabilities, operating efficiencies, and effectiveness in pursuing the clinical and academic missions (Barrett, 2008, Stimpson et al., 2014; Reece, Chrencik & Miller, 2012). Consensus on the optimal AHC organizational structure does not exist. Full structural integration facilitates strategic focus, advances the shared objectives of the combined enterprise, and enables the clinical operation to build market share and cross subsidize the academic efforts (Barrett, 2008; Daniels & Carson, 2011; Wartman, 2010). A loose affiliation among the hospital, physician group practice, and medical school allows for flexibility and entrepreneurialism to react quickly to changing market conditions, and deliver greater financial outcomes (Barrett, 2008; Keroak, McConkie, Johnson, Epting, Thompson, & Sanfilippo, 2011). Economics and competition can compel changes in structure, and no single alignment appears to have uniform applicability to differing external circumstances (Pizzo, 2008).

AHCs generally adopt one of several organizational forms at any point in time. The hospital, physician group practice, and medical school can operate separately in a loose affiliation, combine into a fully integrated structure under single ownership, or assume a partially integrated form where two of the three entities combine and the third holds a degree of autonomy (Barrett, 2008). The challenge facing AHCs is which organizational structure facilitates improving performance in pursuit of the clinical and academic missions given prevailing environmental conditions.

Study Aims and Research Questions

The aim of this study is to examine relationships among market and economic conditions, the organizational structures of AHCs, and measures of performance. The first objective is to establish an association or fit between the AHC structural arrangement among the hospital, physician group practice, and medical school, and prevailing environmental contexts. The second objective is to determine if this environmental-structural fit has an association with indicators of successful performance toward the clinical and academic missions. The final objective of this study is to perform these examinations within the context of structural contingency theory, which serves as the conceptual framework for this analysis, and is the topic of a subsequent section in this introductory chapter.

To reiterate, the research questions in this study are:

1. Do AHCs adopt organizational structures appropriate to environmental conditions?
2. Do AHCs that have organizational structures that fit environmental conditions experience better performance in pursuing the clinical mission than AHCs with structures that do not fit the environment?
3. Do AHCs that have organizational structures that fit environmental conditions experience better performance in pursuing the academic mission than AHCs with structures that do not fit the environment? Corollary: do measures of clinical success that have an association with AHC environmental-structural fit impact academic performance?
4. Is environmental-structural fit in a dynamic environment more impactful to AHC performance than fit in a stable environment?
5. Is fit to the clinical environment alone more impactful to AHC performance than fit to a combined clinical-academic environment?

Study Significance

A multitude of individual case studies exist that describe how specific AHCs alter organizational structures in reaction to changes in market and economic conditions, and how those changes lead to performance improvements, but what is missing from the literature is a broad and systematic examination of the relationships among environmental forces, organizational alignments, and indicators of mission success across all AHCs. Qualitative case studies descend into individual organizations in great detail, but the research technique struggles to produce results that are generalizable to the population of AHCs (Mallon, 2003). More comprehensive research through an empirical study across a large number of AHCs would test the foundations upon which many observers base the assertion that AHCs must make organizational changes in alignment with environmental forces to achieve mission-based success. A review of the literature, however, demonstrates the scarcity of research that evaluates how the structure of the AHC hospital, physician group practice, and medical school fit environmental conditions, and if this fit improves AHC effectiveness toward mission performance. This study addresses that gap in the research literature.

Failure to make organizational adjustments given changing environmental conditions can lead to competitive disadvantages and ultimately to jeopardizing the financial viability and continuing existence of the AHC (Porter, 1985). Responding to evolving market and economic situations with effective organizational changes should produce positive outcomes for the AHC, establish viability, and ensure ongoing and advancing patient care, research, and education operations (Luke et al., 2004). Continuing financial viability of AHCs preserves the unique institutional abilities to educate and train physicians, engage in research activities and clinical investigations, and provide complex care for high acuity patients simultaneously. The fundamental concurrency of the clinical and academic missions requires an effective organizational arrangement among the hospital, physician group practice, and medical school within the AHC.

Theoretical Framework

The conceptual model for this study originates from structural contingency theory (Burns & Stalker, 1961; Donaldson, 2001; Lawrence & Lorsch 1967). Structural contingency theory focuses on the relationships among environmental forces, organizational structures, and institutional effectiveness (Donaldson, 2001; Pennings, 1975). The theory challenges the notion that a single ideal organizational structure is effective in all settings, and asserts that different organizational structures are not equally effective (Lawrence & Lorsch, 1967). Certain types of organizational arrangements fit specific environmental conditions better than others, and the outcome is effective performance (Pennings, 1975). The fundamental proposition is that effective performance results from fitting the organizational structure to prevailing environmental conditions or contingencies (Burns & Stalker, 1961; Donaldson, 2001; Pennings, 1975).

Structural contingency theory utilizes the four constructs of context, structure, fit, and effectiveness (Donaldson, 2001; Pennings, 1975). Context is the environment within which organizations operate to achieve mission goals, and has multiple facets. Market stability or dynamism, and the general munificence or availability of resources are prevailing contingencies that characterize environments (Dess & Beard, 1984; Donaldson, 2001). Changes in market conditions can create circumstances where an organization's existing structure no longer yields effective performance. The organization itself is a structural arrangement of integrated or differentiated operational units that coordinate work activities (Hollenbeck, Moon, Ellis, West, Ilgen, Sheppard, Porter & Wagner, 2002; Lawrence & Lorsch, 1967). Ideally, these operating units should take a form that fits the environmental conditions to achieve effective performance.

Fit is the association between the environmental conditions and the organizational structural characteristics (Burns & Stalker, 1961).

According to structural contingency theory, two basic organizational structures exist: centralized and organic. Centralized or integrated arrangements among the organization's operating units have bureaucratic structures with consolidated decision-making through hierarchies, and this type of structure fits stable environments where routine processes lead to successful performance toward mission objectives (Burns & Stalker, 1961). Organic structures are loose affiliations among the organization's operating units, which function relatively independently (Burns & Stalker, 1961). Organic structures possess decentralized participatory decision-making processes, and this type of organizational arrangement fits dynamic environments where successful mission performance requires the flexibility to innovate and make tactical choices at the sub-unit level (Donaldson, 2001).

Utilizing the structural contingency theoretical framework in this research involves the following propositions:

I. AHCs, as structural arrangements of operational units, attempt to organize the hospital, physician group practice, and medical school in a manner that fits the prevailing environmental conditions to generate successful performance in pursuing the clinical and academic missions.

    a. AHCs that adopt consolidated organizational structures and exist in a stable environment generate successful performance in pursuing mission objectives.

    b. AHCs that adopt loosely affiliated organizational structures and exist in a dynamic environment generate successful performance in pursuing mission objectives.

II. Conversely, AHCs that adopt an organizational structure that is a misfit with the prevailing environmental conditions do not generate successful performance in pursuing the clinical and academic missions.

   a. AHCs that adopt a consolidated organization structure and exist in dynamic environments do not generate successful performance in pursuing mission objectives.

   b. AHCs that adopt a loosely affiliated organizational structure and exist in stable environments do not generate successful performance in pursuing mission objectives.

Hypotheses

Applying the structural contingency theory propositions to this study lead to four hypotheses:

H1: AHCs that have an organizational structure that fits the prevailing environment experience better performance in pursuing the clinical mission than AHCs with a structure that misfits the environment.

H2: AHCs that have an organizational structure that fits the prevailing environment experience better performance in pursuing the academic mission than AHCs with a structure that misfits the environment.

The second hypothesis involves the underlying supposition that successful pursuit of the academic mission relies on the munificence of the clinical environment, which is the result of financial successes from the AHC patient care operations. Testing hypothesis 2 involves using the performance measures from the tests of hypothesis 1 (the dependent variables) as indicators of financial munificence for the tests of hypothesis 2 (independent variables).

H3: AHCs that have an organizational structure that fits a dynamic environment have better performance in pursuing the missions than AHCs with an organizational structure that fits a stable environment.

The inherently delicate financial balancing necessary for successful AHC operations, and the ultimate reliance on clinical funds to flow to the academic mission, leads to the exploration of which environment has the greater impact on AHC performance: the clinical environment only or the combined clinical and academic environment (Miller et al., 2012). The fourth hypothesis is that organizational fit with the clinical market has stronger influence on the AHC performance.

H4: AHCs that have an organizational structure that fits a prevailing clinical environment have better performance in pursuing the missions than AHCs with an organizational structure that fits a prevailing combined clinical and academic environment.

Data Sources and Analyses

This study uses secondary retrospective data from a variety of sources to test the hypotheses. The Association of American Medical Colleges annual Council of Teaching Hospitals and Health Systems Survey of Hospital Operations and Financial Performance (2007-2016), contain the data for most of the measures in this study, including information on organizational structural arrangements among AHC hospitals, physician group practices, and medical schools. The survey also gathers data on AHC clinical operational environments, educational programming, and financial performance. The United States Department of Health and Human Services National Institute of Health and the Blue Ridge Institute for Medical Research offer data on bio-medical and health research efforts at AHCs. The American Hospital

Association, and the United State Census Bureau track information on the characteristics of health care markets and environments.

Testing the hypotheses involves an analytical model using ordinary least squares regression equations where the independent variables are measures of performance in the patient care, research, and education operations. The analysis employs a panel design, measuring AHC environmental-organizational structure fit in the year 2011, and capturing AHC performance across the years 2013 through 2016. Those AHCs with structures that fit the prevailing environment in 2011 should have positive and statistically significant relationships with performance indicators. The analysis determines environmental-organizational structure fit by using indicators of clinical and academic environmental stability, the two categories of organizational structure (integrated and loose affiliation), and the structural contingency theory definitions of fit. The model controls for environmental and organizational characteristics outside of fit that may impact AHC performance. The model also controls for the impacts of past AHC clinical and academic performance from the years 2007-2010.

Outline of Remaining Chapters

Chapter two of this dissertation provides a literature review on AHCs. The chapter begins with information on the origins, missions, and importance of AHCs, and outlines how AHCs organize and function. The chapter also contains sections describing the external environments within which AHCs operate, and how and why AHCs make organizational adaptations. The narrative then reviews empirical studies exploring the relationships among environments, organizational structures, and performance for AHCs and the health care industry outside of academic medicine. Finally, the chapter summarizes the gaps in the literature and offers the rationale for the importance of this study.

Chapter three establishes the theoretical framework for this dissertation. The chapter defines the structural contingency theory constructs of environment or context, organization and structure, contingent pairs or environmental-structural fit, and organizational effectiveness or performance, and outlines cases where the concepts have application in the health care industry and this study in particular. After these definitions and the establishment of the fundamental proposition that effective organizational performance results from fitting the organization structure to prevailing environmental conditions, the chapter concludes with the conceptual model for this study and the theoretical rationale for the hypotheses.

Chapter four moves into the methodology for testing the hypotheses. The chapter outlines the observational, correlational, and retrospective research approach using multiple cross sections. Subsequent sections outline the methods to mitigate threats to internal, external, and construct validity consistent with structural contingency theory. After a description of the data sources, study population, and the inclusion/exclusion criteria for the sample, the chapter outlines the dependent, independent, and control variables, including the methods of determining environmental-structural fit. The chapter concludes with a justification for using regression analysis, the challenges with sample size, statistical validity, the research schematic, and the fundamental regression equation.

Chapter five presents the results from the quantitative analyses. The initial section introduces the general findings and then offers interpretations of descriptive statistics. The chapter proceeds to the hypotheses testing and the results from the regressions.

Chapter six offers general conclusions from the analyses and implications for future studies. The chapter examines the findings of this dissertation, and discusses the results in terms of structural contingency-based research and the operations of AHCs. Finally, the chapter catalogs the limitations of this study and offers suggestions for future research.

Chapter 2: Review of the Literature

Introduction

The literature on the structures and operations of AHCs contains relatively few empirical studies using representative sample sizes and advanced quantitative techniques. Individual case studies, commentaries, and media reports dominate the body of knowledge of how AHCs adapt to changing market and economic conditions (Kastor, 2004, Rahn, 2015; Rothman et al., 2015; Stimpson et al., 2014; Wilemon, 2014). The few studies that research AHCs with a measure of comprehensiveness and with some statistical rigor focus solely on the clinical mission or utilize simple comparative or correlational analytical models (Keroack et al., 2011; Livingston, 2001; McCue & Thompson, 2011; Szabat & Walsh, 2007). Given these circumstances, this literature review frequently references the case studies and commentaries as the chapter progresses from detailed descriptions of how AHCs function to a review of pertinent empirical analyses regarding relationships among environments, organizational structures, and performance. Supplementing the scarce empirical research regarding AHCs are references to more analytically rigorous studies involving the broader health care industry outside of academic medicine.

This chapter contains eight sections. The first five cover 1) the origins, missions, and importance of AHCs, 2) how AHCs organize and function, 3) the environments within which AHCs operate, 4) how AHCs make organizational adaptations, and 5) why AHCs make organizational changes. The next two sections review 6) empirical studies exploring the relationships among environments, organizational structures, and performance for AHCs and the health care industry, and 7) a description of the gaps in the literature. The final section is 8) a chapter summary.

Origins, Missions, and Importance of AHCs

This section initiates a detailed description of the origin and purpose of AHCs. The focus is an explanation of why patient care, research, and education are the three essential operations of AHCs, creating the overall importance of these institutions to the American health care system. Thus, this section begins establishing the relevance of this study, which seeks to generate insights to strengthen AHC viability and improve performance. The inescapable reality is that AHCs pursue the clinical and academic missions simultaneously, experience the environmental pressures in the patient care, research, and education operational areas at the same time, and therefore any comprehensive determination of organizational performance must involve measures in each area.

The AHC missions. The origin of the contemporary AHC is from a reform effort with respect to medical education. Abraham Flexner’s 1910 report outlining the need for improvements in American pedagogy describes medicine as a scientific discipline requiring laboratory investigation and clinical training in university hospitals (Duffy, 2011). The Flexner study, emanating from the Carnegie Foundation and Johns Hopkins University, outlines the need for research and patient care facilities where medical school faculty possess rights to practice and teach (Bland 2011; Duffy, 2011). In Flexner’s view, the only effective medical educational model involves the tripartite mission of research, instruction, and clinical care in university and hospital settings (Bland, 2011). Flexner generates early controversy though, when the reform effort calls for medical faculty to focus mainly on research and teaching and places patient care as a distant tertiary responsibility (Duffy, 2011). While most progressives at the time accept the need to create standards and protocols for medical education as a science, prominent academic physicians such as William Osler and Harvey Cushing oppose the removal of patient care practice from the faculty, citing the primacy of serving as a beneficent healer (Duffy, 2011). What emerges from the debate is the AHC as an institution that houses education, research and patient care operations within a university medical school and clinical facilities, and involves faculty/physicians (Bland, 2011; Duffy, 2011).

More recent commentary on the missions of the AHC addresses the broad institutional purpose of improving health through treatment, teaching, and discovery. AHCs "accomplish this purpose by providing patient care; educating and training future health professionals; conducting biomedical, translational, clinical, population-level, and health services research; and translating research discoveries into improved approaches to health and disease" (Rahn, 2015, p. xv). Patient care, teaching, and research are the missions of AHCs and exist as efforts that "act synergistically to advance [the] unified purpose" of a healthier society (Rahn, 2015, p. xv). The patient care enterprise is the foundation for advancing the three missions, serving as the AHC's "largest classroom" and the setting where faculty/physicians maintain and hone medical skills (Rahn, 2015, p. xv). The clinical arena also is the place where patients receive care and generate information for research (Rahn, 2015). "[I]ntegrat[ing] patient care, teaching, and research in the clinical setting" imparts knowledge on students and directs discovery efforts (Rahn, 2015, p. xv). The missions are interdependent and support a common purpose of improving public health (Ramsay & Miller, 2009).

The AHC is an effective setting for the concurrent missions (Dzau et al., 2013). The academic efforts of teaching and research lead to medical innovations that translate to the clinical environment of physician practices and hospitals for testing and application on complex patients in multicenter clinical trials (Beller, 2000; Dzau et al., 2013). Medical research has a higher probability of producing knowledge in a setting where physicians participate in the effort or have close interactions with the primary investigators, and such relationships exist naturally at AHCs (Blumenthal et al., 1997). Furthermore, imparting knowledge to an eventual medical professional requires a wide range of specialized education and practical experience with patients, creating the need for an institution that treats a variety of conditions at different levels of complexity (Stimpson et al., 2014).

The importance of the AHC missions to the American health care system. The uniquely multi-faceted mission of AHCs places the organizations at the center of the American health care system. AHCs produce physicians, search for knowledge, and treat patients with complex conditions (Shi & Singh, 2008; Dunn, 2014; Stein et al., 2015). The United States dedicates approximately 18% of the $3.0 trillion annual gross domestic product to health care, and AHCs account for 20% or $540 billion of the expenditures (Sabeti et al., 2015). AHCs graduate approximately 17,300 medical doctors annually and grow the number of physicians by 2% each year, utilize over $27 billion in annual sponsored research funding, represent 22% of national hospital admissions and outpatient visits, conduct over 80% of all heart, liver, and lung transplants, and provide more than 40% of the country's charity care (PricewaterhouseCoopers, 2012; Rowe & Wisniewski, 2013).

How AHCs Function

The multiple missions, placing AHCs in a distinctive role within the American health system, also generates organizational complexities. This section outlines the component parts of the AHC organizational structure, and describes the financial interdependencies among the entities. AHCs can align the parts in a variety of arrangements. The purpose of the adopted organizational structure is to enhance the financial relationships among the parts and foster the exchange of economic value (Wartman, 2008). When resources flow effectively among the organizational entities, the AHC's ability to pursue the clinical and academic missions strengthens (Kennedy et al., 2007).

The organization of AHCs. AHCs typically involve a relationship of three entities in organizational structures that can assume several formations. A hospital (or multiple hospitals), a multi-specialty physician group practice, and a graduate medical school operate together to fulfill the clinical and academic missions (Kastor, 2004). The professional physicians of the group practice generally serve as faculty of the medical school and the clinical staff of the hospital, thus creating the connections among the functions of the three entities (Kastor, 2004). The formal and informal interrelationships among the hospital, physician group practice, and medical school involve varying degrees of integration, or the extent to which the component organizations operate under singular management and governance (Barrett, 2008).

Barrett (2008) writes how Levine introduces the idea of an internal structural continuum for AHCs, where hospitals, physician group practices, and medical schools can exist in a loose affiliation at one end of a range of integration, a fully consolidated arrangement at the opposite end, or assume a partially integrated form where two of the three entities combine and the third holds a degree of autonomy. A loose affiliation is where the medical school, as an extension of the parent university or a stand-alone health sciences academic institution, the hospital, and the physician group practice operate separately from each other. This distinctness is legal in nature, where the university (medical school) has no ownership of the hospital or group practice. A fully consolidated organization structure is where the university (medical school) owns the hospital and the physician group practice. All three AHC entities operate under single executive leadership and an administration controlled through the university. The organizational structures in between a loose affiliation and full consolidation are the three combinations of partial integration: 1) the hospital and physician group practice combine into a clinical operation and affiliate with the medical school, 2) the medical school and physician group practice combine into a university-academic orientation and affiliate with the hospital, and 3) the medical school and hospital are university-owned and affiliate with the physician group practice which is a professional-clinical operation. Figure 1 displays the Levine model and these organizational structure categories.

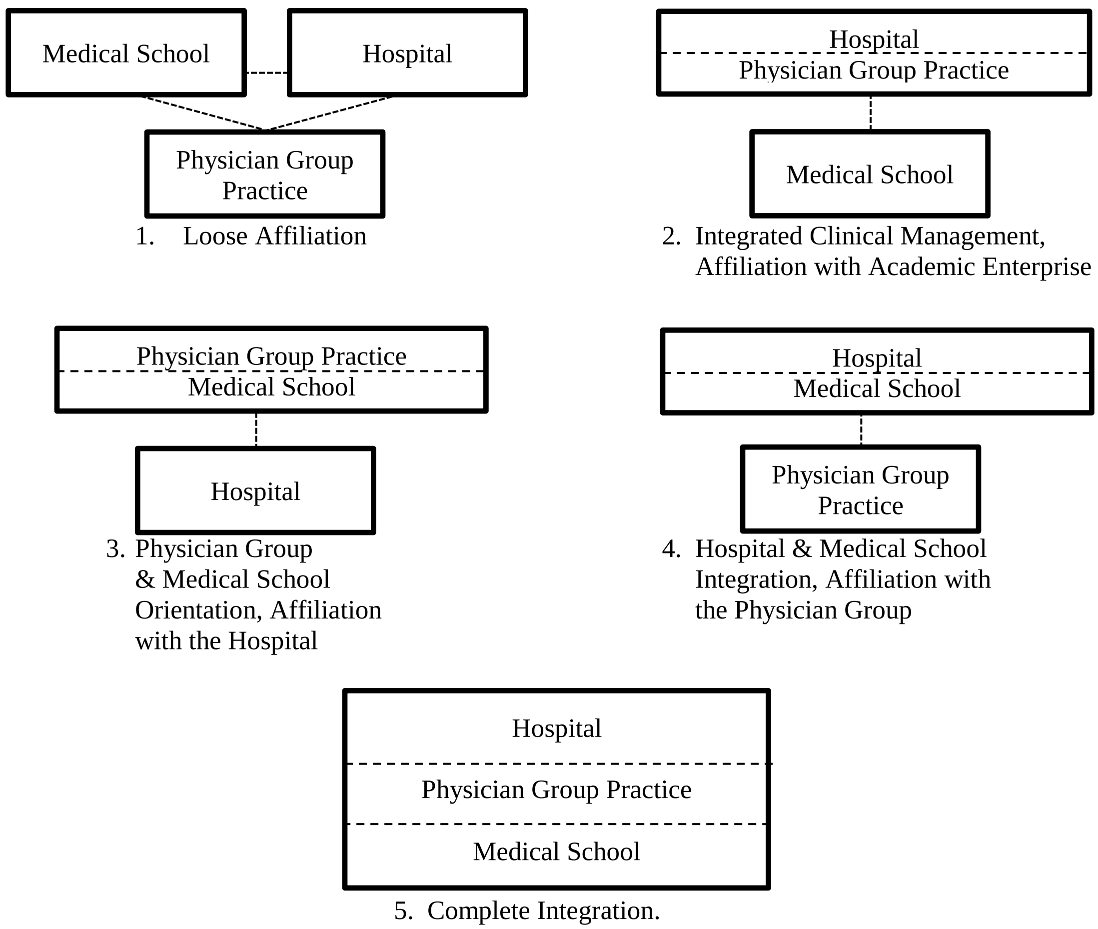

Figure 1. Levine's AHC Organizational Alignment Continuum (Barrett, 2008).

Table 1 displays the Levine categories with examples from 2008 of AHCs that adopt the specific type of organizational alignment.

Table 1

Examples of AHCs in Levine's Organizational Alignment Categories (Barrett, 2008)

1. Loose affiliation	2. Clinical integration	3. Academic orientation	4. Hospital and medical school integration	5. Complete integration
Medical College of Georgia	Harvard University, Massachusetts General	Columbia University	Mayo Medical College	University of Michigan
George Washington University	Tufts University	Johns Hopkins University	State University of New York-Brooklyn	University of Pennsylvania
University of Cincinnati	University of Vermont	University of Chicago	University of Alabama	University of California
		University of Florida	University of Virginia	Wake Forest University

Wartman (2008) simplifies the AHC organizational structure options into two prototypical models: 1) integrated and 2) split/splintered. Integrated is where a governance board and executive oversee patient care, research, and education functions in a consolidated organization. The split/splintered model is where multiple boards and executives manage the clinical and academic operations as autonomous but affiliated organizations. This notion of the split/splintered structure becomes pertinent in the development of the theoretical framework of this dissertation in Chapter 3, and the research model in Chapter 4.

The financial structure of AHCs. Within the AHC's organizational alignment is a delicate financial structure among the hospital, physician group practice, and medical school. Resource management efforts contend with expensive clinical operations and under-funded academic activities. AHCs engage in multiple funds flows among and within the patient care, research, and education operations, shifting surpluses and making strategic investments to advance the clinical and academic missions simultaneously. This section describes the financial conditions within the organizational entities and the funding relationships among the hospital, physician group practice, and medical school.

Financial pressures are a constant presence in the clinical and academic mission areas. The patient care environment is costly when accompanied by teaching efforts, where faculty and students take longer with patients than private practice physicians and utilize more diagnostic and therapeutic resources (Blumenthal et al., 1997). The business models of AHC hospitals and physician group practices also have limited flexibility regarding the financial management of clinical services. AHCs cannot eliminate unprofitable patient care operations if the particular service or specialty is a requirement for accreditation as a graduate medical school (Stimpson et al., 2014). AHCs must incur the costs of administrative structures to meet clinical and academic regulatory standards, including liability insurance for possible medical errors in the teaching environment (Stimpson et al., 2014). AHCs also provide a disproportionate share of complex and unprofitable but necessary services as compared to private practice hospitals and physician groups (Blumenthal et al., 1997). These services include trauma and burn care, and treatment of complex diseases and patients with multisystem organ failures (Blumenthal et al., 1997). Finally, a large portion of the AHC patient population has no health insurance coverage or are enrollees of the low reimbursement Medicare or Medicaid programs (Stimpson et al., 2014).

AHCs also consume resources when conducting biomedical research, which is the development of knowledge applicable to human illness, the refinement of surgical and procedural techniques, and the discovery of new diagnostic and therapeutic regimens (Blumenthal et al., 1997). Typically, the funding for research from government agencies such as the National Institute of Health (NIH), private non-profit foundations, pharmaceutical, biotechnology, and medical device firms, and sources internal to the AHC cover only a portion of the costs to conduct the work (Dorsey et al., 2010; Wartman, 2008). An Association of American Medical Colleges (AAMC) (2015) survey-based study reveals that for every dollar in external funding for research at medical schools, AHCs invest $0.53 from other sources to cover the costs of the necessary personnel, infrastructure, and support services. The typical sources of this additional funding are the clinical enterprises (Liaison Committee on Medical Education, 2016a).

AHCs need to finance the academic cost structure with multiple sources of recurring funding to maintain and advance the clinical and academic missions. As stated above, sponsorship grants from organizations external to the AHC are the primary source of funding for biomedical and clinical research (Clarke et al., 2015). The education operation of the academic mission relies on funds from student tuition and fees, federal programs for undergraduate and graduate medical education, and other sources such as investment interest from gifts and endowments (Stimpson et al., 2014). As noted earlier, however, the costs of the research and teaching efforts exceed the revenues from these sources, creating a reliance on transfers of clinical funds from the hospital and physician group practice (Kastor, 2004). Table 2 outlines the sources and proportions of medical school annual income to conduct the research and teaching operations, showing that transfers from the clinical enterprise and grants and research contracts account for over 80%.

Table 2

Sources and Proportions of Medical School Annual Income (Liaison Committee on Medical Education, 2016a)

Sources of Medical School Revenue	**2011**	**2012**	**2013**	**2014**	**2015**
Hospital, Faculty/Physician Group Practice Transfer	37.3%	38.7%	39.1%	40.3%	41.9%
Hospital-based Federal Educational Programs (GME)	15.6%	16.5%	17.2%	17.8%	18.1%
Sub-Total Clinical Enterprises	52.9%	55.2%	56.3%	58.1%	60.0%
Grants and Research Contracts	29.7%	27.8%	26.0%	24.4%	23.0%
State and Local Government; Parent University	5.1%	4.9%	5.1%	5.1%	5.0%
Tuition and Student Fees	3.6%	3.7%	3.8%	3.8%	3.8%
Gifts	2.4%	2.3%	2.5%	2.3%	2.0%
Endowment Investment Returns	1.8%	1.9%	2.1%	2.0%	1.8%
Other Sources	4.5%	4.2%	4.2%	4.3%	4.4%
Total	**100%**	**100%**	**100%**	**100.0%**	**100.0%**

Cross-subsidization occurs even within the clinical operations, where patients with commercial insurance generate as much as 50% more in reimbursements than patients with Medicaid and Medicare coverage (Rothman et al., 2015). The presence of managed care payers impacts this balance as well, where fixed payments for health services can lower clinical surpluses (Rothman et al., 2015; Thorpe et al., 2001). AHCs manage the payer-mix and reimbursement contracts with commercial insurers, attempting to ensure that clinical volumes contain an adequate number of commercially insured patients to offset the lower revenue or losses from those with coverage from fixed dollar plans and government sources. Table 3 shows the average distribution of patient care revenues among the different types of payers for AHCs from 2011 to 2015, and offers evidence that managed care is a growing presence in the AHC payer-mix.

Table 3

AHC Sources of Patient Revenue by Payer (derived from Association of American Medical Colleges, Council of Teaching Hospitals and Health Systems, 2008-2015)

AHC Payer Mix: Sources of Patient Care Revenue	**2011**	**2012**	**2013**	**2014**	**2015**
Commercial Insurance	29.3%	30.0%	30.2%	30.7%	30.3%
Managed Care (Commercial, Medicare, Medicaid plans)	17.5%	20.3%	21.1%	21.0%	22.4%
Medicare	26.4%	28.7%	27.8%	27.7%	27.7%
Medicaid	17.2%	17.4%	17.2%	17.1%	17.4%
Other (uninsured patients, self-pay patients, and other)	9.6%	3.6%	3.7%	3.5%	2.3%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

The economics of funds flows. Financial surpluses or positive margins must result from patient care operations to flow into and advance the academic enterprises (Rothman, et al., 2015). The resulting transactions or funds flows (Kennedy et al., 2007), appear as a subsidy from the clinical enterprise to the medical school, but also act as an investment from an economic standpoint. This section discusses the fundamental funds flows that occur within AHCs and describes the financial and economic interdependencies and relationships among the hospital, physician group practice, and medical school.

Wartman (2008) depicts a virtuous cycle where AHCs invest clinical revenue in research and education which, in turn, produce and disseminate new biomedical and health knowledge that grows the brand value of the AHC and the patient care enterprise. This economic value enhancement generates greater demand among patients to receive care at the AHC, which then grows clinical revenue for more investment in research and education (Pomeroy, Rice, McGowan & Osburn, 2008). Therefore, a successful academic enterprise can produce financial benefits to the clinical enterprise. Figure 2 shows the virtuous cycle of funds flow and the economic benefits between the clinical and academic missions of AHCs.

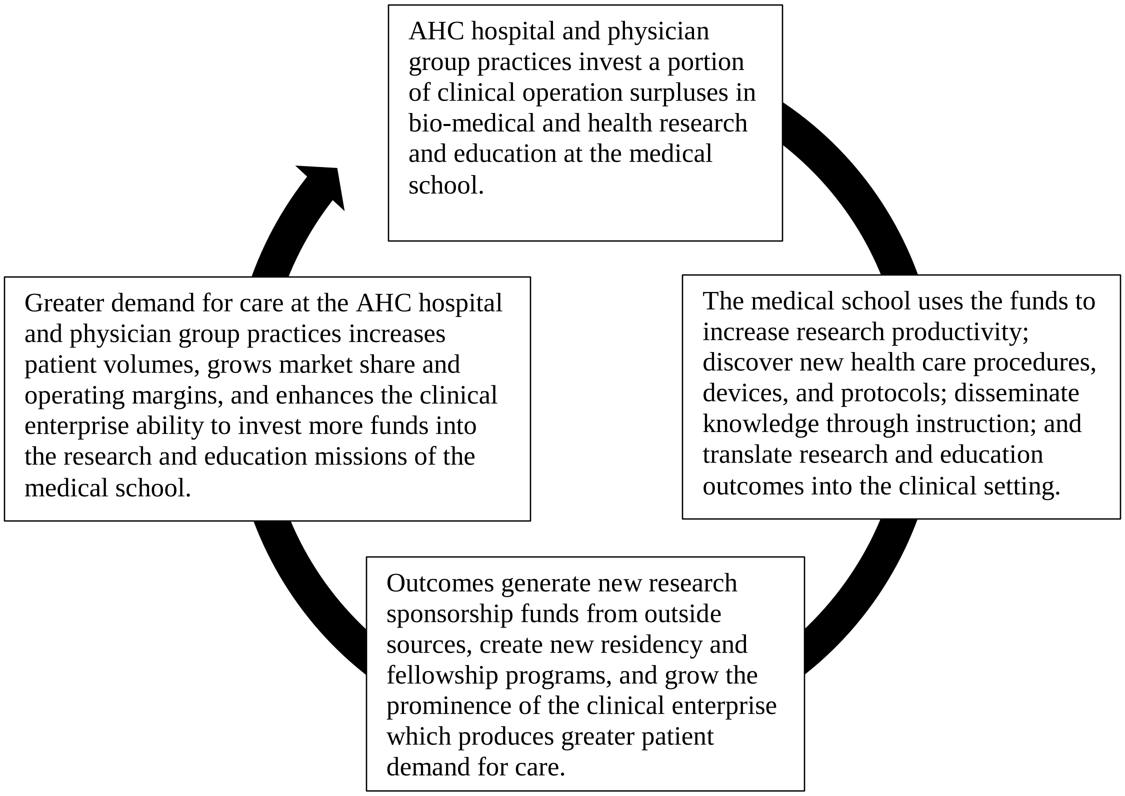

Figure 2. The Virtuous Cycle of Funds Flow and Economic Benefits (Levine, Detre, McDonald, Roth, Huber, Brignano, Danoff, Farner, Masnick & Romoff, 2008).

The financial management challenge for AHCs is to balance capital and cash flows, creating surpluses that support the patient care, research, and education operations while also funding the maintenance and upgrading of technologically advanced clinical equipment and facilities (McCue & Thompson, 2011; Rothman et al, 2015). Moody's Investors Services (2016) states that financially viable AHCs include hospitals and physician group practices that produce operating margins that provide adequate liquid current assets for clinical operational stability, funds for recurring and new health care capital needs, contributions to long-term hospital assets for future stability, and a stream of increasing investments in the academic missions of the medical school.

Several case studies document how AHCs employ incentive-driven mechanisms to initiate and rationalize the funds flows among the patient care, research and education operations. At the University of Pennsylvania, the medical school departments can accumulate financial reserves for academic uses through clinical revenue sharing agreements with the hospital and physician group practice (Kennedy et al., 2007). Departmental faculty generate the revenue as physicians providing patient care services in the hospital and group practice, and through inter-organizational agreements, a portion of the income transfers to their roles as researchers or instructors in the medical school. The sharing agreement incentivizes the faculty to perform clinical work to enable research and teaching efforts. This arrangement is wide-spread among AHCs, existing at such places as the University of Michigan (Comstock, 2015; Zukowski, 2014), Duke University (Dzau, 2013), Temple University (Kaiser, 2013), the University of Utah (Manzo, 2014), Stanford University (Cohen, 2015), the University of Alabama at Birmingham (Meeks, 2015), the Pennsylvania State University (Penn State) (Mallon, 2003), and the University of Massachusetts (Day, 2015). These AHCs also utilize hospital operating margin sharing as a financial incentive to generate academic resources through clinical efforts. For example, Mallon (2003) describes an arrangement at Penn State where the College of Medicine receives 20% of the hospital's operating margin above a threshold level of 2.5%. This agreement incentivizes the faculty/physicians to generate patient care revenue and run the clinical operations efficiently to produce a financial surplus from which a portion helps fund the academic enterprise at the College of Medicine.

AHCs also use cross-organizational joint financial planning to make resource investment decisions in the clinical and academic missions. Case studies of the University of California at Davis (Pomeroy et al., 2008), the University of Kentucky (Karpf, Perman, Lofgren, Melgar, Butler, Day, Clark, Claypool, Gilbert, Gombeski & Higdon, 2007), the University of California at Los Angeles (Karpf et al., 2000), the University of Maryland (Reece et al., 2012), and Johns Hopkins University (Reece et al., 2012) describe the alignments of the hospitals, physician group practices, and medical schools in capital and operating budget processes and resource allocation decisions. Through a study of 85 AHCs, Keroack et al. (2011) demonstrate that such integrated processes have correlations with positive AHC financial performance and effectiveness in teaching and research efforts. Joint resource planning improves the potential of aligning the clinical and academic missions through strategy and financial prioritization, and increases the chances that the patient care, research, and education operations receive levels of funding that preserve if not grow each enterprise.

The AHC case studies describing the funds flows agreements and joint planning efforts document the reliance of the research and education operations on the financial performance of the clinical enterprise. If hospitals and physician group practices fail to produce adequate operating surpluses, then AHCs have diminishing abilities to pursue the academic mission (McCue & Thompson, 2011; Miller et al., 2012). AHCs need to take actions that ensure clinical enterprise financial surpluses exist to meet the cash and capital requirements of large and complex patient care operations, and initiate the virtuous cycle investments in research and education that produce economic value (Moody's Investors Service, 2016; Wartman, 2008).

A primary action AHCs undertake to achieve economic viability is a realignment of the organizational structures among the hospital, physician group practice, and medical school. Such adjustments typically are responses to changing health care market conditions and the munificence of the academic environment (Pizzo, 2008). This section outlines the internal mechanics of AHCs, the organizational structures, financial dependencies, and economic value exchanges among the hospital, physician group practice, and medical school. The following section explores the environmental forces that threaten the delicate financial circumstances of AHCs, and then leads into a discussion about how AHCs respond to external challenges with organizational changes.

The Environments of AHCs

The case studies and commentaries of AHCs assert that changing environmental conditions threaten the balance between the high cost operations and the multiple revenue sources necessary for sustainable AHC performance in pursuing the clinical and academic missions (Karpf et al., 2000; Mallon, 2003; Rothman et al., 2015; Stimpson et al., 2014). Exogenous forces from the clinical environment include competitive health care markets and changing health care reimbursement methodologies (Rothman et al., 2015). The academic environment can also shift from munificent conditions to periods of slow growth and budget cut-backs, as governments change the levels of funding for bio-medical and health research and education (Rothman et al., 2015). The following sections review the clinical and academic environmental forces confronting AHCs.

Patient care market conditions: competition and methods of reimbursement. AHCs face increasing competition from other hospital systems and provider groups to grow patient market share and increase clinical volumes to offset lower revenues (Alexander et al., 1997; Daniels & Carson, 2011; Mallon, 2003; Thorpe et al., 2001). The development of managed care, capitated, and bundled payment policies place downward pressure on revenue for hospitals and group practices in a particular market, and these provider organizations, including AHCs, seek to grow patient volumes through expanding operations, or engaging in mergers, acquisitions, and affiliations with other provider organizations (Gaynor, 2006; Gaynor 2014; Stimpson et al., 2014; Town, Wholey, Feldman & Burns, 2007). The objectives of growing the organizational size or creating large care networks is to offset lower reimbursements through greater volumes and reduce operating costs through economies of scale (Cutler & Morton, 2013; Gaynor, 2006). Larger market shares also enable hospital systems and physician groups to achieve greater bargaining power when negotiating payment rates with commercial insurers, creating a counter lever to decreasing reimbursement within a market (Cutler & Morton, 2013; Gaynor, 2006). This competitive climate compels AHCs to examine corporate arrangements and organizational alignments to improve operational efficiencies, gain market share, and grow negotiating power with commercial insurers all to generate the operating surpluses necessary to fund the clinical and academic missions (Thorpe et al., 2001).

Multiple case studies mention increasing competition for patients and payment reforms as challenges to AHCs. The University of Minnesota (Glazer, Miller & Kaslow, 1999; Scott, 1996), George Washington University (Blumenthal & Weissman, 2000; Kastor, 2008), Georgetown University (Kastor, 2008), and Tulane University (Blumenthal & Weissman, 2000) experience a growing managed care market presence and the resulting financial losses as reasons for making operational and organizational changes. An increasing managed care presence in the market also compels the Oregon Health Sciences University (Alexander et al., 1997) and the University of Pittsburgh (Levine et al., 2008) to reorganize the AHC to mitigate financial risks. Growing provider competition in the market drives the University of Florida (Barrett, 2008), Penn State (Kirch, Grigsby, Zolko, Moskowitz, Hefer, Souba, Carubia & Baron, 2005; Mallon, 2003), Johns Hopkins University (Kastor, 2004), the University of Pennsylvania (Kastor, 2004; Rodin, 2004) and the University of California at Los Angeles (Karpf et al., 2000) to make corporate structural changes to generate operational efficiencies and gain market share.

Therefore, the two predominant forces within the clinical environment that challenge AHCs are 1) competition with other hospitals and physician groups for patient market share, and 2) withstanding and countering the downward pressure on revenue from a growing managed care presence in the market. The case studies on AHCs document these two forces as threats to the clinical financial resources flowing into AHCs, and as catalysts for organizational change.

Academic environment munificence. The availability of resources for research and education, or the munificence of the academic environment, is another dominant theme in case studies and commentaries of AHC operating conditions. AHCs rely on external funding to advance the academic mission. Grants and contracts are the largest academic source of funds for AHC medical schools, but are second to transfers from the clinical enterprises (see Table 2). Changes in research funding accelerate or impede the AHC academic enterprise, and alter the degree of reliance on other sources for financing research, including the clinical enterprise (Lanahan, Graddy-Reed & Feldman, 2016). The largest source of grant funding is the federal government, accounting for approximately 70% of AHC medical school external resources for research (see Table 4).

Table 4

Distribution of External Sources of AHC Medical School Research Funds (derived from Liaison Committee on Medical Education, 2016a)

External Sources of Research Funds for AHC Medical Schools	**2011**	**2012**	**2013**	**2014**	**2015**
Federal grants	74%	72%	71%	69%	68%
State and local governments	5%	5%	5%	6%	6%
Other sponsors	21%	22%	24%	25%	27%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Other research sponsors include private foundations, public charities, medical research organizations, and industry, which generally involves pharmaceutical, biotechnology, and medical device firms (Dorsey et al., 2010). These other sponsors of grant funding are growing as a percentage of medical school research resources, but the federal government continues to serve as the primary provider of sponsorship dollars, and thus is an influential force impacting the AHC research environment (Dorsey et al., 2010; Lang, 2008; Manton, Gu, Lowrimore, Ullian & Tolley, 2009; Osthus & Benos, 2006).

Within the federal government, the NIH is the predominant agency that funds bio-medical and health research at AHC medical schools, committing between $11.1 billion and $12.6 billion each year from 2011 to 2016 (Blue Ridge Institute for Medical Research, 2007-2016; Hromas, Abkowitz & Keating, 2012; Lang, 2008; Manton et al., 2009; Mitka, 2007; Osthus & Benos, 2006). Figure 3 displays the annual amounts of NIH funding to medical schools in the United States. Since 2007, total award levels fluctuate with annual declines reaching close to six percent and yearly increases growing as high as approximately eight percent (Blue Ridge Institute for Medical Research, 2007-2016). Changes in the median NIH total awards per medical school follow a similar trend.

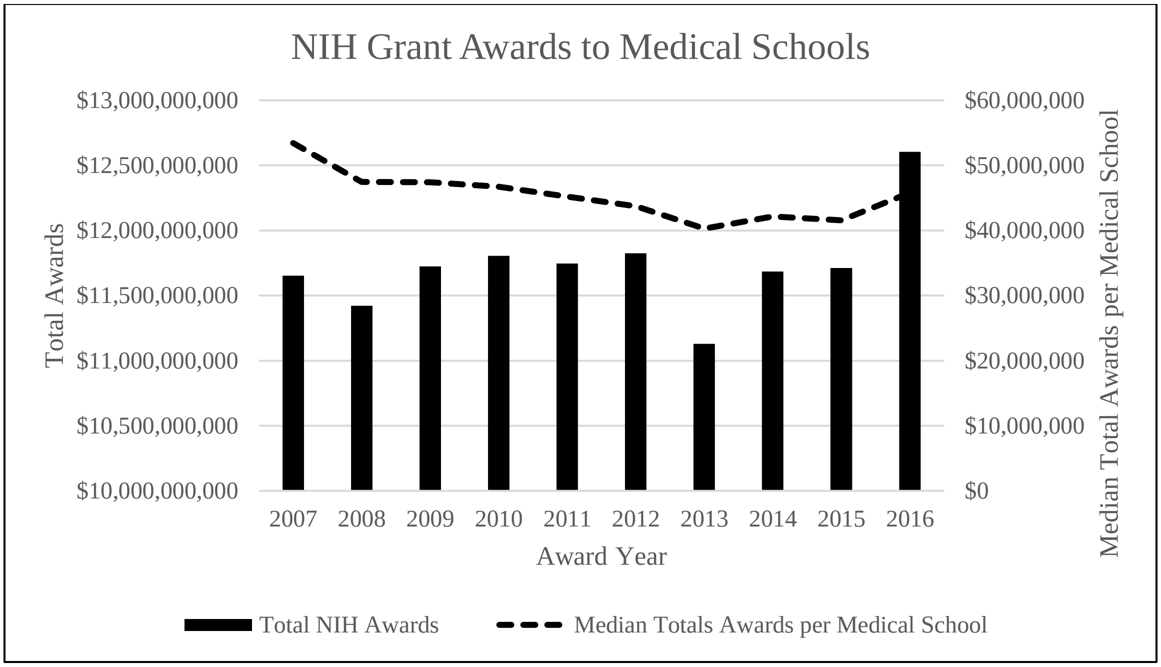

Figure 3. Annual Amounts of NIH Funding for Research to Medical Schools (Blue Ridge Institute for Medical Research, 2007-2016).

AHC faculty members compete for NIH funding to bring resources to their respective universities and medical schools (Mitka, 2007). Case studies of the Oregon Health Sciences University (Alexander et al., 1997), New York University (Kastor, 2004), and the University of Pennsylvania (Rodin, 2004) reference reductions in federal funding for research as a reason for changing the AHC operations and structures at these institutions.

The competition intensifies when new funding availability levels decline and the number of award recipients also diminishes (Hromas et al., 2012). AHCs experience fluctuations on research resource levels, as Table 5 illustrates by outlining the top ten NIH-funded medical schools in each year from 2011 to 2016, the dollar value of the awards, and the annual rank.

Table 5

Top 10 NIH Funded Medical Schools (Blue Ridge Institute for Medical Research, 2007-2016)

Top 10 NIH Funded Medical Schools [$ in millions, rank in parentheses]	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Johns Hopkins University	$450.7 (1)	$433.1 (2)	$404.9 (2)	$429.0 (2)	$420.1 (2)	$461.6 (2)
University of California, San Francisco	$420.2 (2)	$448.7 (1)	$439.6 (1)	$480.5 (1)	$496.5 (1)	$519.4 (1)
University of Pennsylvania	$391.2 (3)	$388.2 (3)	$379.4 (3)	$410.2 (3)	$373.8 (4)	$392.0 (3)
Washington University	$348.0 (4)	$360.2 (4)	$298.5 (6)	$353.9 (4)	$352.7 (5)	$374.0 (5)
Yale University	$338.6 (5)	$339.7 (5)	$311.8 (5)	$328.1 (6)	$319.1 (6)	$365.9 (6)
University of Michigan	$318.8 (6)	310.5 (7)	----	----	----	----
University of Pittsburgh	$316.4 (7)	326.9 (6)	$297.0 (7)	$317.3 (7)	$316.8 (7)	$361.7 (7)
University of California, San Diego	$309.3 (8)	305.4 (8)	----	$295.4 (9)	$291.3 (8)	----
University of Washington	$297.1 (9)	312.7 (9)	$293.2 (8)	$302.0 (8)	----	----
Vanderbilt University	$293.4 (10)	----	$292.4 (9)	$294.0 (10)	$291.2 (10)	$340.0 (8)
Duke University	----	$295.5 (10)	$285.0 (10)	----	----	$337.7 (9)
Stanford University	----	----	$314.8 (4)	$349.0 (5)	$375.3 (3)	$381.7 (4)
University of California, Los Angeles	----	----	----	----	$291.3 (9)	----
Columbia University	----	----	----	----	----	$327.3 (10)

Within the NIH is the Research Project Grant Program, which is the mechanism for prestigious faculty/investigator-initiated projects (Hromas et al., 2012), and of the various program awards, the R01 represents sixty percent of the total annual new grants and dollar amounts (NIH Research Portfolio Online Reporting Tools, year 2011). The NIH issues R01 grants to experienced scientists who have moved beyond the less lucrative career development awards, so AHCs that have many R01 sponsored faculty gain prestige and higher levels of resources (Gerin & Kapelewski, 2011). The annual success rate of earning an NIH R01 award is a function of federal government funding levels and the number of applicants (Hromas et al., 2012). Table 6 contains data on the number of new NIH R01 grant awards, the success rate, and dollar amounts from 2011 to 2016.

Table 6

NIH New R01 Grant Awards (NIH Research Portfolio Online Reporting Tools, 2011-2016)

NIH New R01 Research Awards	2011	2012	2013	2014	2015	2016
Applicants	23,383	24,637	23,261	23,004	24,587	26,187
Awards	3,530	3,662	3,331	3,554	3,934	4,531
Success rate	15.1%	14.9%	14.3%	15.4%	16.0%	17.3%
Amount awarded (in millions)	$1,541.0	$1,592.5	$1,432.9	$1,604.3	$1,785.1	$2,196.1
Average amount per award	$436,522	$434,880	$430,182	$451,419	$453,751	$484,686

In addition to research, the availability of public funding also impacts the environment of medical education (Sabeti et al., 2015). The federal government supplements Medicare reimbursement payments to AHC hospitals, recognizing the additional costs to the clinical enterprise of conducting physician training (Gold, Stimpson & Caverzagie, 2015). Medicare provides over $3.0 billion annually to teaching hospitals for direct graduate medical education (DME) residency training, and over $7.0 billion each year for indirect medical education (IME) costs (Association of American Medical Colleges, 2016; Gold et al., 2015). The funding environment is in flux, with appropriation reductions as a persistent consideration in Congress (Holt, Miller, Philibert & Nasca, 2014; Metzler, Ganjawalla, Kaups & Meara, 2012). Holt et al. (2014) and the Accreditation Council for Graduate Medical Education show that reductions in federal support for DME and IME would impact decisions regarding the size and composition of physician training programs. Federal law establishes the methodology for calculating the Medicare GME amount for teaching hospitals, and the formula involves allowable cost per student resident, the number of residents, the number of beds, and the hospital's share of all Medicare covered patients (Centers for Medicare and Medicaid Services). The law also limits the number of Medicare fundable residents for each hospital, which, for most institutions, involves a base figure from 1996 (Centers for Medicare and Medicaid Services). All of these determinants of federal support for medical education cause fluctuations in annual funding. For example, Table 7 outlines the DME, IME and total GME federal outlays from 2011 to 2013, showing an increase and a decrease in the short three-year period.

Table 7

DME, IME, and Overall GME Federal Outlays from 2011 to 2013 (derived from the Robert Graham Center)

Federal Medicare Outlays for Graduate Medical Education ($ in millions)	**2011**	**2012**	**2013**
Direct Graduate Medical Education (DME)	$3,264.2	$3,342.9	$3,173.5
Indirect Medical Education (IME)	$7,085.6	$7,333.1	$6,875.9
Total Graduate Medical Education (GME)	**$10,349.8**	**$10,676.0**	**$10,049.4**
Annual percent changes	----	+3.2%	-5.9%

In summary, federal funding for research and education are prominent elements in the AHC financial portfolio, and variability in the levels of support impact the AHC academic operations (Holt et al., 2014; Hromas et al., 2012). The two largest forces that influence the stability of the academic environment of AHCs are 1) NIH funding and success in earing R01 grant awards, and 2) the level of federal funding for GME through the Medicare program. NIH grant funds represent half of the annual revenue for AHC medical schools from academic sources, and thus have the largest impact on academic environment stability (Liaison Committee on Medical Education, 2016a).

The prior sections describe the missions, organizational components, financial interdependencies, and operating environments of AHCs, and now this literature review examines how AHCs respond to changes in the clinical and academic environmental conditions. The following section references case studies and multiple scholarly and professional perspectives suggesting that AHCs respond to changing conditions by reorganizing the structural arrangement among the hospital, physician group practice, and medical school. The primary assertions are that adapting the AHC organization to the prevailing environmental conditions will create operational efficiencies, enhance the ability to compete in health care markets, generate funds flows to the clinical and academic missions, and optimize the virtuous cycle of economic benefits (see Figure 2) (Kennedy et al., 2007; Pomeroy et al., 2008; Rothman et al., 2015; Wartman, 2008). What does not exist is a consensus on the best organizational structure. The following section reviews the literature regarding the types of organizational changes AHCs make, the environmental rationales for the changes, and the multiple propositions regarding which organization structure is the most effective.

Organizational Restructuring as a Reaction to AHC Environmental Conditions

AHCs respond to the threats of changing environmental conditions by reorganizing structural arrangements to create competitive advantage and operational efficiencies (Barrett, 2008; Stimpson et al., 2014; Wartman, 2010). Commentators Alexander et al. (1997) and Andreopoulos (1997), case study authors Barrett (2008), Mallon (2003), and Kastor (2004), and researchers Keroak, et al. (2011) describe four general acts that create AHC organizational structure realignments in response to environmental changes: 1) selling the clinical enterprise, 2) separating the clinical enterprise, 3) mergers with or acquisitions of other clinical enterprises, and 4) consolidating the academic and clinical enterprises. The following sections outline each type of realignment and offer examples of AHCs that operate under the specific structure.

Selling the clinical enterprise. Universities sell the hospital to private enterprise and retain the medical school for a variety of reasons (the physician group may or may not join the hospital in the sale). The organizational change removes the financial risk of the clinical enterprise from the university, generates funds to support research and education through the sales price or a schedule of payments, and places the patient care operations presumably into a private provider organization more able to compete and generate financial success (Kastor, 2008). This action results in a loose affiliation structure or a partially integrated arrangement if the physician group practice remains under university/medical school ownership.

Several universities respond to environmental financial pressures by selling the AHC clinical enterprise. The typical situation is that the hospital suffers financial losses as a result of a growing managed care presence in the market or greater competition for patients from other provider organizations. These conditions compel the University of Minnesota (Glazer et al., 1999; Scott, 1996), George Washington University (Blumenthal & Weissman, 2000; Kastor, 2008) Georgetown University (Kastor, 2008), and Tulane University (Blumenthal & Weissman, 2000) to sell the clinical enterprise to non-profit or for-profit health systems. Each of these transactions involve agreements to contribute funds to the academic missions of the medical schools through operating margin sharing arrangements (Blumenthal & Weissman, 2000; Kastor, 2008; Scott, 1996).

Separating the clinical enterprise. Another method of isolating the financial risks inherent in patient care operations from the university is spinning-off the AHC, hospital, and/or the physician group practice into a separate corporation. The university may retain an affiliation relationship with the separate corporate entity if the medical school does not spin-off, developing a financial contract arrangement to support research and education. The intent of this organizational change is to allow the separate corporate entity to raise capital outside of the university and make strategic maneuvers in the health care market more readily (Mallon, 2003). Similar to selling the clinical enterprise, this action results in a loose affiliation structure or a partially integrated arrangement if the physician group practice is under university/medical school ownership.

Multiple universities choose separating from the AHC through new corporate structures as environmental conditions become financially challenging. The reasons for the separation of the clinical enterprise are the rise of managed care in the market, cuts in federal funding for health education, the need to streamline processes to enable fast adaptation to competitive market changes, and to create independent access to capital markets (Barrett, 2008, Levine et al., 2008; Wilemon, 2014). The Oregon Health Sciences University (Alexander et al., 1997), the University of Florida (Barrett, 2008), the University of Maryland (Schimpff & Rapoport, 1997), the University of Pittsburgh (Levine et al., 2008), and Vanderbilt University (Wilemon, 2014) create new clinical corporations for the AHC hospital and physician group practices for such reasons. The resulting organization is an independent and private non-profit corporation that typically involves a link to the former parent university, whether through seats on the board of directors or a commitment to flow surplus funds as investments in research and education (Barrett, 2008; Levine et al., 2008, Wilemon, 2014).

Mergers and acquisitions. A third way of restructuring an AHC is through mergers and acquisitions. This maneuver involves combining the AHC with other clinical enterprises or other AHCs to create economies of scale, build market strength, and reduce service duplications in both the clinical and academic enterprises. Mergers can result in corporate structures that are separate from the parent university (loose affiliation or partial integration), or simply larger clinical or academic enterprises within the parent university (integrated organizational structure).

AHCs that experience vulnerabilities such as a weak position in the patient care market or high cost structures that produce operating losses seek to join other stronger partners. Penn State addresses market share challenges by merging the AHC hospital with the non-profit Geisinger Health System, hoping to improve competitiveness through institutional size and broader geographic coverage (Mallon, 2003). The University of Arizona AHC clinical operations incur "consistent annual deficits" from greater competition for patients and a high cost structure, and places the hospital into a partnership with Banner Health, a non-profit system (Cairns, Bollinger & Garcia, 2017, p. 20).

AHCs also can merge with other AHCs, and this typically occurs if the two institutions reside in the same market. Responding to a growing managed care presence in the San Francisco metropolitan area, seeking market strength, and attempting to achieve operational efficiencies, Stanford University and the University of California at San Francisco (UCSF) merge clinical operations (Kastor, 2001; Pizzo, 2008). The same market forces in the New York City metropolitan area compel the New York University (NYU) and Mount Sinai AHCs to merge hospitals to grow market share and achieve operational economies of scale (Kastor, 2010).

Consolidating the academic and clinical enterprises. The final method of restructuring an AHC is a movement in the opposite direction of sales and separations. Universities and AHCs can consolidate, or organize the hospital, physician group practice, and medical school into an integrated structure. This organizational alignment can create operational efficiencies, create a coordinated strategic response to competitive and economic pressures, and improve financial performance (Keroack et al., 2011).

Examples of AHCs that integrate the hospital, physician group practice, and medical school are the University of California at Los Angeles (UCLA) (Karpf et al., 2000), the University of Pennsylvania (Rodin, 2004), the University of California at Davis (UC-Davis) (Pomroy et al., 2008), and Johns Hopkins University (Kastor, 2004). Each AHC seeks to gain leverage against managed care insurers, grow clinical revenues in response to lower government funding for research, and improve financial margins by consolidating administrative structures. The universities each create a single board governance arrangement for the AHC, or combine the clinical CEO and medical school dean positions into a single executive role (Karpf et al., 2000; Kastor, 2004; Pomroy et al., 2008; Rodin, 2004).

AHCs also change the institutional organizational arrangements after an initial restructuring strategy fails to produce advantages. The spin-off of the AHC hospital at the University of Florida creates a separate organizational identity and culture between the clinical operations and academic enterprise, and the result is a problematic divergence of strategies and operations for the two organizations (Barrett, 2008). The university and health system leadership make the internal management change of having the hospital chief executive officer report to the university president, offering an opportunity for a unifying culture between the patient care and academic operations (Barrett, 2008). The Penn State – Geisinger merger fails for cultural reasons as well, but the partnership also suffers from dysfunctional management structures and governance arrangements that generate financial losses (Mallon, 2003). The two health systems decouple and Penn State adopts a corporate structure where the hospital becomes a distinct non-profit organization under the control of the university, the physician group practice is part of the hospital, and the hospital CEO is also a senior vice president of the university and dean of the medical school reporting to the university president (Kirch, et al., 2005).

Conclusions regarding AHC organizational restructuring. The four general methods of organizational restructuring for AHCs generate equally varying propositions in the commentary literature regarding the proper realignment. Stimpson et al. (2014) state that the degree of autonomy and integration among the hospital, physician group practice, and medical school varies among AHCs, and the chosen organizational structure should “be the best one for achieving efficiency and effectiveness in the performance of its mission[s] (p. 855).” Wartman (2008) notes that AHCs fluctuate between integration and loose affiliation depending on economic and market conditions. Daniels and Carson (2011) observe that financial pressures motivate AHCs to align with greater integration to augment revenues, build market share, and engage in innovative product development. Reece et al. (2012) call for a degree of alignment where the AHC component organizations work cohesively to improve institutional dexterity during volatile times and achieve greater revenues, patient volumes, and facility size. Wartman (2010) sees full structural integration facilitating strategic focus, advancing the shared objectives of the combined enterprise, and enabling the clinical operation to cross subsidize the academic efforts. Keroack et al. (2011) describe loose affiliations among the AHC entities as functional alignments, where collaboration on strategic planning and budgeting exist, but the AHC retains a flexibility and entrepreneurialism to react quickly to changing market conditions and produce greater financial outcomes. Stimpson et al. (2014) challenge the effectiveness of the fully integrated model in circumstances where state regulations of publically-owned hospitals or universities limit the market competitiveness of the AHC. Finally, Pizzo (2008) notes wide variation in the governance and organization of AHCs, asserts that economics and competition compel changes in organization structure, and concludes that no single alignment has uniform applicability to external circumstances.

What emerges from this literature review of case studies, commentaries, and articles on AHC organizational changes is how sales, spin-offs, mergers and acquisitions, and consolidations of the clinical enterprise creates two basic types of structures:

1. Integrated: the hospital, physician group practice, or medical school can combine into a consolidated organization structure (involving two of the entities or all three).
2. Loose affiliation: the hospital, physician group practice, and medical school each operate as separate entities.

The purpose of making organizational changes at AHCs is to improve operational performance across the clinical and academic missions, and the next section in this literature review explores the more typical indicators of success. The case studies and commentaries focus on economic and financial outcomes to gauge whether or not an AHC adopts an effective structure. The intent of the organizational change is to protect and grow the ability to generate resources for the patient care, research, and educational operations to pursue the clinical and academic missions (Kastor, 2004; Reece et al., 2012; Rothman et al., 2015).

Objectives of AHC Organizational Changes

Competitive advantage in patient care markets, clinical financial surpluses, external funding for research and education, and academic program growth are the principal objectives of AHC organizational restructuring. According to multiple commentaries, gaining a larger share of the health care market for patient care services indicates successful efforts to compete against other providers and advance the clinical mission of AHCs (Cutler & Morton, 2013; Hibbard, Stockard & Tusler, 2005; Szabat & Walsh, 2007). Other commentators discuss the level of profitability of hospitals in general as a measure of financial success, but hospital financial surpluses are of particular importance to AHCs given the need to fund patient care, research and education efforts (Bazzoli, Chan, Shortell & D'Aunno, 2000; Ramamonjiarivelo, Weech-Maldonado, Hearld, Menachemi, Epane & O'Connor, 2015; Rothman et al., 2015; Thorpe et al., 2001; Wartman, 2008). Growing funds flows from clinical profits to research and education operations enables AHCs to expand training programs, invest in early career scientists, and finance promising studies that could attract external grant sponsorship (Rothman et al., 2015). Annual growth in the NIH sponsorship funding levels and growth in the number of research principal investigator faculty members with NIH R01 grants are traditional indicators of research accomplishment at AHC medical schools (Goldstein, Lunn & Peng, 2015; Johnson et al., 2015; Keroack et al., 2011; Miller, 1999; Pomeroy et al., 2008; Souba, Mauger & Day, 2007). Finally, according to a few of the AHC case studies, expansion in the number of residency positions measures the robustness of graduate medical educational programs at AHCs (Pizzo, Braddock & Prober, 2015; Rodin, 2004).

The case studies and reports on specific AHCs from the previous section confirm the aforementioned indicators of success. The University of Minnesota ("Fairview name would disappear", 2015; Glazer et al., 1999), George Washington University (Kastor, 2008), Georgetown University (Kastor, 2008), Penn State (Mallon, 2003), UC-Davis (Pomeroy et al., 2008), Vanderbilt University (Voosen, 2016), and the University of Arizona (Cairns et al., 2017) use increasing funds flow from growing clinical enterprise financial surpluses to the medical school to justify organizational restructuring. The University of Pittsburgh (Levine et al., 2008), Johns Hopkins University (Kastor, 2004), and the University of Pennsylvania (Rodin, 2004) note growing shares of the health care market for patient services as an intention for AHC organizational changes. The University of Arizona aims to "enhance educational and training programs" with the AHC restructuring (Cairns et al., 2017, p. 21). Johns Hopkins University and Stanford University utilize growing internal funding after the AHC restructuring to finance research development, "starter grants", and biomedical cross-disciplinary study efforts to improve institutional ability to attract increasingly competitive NIH sponsorship (Rothman et al., 2015, p. 8). The University of Pittsburgh follows the same strategy, deploying funds flows into biomedical discovery initiatives that produce preliminary results and attract broader financial sponsorship from the NIH and other sources (Levine et al., 2008).

This case study literature supports the conclusion that the objectives of AHC organizational changes in response to challenging environmental conditions focus on four general goals:

1. Gaining greater market share for patients.
2. Growing clinical revenue and margins to flow funds to the research and education enterprises.
3. Enhancing the external funding for biomedical and health research and growing the research effort.
4. Enhancing the growth of medical education programs.

The question remains, however, as to whether or not the AHC responses to environmental conditions produce the sought after outcomes. A preceding condition to the answer of that question is whether the AHC adopts an effective organizational structure in response to or in anticipation of environmental conditions. While case studies offer insights into the relationships among organizational structures, market and economic conditions, and performance, these qualitative profiles struggle to produce results that are generalizable to the population of AHCs (Mallon, 2003). More comprehensive research through an empirical study across a large number of AHCs would test the foundations upon which many observers base the assertion that AHCs must make organizational changes in alignment with environmental conditions to improve performance in pursuit of the clinical and academic missions. The following section reviews the pertinent existing studies involving samples of AHCs that attempt to examine this proposition. Given the relative scarcity of such analyses, the next section also includes a sampling of the research on non-AHC hospital structures and the market conditions associated with the organizational alignments.

Review of Research Analyses of AHC and non-AHC Hospital Organizational Change

A review of the literature demonstrates the shortage of rigorous and comprehensive research that evaluates how the structure of the AHC hospital, physician group practice, and medical school fit environmental conditions, and if this fit improves AHC performance. Researchers using analytical methods tend to rely on small sample size qualitative studies of AHC organizational characteristics. The more notable quantitative studies of AHCs involve statistically significant sample sizes, but either the analytical methods are simple correlations or the research does not capture the complexities of the environment, the multiple missions, and the impacts of changes over time. A broader body of literature involving evaluations of non-AHC hospital organizational structures and relationships with operational environments and performance provides examples of more robust analyses using rigorous research designs and statistical methods. That body of knowledge is applicable to studies of AHC clinical operations, and even captures a portion of the research and education missions if the hospitals in the samples have clinical trials or residency programs, but does not engage the unique organizational affiliations of AHCs across all three operating areas (patient care, research, and education). The following section contains reviews and critiques of several studies involving AHCs, and the subsequent section references several examples of non-academic health systems studies containing analyses pertinent to this dissertation.

Analyses involving AHCs. Changing economic and market environments compel researchers to examine the impacts on the ways AHCs relate to parent universities and align the organizational entities. Nonnemaker and Griner (2001) examine trends across 14 AHCs over a four-year period during a time of growing managed care in the markets and lower government appropriations. The researchers apply a survey approach to the sample and "monitor how these institutions were managing chang[ing]" economic conditions (Nonnemaker & Griner, 2001, p. 10). The results are general pronouncements of how economic uncertainties, and the reliance of the medical school on the business proceeds of the clinical enterprise, shape relationships between AHC entities and the parent university. Nonnemaker and Griner (2001) conclude that "an increasingly competitive environment for patient care and research" focuses faculty effort on the clinical mission, strains the work on the academic missions, separates the culture of the medical school from the parent university, and triggers considerations of reorganizing the AHC (p. 11). The restructuring of the AHC falls into two approaches: creating a new legal corporate structure separate from the university or rearranging the existing governance to "achieve a more intimate relationship" between the AHC and the university (Nonnemaker & Griner, 2001, p. 13). While this study is broader in scope than a profile of a single AHC, ultimately the analytical methodology is a simple compilation of individual cases. Nonnemaker and Griner (2001) do not calculate the degree of environmental uncertainty that triggers an AHC organizational change, and which type of structure positions the AHC to produce the strongest performance in pursuit of the missions.

Following the same approach as Nonnemaker and Griner (2001), Szabat and Walsh (2007) compile characteristics of 19 AHCs to determine how the institutions create strategic ventures in response to "declining profitability and intense rivalry for market share" (p. 13). The authors use four categories of strategic initiatives: 1) internal ventures, where AHCs create subsidiary organizational units for operational flexibility, 2) pre-affiliations, where AHCs engage in relations with external provider organizations in specific services to share financial risk, 3) intermediate ventures, where AHCs create interdependencies with other provider organizations and gain market strength, and 4) partnerships and mergers, where AHCs create formal ventures that result in a new and independent provider organization (Szabat & Walsh, 2007). The researchers conduct a longitudinal study from 2000 to 2006 using a survey instrument to explore which of the four strategic arrangements is the most prevalent during periods of environmental financial pressures. Intermediate ventures have the greatest growth rate, where AHCs create "enduring" affiliation "structures" with other provider organizations that have market power but more flexibility and independence than a full merger (Szabat & Walsh, 2007, p. 18). While this result offers insight into the tactical nature of preferable AHC organizational structures given environmental financial challenges, the study does not examine performance after the structural changes, and also lacks an analytical model to evaluate the relationship between external conditions and the type of organizational change.

A more sophisticated study of the relationship between AHC organizational factors and performance outcomes is from Keroack, Youndberg, Cerese, Krsek, Prellwitz and Trevelyan (2007). Keroack et al. (2007) analyze how AHC organizational factors relate to performance on patient care quality and safety. The authors assemble data from 79 AHCs and create a composite index to measure quality and safety, and then employ qualitative techniques to determine organizational structure characteristics from three top performing and three average performing AHCs. The researchers found associations between quality and safety accomplishment and AHCs that place the clinical mission above research and teaching, have a consolidated organizational structure among the hospital, physician group practice, and medical school, and "demonstrated a blend of central control and decentral responsibility" (Keroack et al., 2007, p.

1183). This study attempts to discern a relationship between organizational factors and performance at AHCs, associating a consolidated structure with positive outcomes, but analyzes data from only six institutions, does not use discrete categories for organizational structures, does not establish associations using statistical techniques, and omits any evaluation of environmental circumstances that could influence organizational form.

McCue and Thompson (2011) take the analytical sophistication further, examining the organizational operational characteristics that distinguish better performing high cash flow AHCs from low cash flow AHCs. McCue and Thompson (2011) note that environmental factors such as “declining reimbursements from payers” and “increasing competition” from other providers are pressuring AHC operating margins, and the authors use cash flow as an “indicator of financial performance” and a measure of ability to fund the research and teaching missions (p. 1100). The researchers gather financial and operational information for 103 AHCs across three years, classify AHCs into high and low cash flow categories, and apply t-tests to determine which operational characteristics have statistically significant associations with cash flow status (McCue & Thompson, 2011). The results show that organizational size (number of hospital beds), the severity of illness of patients (acuity), and the percentage of Medicaid patient discharges among other patient demographic and financial variables, have positive and significant relations with cash flow results (McCue & Thompson, 2011). This study uses more rigorous analytical techniques than surveys to determine relationships between AHC organizational characteristics and financial performance. The scope of the research, however, measures only the performance in pursuing the clinical mission, does not include variables representing the key environmental condition of competition with other providers, and does not address the AHC organizational structure in terms of the hospital, faculty/physician group practice, and medical school. The study focuses on organizational characteristics such as size and type of patients, and associates these with performance, which offers insights into variables other than structure that influence financial outcomes.

Livingston (2001) explores alternative AHC organizational structures and operational effectiveness in a multivariate quantitative analysis involving a sample size of 29 institutions. Again, the study focuses solely on the clinical enterprises of AHCs, but includes both hospitals and physician group practices. Livingston (2001) categorizes the clinical enterprises as having integrated or differentiated organizational structures, and analyzes the relationships between structure and measures of operational effectiveness addressing finances and care quality. The study concludes with a statistically significant relationship between structure type and a measure of efficiency (greater structural differentiation improved the average length of stay of a patient in the hospital), but the research effort struggles to capture the complexities of the external AHC environment. Also, Livingston (2001) does not account for the presence of the academic missions in AHC operations.

Perhaps the most comprehensive and analytical study of how AHC organizational alignment relates to performance in pursuit of the clinical and academic missions comes from Keroack et al. (2011). The authors examine directly the organizational structure of the hospital, physician group practice, and medical school of 85 AHCs and the type of alignment that produces stronger performance across the patient care, research, and education operations (Keroack et al., 2011). This study involves the constructs of “structural integration” and “functional alignment” to represent the organizational arrangements of the three AHC entities (Keroack et al., 2011, p. 120). Paralleling Lavine’s continuum model, Keroack et al. (2011) define AHCs with high structural integration as organizationally centralized while low structural integration signifies more autonomy among the hospital, physician group practice, and medical school. Functional alignment is not necessarily structural, but represents the degree of operational collaboration among the three AHC entities with such efforts as financial management, information systems, and capital planning (Keroack et al., 2011). The authors analyze whether high or low structural integration or functional alignment correlate to measures of academic and clinical performance (Keroack et al., 2011). The results show that structural integration has no association with the measures of performance in any mission area, but functional alignment has a significant association with teaching and research performance indicators (Keroack et al., 2011). However, AHCs with high functional alignment are structurally integrated (Keroack et al., 2011). This study moves closer to understanding the relationships between AHC organizational structures and performance in pursuit of the three mission areas. The research, however, tests only for correlation at a single point of time, and the authors acknowledge that a longitudinal study may better determine the effects of organizational structure on performance (Keroack et al., 2011). The authors also do not account for the environmental factors that could influence the organizational alignment of the AHC entities, and whether or not an appropriate fit associates with performance. The proposition is that only high or low integration/alignment has correlation with positive performance in any environmental situation.

This review of the literature involving research on the environments, structures, and performances of AHCs reveals multiple analytical and conceptual gaps. Studies are either observational compilations of individual cases, or focus on patient care operations and omit research and education (Keroack et al., 2011 excepted). The literature also does not include analyses measuring the external environment, which the case studies show is a prominent concern of AHCs. Keroack et al. (2011) come close to capturing the multi-faceted nature of AHC operations, but employ only a simple correlational model and do not account for the environmental forces. The case study literature portrays AHCs as clinical and academic enterprises with patient care, research, and education operations occurring simultaneously within an organizational arrangement involving a hospital, physician group practice, and medical school. The case studies also point to environmental pressures that challenge the resources necessary to pursue the missions. Missing from the empirical research literature are studies that reflect these realities of AHCs. More comprehensive research would contain measures representing clinical and academic environmental forces, organizational structures, and performance in pursuit of the missions.

While this dissertation seeks to address this gap in the body of knowledge, this literature review attempts to reference empirical studies that contain some of the salient elements necessary for a comprehensive analysis of AHCs. Examining empirical analyses outside of academic medicine is necessary to accomplish this objective. While such studies focus on patient care operations only in non-AHC organizations, the clinical enterprise is a significant presence at AHCs, providing practical value to an examination of the body of work. The following section reviews examples of empirical research analyzing how environmental forces impact the organizational structures of clinical operations, including hospitals and physician group practices, thereby addressing two of the three organizational units of AHCs, and offering insights toward the formulation of the hypotheses for this dissertation.

Analyses involving non-AHC hospital environments, organizational change, and performance. A substantial body of work exists that analyzes how market forces and the regulatory climate relate to hospital and physician group horizontal and vertical integrations through mergers, acquisitions, or affiliations. Horizontal integration is when hospitals merge with other hospitals, or a consolidation of organizations that produce similar service lines (Rice & Unruh, 2016). Vertical integration is a merger along dependency relationships, as when physician groups, who refer patients to hospitals, merge with hospitals (Rice & Unruh, 2016). Vertical and horizontal mergers concentrate health care provider markets, and typically these institutional integrations result from the environmental forces of economic pressures or permissive regulations (Frech III, Whaley, Handel, Bowers, Simon & Scheffler, 2015; Gaynor, 2014; Town et al., 2007).

Multiple studies test these assertions and a few examples follow. Cutler and Morton (2013) examine the effects of two environmental conditions on health system structures: market movement away from inpatient care and the adoption of the Patient Protection and Affordable Care Act of 2010 (PPACA). The study of over 300 markets and close to 5,000 hospitals shows an observable growth in both horizontal and vertical consolidations of hospitals and physicians, increasing health care provider market concentration (Cutler & Morton, 2013). Changes in environmental conditions associate with changes in hospital-provider organizations, specifically, the PPACA policy incentives to coordinate patient care across hospitals and providers, including financial rewards for cost savings through Accountable Care Organizations (ACOs) (Cuter & Morton, 2013). Wang, Wan, Clement, and Begun (2001) use linear structure equations to report associations between a growing managed care presence in California markets and increasing hospital-physician vertical integration, and then vertical integration and improved financial performance. This analysis includes environmental conditions, hospital-physician structures, and the outcome measure of financial performance. Town et al. (2007) use linear regression to demonstrate an increase in hospital horizontal integration resulting from growing competitive forces from managed care penetration in health care markets. Frech III et al. (2015) determine that high managed care penetration and competitive hospital and physician environments increase the likelihood of vertically integrated ACOs entering the market. The results from this sample of empirical work provide evidence of relationships between changing environmental conditions and hospital-physician restructuring. In several instances, a growing managed care payer presence has an association with hospital and physician organizational integration through horizontal and vertical mergers.

The subject of hospitals developing health networks or consolidated system structures with other provider organizations occupies a similarly robust body of research. Bazzoli, Shortell, Dubbs, Chan & Kralovec (1999) create a taxonomy of health systems uses three structural dimensions: differentiation, or the number of unique services available to patients; integration, or the "mechanisms" to "achieve unity of effort across organizational components"; and centralization, or the degree of centralized or decentralized decision making (p. 1686). Bazzoli et al. (1999) apply these dimensions to hospitals, physicians, and insurance activities while examining national data on health organizations. Five classifications of health systems along a centralization spectrum emerge from the study: 1) centralized health network/system, 2) centralized physician-insurance health system, 3) decentralized health network/system, 4) moderately centralized health network/system, and 5) independent hospital network/system (Bazzoli et al., 1999). Hospitals and health systems can adopt centralized and integrated organization structures, decentralized or loosely affiliated organizational arrangements, or some type of form in-between. Also, hospitals, physicians, and other health service entities can operate as independent organizations. These classifications parallel the Levine AHC organizational alignment continuum (see Figure 1) which also ranges from centralized systems to loose affiliations, making a review of empirical analyses using the Bazzoli et al. (1999) categories applicable to this literature review supporting a study of AHCs.

The Bazzoli et al. (1999) taxonomy serves as the framework for analyzing the relationship between health organization structures and performances. Bazzoli et al. (2000) use environmental circumstances as a theoretical foundation to hypothesize that organizational survival in a competitive climate compels adoption of an integrated form. Bazzoli et al. (2000) employ multi-variate regression models and national data to conclude that hospitals in unified health systems (taxonomy categories 1 and 2 above) have stronger financial performance than hospitals in less integrated organizational arrangements (the decentralized and independent network taxonomy categories). Chukmaitov, Bazzoli, Harless, Hurley, Devers, and Zhao (2009) engage the Bazzoli et al. (1999) taxonomy to study the association of the health system organizational structure classifications on the outcome of medical care quality. Using a panel design with fixed effects and data from 11 states, the researchers conclude that centralized health systems have better care outcomes for certain services than decentralized hospitals (Chukmaitov et al., 2009). These studies take the organizational structure concept to a deeper level, discerning different degrees of integration or decentralization, and showing directional relationships between higher integration and positive performance outcomes. While Bazzoli et al. (2000) use environmental conditions as a theoretical element in that particular study, what remains missing are examinations of the relationships between external conditions and the adopted structures of health care organizations.

Some economists fill this gap, studying the association of hospital and health system organizational structures and the market environment to explore external changes in competitive conditions. Gaynor and Haas-Wilson (1999) discuss the “implications of the restructuring of the health care industry for competition, efficiency, and public policy", and focus on hospitals, physician groups, and insurance companies as the market actors (p. 141). Insurance companies and managed care payers negotiate the price of medical care with health care providers (hospitals and physician groups). If a market contains few insurers or payers and many providers then hospitals and physician groups are price takers and settle for lower reimbursements (Gaynor, 2006). This situation compels vertical and horizontal mergers of providers seeking negotiating leverage to counter-balance a consolidated payer market or simply to strengthen the ability to increase reimbursement levels (Gaynor, 2006). Gaynor and Haas-Wilson (1999) pose the two fundamental questions regarding the consolidation of the market actors: 1) is this outcome "an efficient response to external changes in demand, technology, and other forces", or 2) is the outcome a product of "strategic attempts by firms to gain anticompetitive advantage" (p. 144).

A sample of studies exploring the relationship between competitive market conditions and health care provider organizational structures reveal complex correlations. Hospitals can gain bargaining power over health insurers and receive higher reimbursements when restructuring into a horizontal merger with other hospitals (Dafny, Ho & Lee, 2016). The same revenue-enhancing results can come from a vertical merger between hospitals and physician groups (Gal-Or, 1999), but such organizational changes can have little impact on internal operational efficiencies (Cuellar & Gertler, 2006). Conversely, Ciliberto and Dranove (2006) find no significant changes in health care prices in a study of hospital-physician mergers in California markets. Gaynor (2006) comments that these different outcomes are indeed dependent on the existing environmental conditions within the various health care markets. Negotiating power with insurers increases for hospital-physician mergers if either provider entity has significant market share prior to the integration (Gaynor, 2006). Mergers, as organizational structural changes, may occur in competitive markets to strengthen the hospital-physician practice position to ensure future viability, and happen in more concentrated markets to forestall the entry of competitors or counter the growing strength of payers if insurers consolidate (Gaynor, 2006). A conclusion that emerges from these studies is that competitive market conditions can impact the organizational structure of hospitals and physician group practices, and the outcome objective is financial gain.

Swofford (2011) tests whether or not hospitals achieve this objective. Using a theoretical and empirical approach, Swofford (2011) measures the fit between the prevailing environment and the type of organizational structure the hospital adopts. The theoretical proposition is that financial performance depends on whether or not the hospital adopts an organizational structure that enables successful operations given existing market conditions (Swofford, 2011). This is structural contingency theory, which asserts that organizational structure must fit the environmental contingencies to improve performance. Swofford (2011) studies 1,010 rural hospitals across multiple years in markets with different economic conditions (per capita income and unemployment rate), and degrees of competition (the proximity of other hospitals or systems). The author then examines the hospital organization structure, determining if the institution was a stand-alone facility or a member of a multi-facility system (a horizontal merger). Swofford (2011) then pairs market conditions with organizational structure type, theorizing that higher environmental munificence does not require hospital system membership for better financial performance, and that greater proximity to competitors requires a system affiliation for strong financial performance. Swofford (2011) uses regression analysis and finds that hospitals with organizational structures that fit the prevailing environmental conditions generate greater profitability than hospitals that are not aligned with the market circumstances.

This sample of empirical analyses focusing on non-AHC hospitals and physician groups offers insights into how environmental forces associate with organizational structuring. Researchers demonstrate that horizontal or vertical integrations among hospitals and physician groups relate to the competitive climate in the market for medical care. An intensifying presence of managed care payers or little competition among insurers correlate with a consolidation of health care providers. The goal of these consolidations is improvement in financial outcomes. Bazzoli et al. (2000) affirms this objective using a taxonomy of health care provider organization types to distinguish among the various organizational forms involving hospitals and physician groups, from loosely affiliated independent networks to integrated centralized systems. The study of market conditions and health care provider organizations involves economists as well, examining mergers in terms of anti-competitive impacts on medical service prices. The competitive climate of the health care market is a powerful force that associates with hospital and physician mergers, and again, financial gain is the goal. Swofford (2011) demonstrates that hospital organizational structure has an optimal fit with different types of environments, which relates to improvements in financial performance. The results of these studies provide understanding as to how market forces and the structures of hospitals and physician groups associate to generate resources which improves the chances of future viability. These studies also provide a foundation of literature for the clinical enterprise of AHCs, but do not address the complexities of the academic missions. This is a gap in the literature that this dissertation addresses.

Summary of the Gaps in the Literature

The literature on AHCs reflects the challenges of analyzing these structurally complex organizations with multiple missions operating simultaneously in clinical and academic environments. The case studies, commentaries, and media reports make assertions that changes in the environments cause AHCs to restructure for better performance, but do not perform analytical tests that support or refute the claims or produce generalizable results. The studies that involve relevant sample sizes and apply quantitative models tend to focus only on the clinical operations, omitting the impacts of the inter-dependencies among the patient care, research, and education operations. Two studies in this literature review together come the closest to capturing the clinical and academic missions of AHCs, the environmental conditions and organizational structures that impact AHC performance in pursuing those missions, and the theoretical fits and relationships among environment, structure, and performance. Keroack et al. (2011) analyze structure and performance across the clinical and academic missions with a statistically representative sample size of AHCs, but omits the impacts of environmental stability. Swofford (2011) examines environmental stability, organizational structures that fit the environmental conditions, and financial performance with a large sample size and a robust quantitative model, but analyzes only non-AHC rural hospitals. Bringing the elements of these two studies together in an analysis of AHCs would offer insights into how these institutions can maintain and grow a viable presence central to the American health care system.

Chapter Summary

The initial sections of this chapter examine the origin, missions, and functions of AHCs to establish a foundational understanding of the central role academic medicine plays in the American health system, and the organizational intricacies of these institutions. AHCs pursue clinical and academic missions simultaneously, engaging in patient care and bio-medical and health research and education. AHCs produce future generations of physicians, discover new treatments, generate greater insights into the mechanisms of disease and health, and treat patients with complex conditions. AHCs perform these functions in an organizational arrangement involving a hospital, a physician group practice, and a medical school. Financial, economic, and operational dependencies exist among these entities. Research and education at the medical school rely on financial surpluses from the hospital and physician group practice to cover all academic costs. The clinical enterprises rely on the academic missions to generate economic value through discovery, reputation, and the resulting increasing demand of patients to receive care at the hospital and physician group practices.

According to multiple case studies, external environmental forces can disrupt theses organizational inter-dependencies. The financial performance of the AHC clinical enterprises is susceptible to health care market forces. The AHC academic enterprise faces external pressures from government funding for research and education. The following list outlines the most prominent environmental forces impacting AHCs found in the literature:

1. Market competition for patient market share.
2. Changing reimbursement methodologies toward managed care.
3. NIH funding and the success rates in earning grant awards.

The case studies, commentaries, and media reports state that changes in these environmental forces compel AHCs to adjust the organizational arrangements. The intention of the restructuring is to modify operations and mitigate the external threats of the environmental forces on the financial, economic, and operational inter-dependencies among the clinical and academic enterprises of AHCs. The structural changes can involve separating the clinical enterprise from the medical school to enable more nimble market strategies, or consolidating the clinical and academic enterprises to improve strategic alignment and resource planning. AHCs can operate in an integrated fashion, where the hospital, physician group practice, or medical school can combine into a consolidated structure. AHCs can adopt a loose affiliation structure, where the three entities are independent.

The case studies, commentaries, and media reports assert that AHC organizational changes in response to environmental conditions should lead to improvements in performance. The performance indicators in the literature align with the mission areas of AHCs, and the following measures are the most prevalent:

1. Gaining greater market share for patients.
2. Growing clinical revenue and margins to flow funds to the research and education enterprises.
3. Enhancing the funding for biomedical and health research and growing the research effort.
4. Enhancing medical education and growing the teaching effort.

While multiple case studies outline the experiences of individual AHCs with the environment-organizational structure-performance dynamic, few quantitative empirical studies test the assertions of the authors.

The latter sections of this chapter explore what empirical analyses exist regarding these relationships within AHCs, broaden the literature review by including studies of non-academic health care organizations, and emphasize the gaps in the analytical literature regarding AHC environments, structures, and performances. Scholarly studies of AHCs using analytical techniques involving small sample sizes and simple univariate statistical models fall short of comprehensive evaluations. These studies examine the environment-structure relationship (Szabat & Walsh, 2007), the structure-performance relationship (Keroack et al., 2007; Keroack et al., 2011; Livingston, 2001), or demographics and performance (McCue & Thompson, 2011).

The studies also tend to focus on the clinical mission only, with Keroack et al. (2011) the exception. None have placed all of the environmental, structural, and performance factors across the clinical and academic missions into a single model, reflecting the realities of AHCs as expressed in the case studies, commentaries, and media reports. The literature involving non-academic health systems, while omitting research and educational missions, contains analyses on the environment-structure-performance associations. Market conditions relate to horizontally or vertically integrated health provider organizational structures, which lead to improved financial performance (Dafny et al., 2016; Gal-Or, 1999; Wang et al., 2001). A theoretical framework bolsters Swofford's (2011) analysis of rural hospitals, where certain organizational structures align with or fit specific environmental conditions, and when hospitals achieve this fit then financial performance outpaces hospitals with structures that are misaligned with the environment. While the literature on non-academic health systems relates environment, structure, and performance, and in the one particular study utilizes a theoretical foundation, AHCs remain unexamined in a comprehensive way and under the rigors of academic research methodology.

This dissertation addresses this gap. This study builds an analytical model with variables that represent the academic as well as the clinical environments, reflect organizational structures that involve all component entities of AHCs, and measure performance in pursuit of both the clinical and academic missions. The effort also rests on a theoretical foundation proposing that organizational performance improves when the structure fits the environment. The following chapter constructs this theoretical framework.

Chapter 3: Theoretical Framework

Structural Contingency Theory Introduction

The conceptual model for this study originates from the structural contingency theory of Burns and Stalker (1961), Lawrence and Lorsch (1967), and the advancement work of Lex Donaldson (2001). Structural contingency theory focuses on the relationships among environmental forces, organizational structures, and institutional effectiveness (Donaldson, 2001; Pennings, 1975). The theory challenges the notion that a single ideal organizational structure is effective in all settings, and asserts that different organizational structures are not equally effective (Lawrence & Lorsch, 1967). Certain types of organizational arrangements fit specific environmental conditions better than others, and the outcome is effective performance (Pennings, 1975). Thus, the fundamental proposition is that effective organizational performance results from fitting the organization structure to prevailing environmental conditions or contingencies (Burns & Stalker, 1961; Donaldson, 2001; Pennings, 1975).

Structural contingency theory emerges from the first half of the 20th century, when the regimented "rational machine" (Harmon & Mayer, 1986, p. 67) of classical organizational theory gives way to observations of organizations as open systems (Thompson, 1967). Growing economic industrialization in the late 19th century compels the work of classicalists such as Max Weber and Frederick Taylor, who espouse notions of organizational structural hierarchies and operational efficiencies through specialized task-oriented units in ordered sequences (Harmon & Mayer, 1986). The classicalists envision carefully managed work-flows within a single optimal organization structure that is applicable in any environmental circumstance (Harmon & Mayer, 1986). Over the next half century, management theorists observe that firms with successful competitive strategies understand the prevailing “economic … characteristics” of markets and adjust “patterns of organization and administration” to the conditions, also known as contingencies (Lawrence & Lorsch, 1967, p. 1). Contingency theorists challenge the fundamental tenets of the classicalists, asserting that successful economic performance of organizations depends on a connection between structure and external conditions (Burns & Stalker, 1961). “[D]ifferent external conditions might require different organizational characteristics and behavior patterns within the effective organization” (Lawrence & Lorsch, 1967, p. 14). Therefore, a successful enterprise adapts the organizational structure to changing environmental circumstances (Child, 1975).

The structural contingency theory constructs and propositions correspond with the circumstances and challenges facing AHCs. Changing environmental situations threaten the viability of AHCs and the patient care, research, and education operations central to the American health care system (Rothman et al., 2015). AHCs attempt to address the shifts in environmental conditions by restructuring the organizational arrangements among the hospital, physician group practice, and medical school; adopting an alignment that enables better performance in the different environment. The essential questions are whether AHCs adopt the right organizational structure and does the tactic of realigning the organization produce better performance. Structural contingency theory provides a construct and proposition framework to address these questions and gain insight into the strategies and operations of AHCs.

The subsequent sections of this chapter describe the main concepts of structural contingency theory in more detail, and connect the theory to analyses of the health care industry and this study of AHCs in particular. Each of the pertinent constructs of structural contingency theory has a dedicated section, after which follow descriptions of the theoretical and conceptual models for this study, and the hypotheses that this analysis tests. First, this chapter methodically builds the theoretical framework by examining the constructs of environment, organization and structure, environmental-structural fit, and organizational effectiveness.

The Theoretical Construct of Environment

This section focuses on the construct of the environment or, as several seminal works of structural contingency theory label the concept, the context. After delving into the multi-faceted definition of environment, this section outlines how some contingency theory researchers utilize the construct of environment in studies of the health care industry. This section concludes with a description of how environment applies to this study of AHCs.

Definition. Structural contingency theorists develop descriptions and categories to define the external context or environment of an organization. Burns and Stalker (1961) use the terminology of "extrinsic factors" to describe the environment, and distill the definition down to "different rates of … market change" (p. 96). Lawrence and Lorsch (1967) concur, defining the external environment as "economic conditions outside the firm" (p. 15). Pennings (1975) adds nuance to the definition, describing the environment as the place of exchange relations for an organization to provide services and to attract resources. The economic exchange relations conditions can exist in a relatively stable form or a dynamic state of unpredictability (Burns & Stalker, 1961; Child, 1975; Lawrence & Lorsch, 1967). Market stability or dynamism and the continuity of economic relations, therefore, are the contexts or contingencies that characterize environments (Dess & Beard, 1984; Donaldson, 2001; Pennings, 1975). So periods of relatively modest market and exchange relation changes produce stable environments, and timelines of more pronounced market and exchange relations changes yield dynamic environments.

Environment has another dimension within structural contingency theory, crossing the external boundaries of organizations and involving internal conditions. Donaldson (2001) states that size and strategy are prominent internal contingencies for an organization. Size reflects the physical dimensions of an organization, such as the number of employees (Donaldson, 2001). Strategy is the degree of product or service diversification in a firm's mission, and is the result of internal management decisions that can occur independently of external conditions (Donaldson, 2001).

Structural contingency theory, therefore, possess a conceptual flexibility and complexity that can conceive of environments in macrocosm and microcosm. The theory addresses the simultaneous existence of external and internal environmental forces (Donaldson, 2001). This circumstance establishes analytical complexity when testing the propositions of the theory. If studying the effects of the external environment on organizational structure and performance, then the analysis should control for the influences of the internal environment (Donaldson, 2001).

Applications of environment in studies of the health care industry. Health care receives the attention of structural contingency analysts because of altering periods of environmental stability and dynamism characteristic of the industry. Mary L. Fennell is a prolific contributor to the body of work, attributing the change in medical care organizations to changes in health care "regulations and reimbursement policies", "an increase in the diversification of…products", and the "development of new interorganizational arrangements" (Fennell & Alexander, 1993, p. 89-91). In a study of 901 hospitals, Fennell & Alexander (1983) find that the degree of stringency in environmental regulatory conditions, controlling for organization size, correlates negatively with hospitals forming multi-hospital system structures.

Swofford (2011), using a structural contingency framework to conclude that alignment between organizational structure and environmental conditions produces stronger financial performance among rural hospitals, controls for hospital size and defines the environment in terms of munificence and proximity to competitors. Lin (2010) uses organization size as a measure of environment, while controlling for service complexity, in a study of nursing unit structure and operational effectiveness.

Applicability of environment to this study of AHCs. The theoretical definition of environment is applicable to this study of AHCs as well. Chapter 2 reviews the literature on the external forces that challenge AHC performance in pursuing the clinical and academic missions, and these include market competition for patients with other providers and resources with managed care payers. These forces are consistent with the stated elements of the structural contingency theoretical environment. Also part of the AHC operational conditions are the relationships among the hospital, physician group practice, and medical school. The size and boundary-spanning strategies among these three entities create the internal environment of the AHC (Fennell & Alexander, 1987). The theory also enables distinctions between the clinical and academic environments, where stability in one and dynamism in another can co-exist. The structural contingency theory construct of environment, therefore accommodates the diverse external and internal conditions of AHCs.

The Theoretical Constructs of Organization and Structure

The second pertinent construct of structural contingency theory is the organization and the structure or form the organization takes. This section outlines how the theorists define the organizational structure, and references several applications of the definition in contingency theory-based studies of the health care industry. The section concludes with a justification of how the construct applies to this study of AHCs.

Definition. The theoretical definitions of organizations and structures are as flexible and complex as the definition of environment. Fennell and Alexander (1987) use a simple theoretical description of organizations as "open systems" susceptible to environmental forces and "capable of adapting to environmental changes" (p. 457). Burns and Stalker (1961) contribute the idea of the organization as a "communication system" within a managed social structure with a "sense of common purpose" (p. 92-94). A more tangible definition of organizations is as a structural arrangement of operational units that coordinate work activities (Hollenbeck et al., 2002; Lawrence & Lorsch, 1967). This more concrete definition of an organization as a system of interrelated departments taking on various structural arrangements is more workable as researchers test contingency theory propositions (Donaldson, 2001).

If the organization is an arrangement of operational units, then the next challenge is to define the various forms these units can take to optimize performance. According to structural contingency theory, two foundational organizational structures exist: mechanistic and organic (Burns & Stalker, 1961). Mechanistic organizations are centralized or integrated arrangements among the operating units, and have hierarchical structures with consolidated decision-making (Burns & Stalker, 1961). Organic structures are loose affiliations among the organizational operating units, which function relatively independently (Burns & Stalker, 1961). Organic structures possess decentralized decision-making processes, where innovations and tactical choices occur at the sub-unit level (Donaldson, 2001).

Burns and Stalker (1961) delve deeper into defining organizational structure, using the concepts of differentiation and integration to describe the "orientation" of "different functional departments" (p. 11). Differentiation is the level of distinctness among the component departments of an organization, and integration is the "state of collaboration that exists among departments that are required to achieve unity of effort by the demands of the environment" (p. 11). Burns and Stalker (1961) offer the notion of degree into the definition of structure, where organizations can have higher or lower levels of differentiation or integration. Higher levels of differentiation among the departments of an organization moves toward an organic structure, and higher levels of integration moves toward a mechanistic structure. For the sake of clarity and consistent terminology, a mechanistic or centralized organization has an integrated structure, an organic or decentralized organization has a loose affiliation structure.

Applications of organization and structure in studies of the health care industry. Studies of health care organizational structures using structural contingency theoretical frameworks tend to follow the integrated-loose affiliation dichotomy. Meyer (1982) concludes that the sudden "environmental jolt" of a physician labor strike impacts the financial outcomes of hospitals differently depending on organizational structure and strategy (p. 515). Hospitals with decentralized decision-making perform better than those with more centralized structures (Meyer, 1983). Fennell and Alexander (1987) employ a complex definition for organizational structure involving "boundary spanning" strategies, where hospitals react to environments by joining systems or connecting with partners (integrating), or remain free-standing (p. 458). Swofford (2011) also uses the system membership or free-standing structural categories in the study of rural hospitals.

Applicability of organization and structure to this study of AHCs. The definitions of organizational structure also align with the general view of AHC organizational forms. Integration and loose affiliation are structures consistent with Levine's AHC organizational alignment continuum (Figure 1). The hospital, physician group practice, and medical school can adopt a loosely affiliated arrangement or some organizational alignment that involves a degree of integration (Barrett, 2008; Kastor, 2004), strengthening the applicability of structural contingency theory to this study.

The fundamental premise of structural contingency theory is that organizational success depends on adapting the structure to the prevailing environmental conditions (Donaldson, 2001). If environments are stable or dynamic, and organizational structures are integrated or loosely affiliated, then the subsequent issue becomes determining which structure fits which environmental condition to generate effectiveness.

The Theoretical Construct of Environmental-Structural Fit or Contingent Pairs

This section outlines the theoretical environmental-structural fits, also known as contingent pairs (Lawrence & Lorsch, 1967). Following the definition of fit, this section describes a prominent application of the construct in Swofford's (2011) study of rural hospitals. Finally, this section outlines how fit is the central concept in this study of AHCs.

Definition. Donaldson (2001) calls the "core contingency theory paradigm" the organizational "structural adaptation to regain fit (SARFIT)" (p. 11). Fit is the association between the environmental conditions and the organizational structural characteristics (Burns & Stalker, 1961). If the environment changes from one condition to another, then organizations theoretically make structural adaptations to fit the new condition and assume a form that improves performance, thus SARFIT (Donaldson, 2001).

Burns and Stalker (1961) engage in qualitative case studies across multiple industries and conclude that specific organizational arrangements fit particular types of environments (Drazin, Gylnn & Kazanijian, 2004). Organizations that adopt integrated structures in stable environments experience better performance (Burns & Stalker, 1961). Similarly, organizations that adopt loose affiliation structures in dynamic environments have better performance (Burns & Stalker, 1961). Lawrence and Lorsch (1967) refine these propositions, stating that the rate or degree of environmental change "should determine the degree of structural differentiation and integration within an organization" (Drazin, et al., 2004, p. 161). Structural contingency theorists, therefore, propose the contingent pairs in Figure 4.

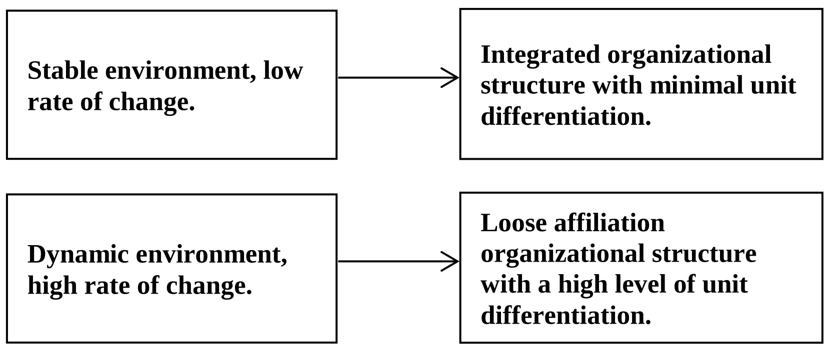

Figure 4. Structural Contingency Theory Contingent Pairs.

The environmental-structural fit of the contingent pairs relies on the concept of organizational performance. Organizations with an integrated structure perform better in stable environments because the absence of external pressures enables an inward focus. Organizations that adopt hierarchical and bureaucratic structures create operational efficiencies through centralized decision-making and standard routine processes (Burns & Stalker, 1961). Organizations with a loose affiliation structure among component units or divisions perform better in dynamic environments because of the need for institutional flexibility. Loose affiliation structures possess decentralized participatory decision-making processes, and this type of organizational arrangement fits dynamic environments where successful mission performance requires the flexibility to innovate and make tactical choices at the sub-unit level (Donaldson, 2001).

An application of environmental-structural fit in a study of the health care industry. An application of contingent pairs in a health care organization analysis is Swofford's (2011) study of rural hospitals. Swofford (2011) creates two basic relationships that link environmental conditions with hospital organizational arrangements, and then compares the financial performance of hospitals that comply with the relationships with hospitals that do not. The pairings are 1) environmental munificence and hospital membership in a system, and 2) the level of competition in the environment and centralized organizational structures (Swofford, 2011). The directional relationships are 1) the more munificent the environment the more likely the hospital becomes a system affiliate, and 2) the greater the level of competition, the more likely the hospital forms partnerships (Swofford, 2011). While Swofford (2011) does not apply the concepts of environmental stability or dynamism directly, the pairings in the study imply these conditions. A munificent environment can offer more stability than resource-challenged conditions, and so hospitals remain in a wholly-controlling structure, and a competitive environment is more dynamic than a market with one or two health care providers, and hospitals relinquish central control and become an affiliate.

Applicability of environmental-structural fit to this study of AHCs. Translating contingent pairs and fit to this study of AHCs is a straight-forward exercise. AHCs existing in stable patient care and academic environments, with relatively unchanging competition for resources, should adopt an integrated organizational structure to maximize central control. This structure consolidates the hospital, physician group practice, and medical school. AHCs existing in dynamic environments should adopt a loose affiliation arrangement among the three units, where the hospital, physician group practice, or the medical school can act independently in response to changing external pressures.

The Theoretical Construct of Organizational Effectiveness or Performance

With the theoretical environmental-structural fits in place, the remaining issue is to consider the definition of organizational effectiveness, or the synonymous constructs of performance or success. Penning (1975) and Donaldson (2001) use the term effectiveness as the ultimate measure of fit or the fundamental contingent pairings of stable environments to integrated structures and dynamic environments to loose affiliations. This section outlines the definition of effectiveness or performance, describes the application of the construct in contingency theory-based studies of the hospital industry, and explains the applicability of performance to this study of AHCs.

Definition. Donaldson (2001) states that "a crisis of poor performance" is the prerequisite for "adaptive change" in an organization (p. 249). This situation implies that the organization is operating in an environmental-structural misfit circumstance, and needs to make adaptations to the structure to create fit and improve performance. For Donaldson (2001), performance is organizational effectiveness in an economic sense, where growth in financial profitability and competitive strength signifies effectiveness. Lawrence and Lorsch (1967) also define successful organizational performance using measures such as growing profits and increasing customer volumes, but add the notion of growing products or services. Performance suffers when profits, market shares, and product or service offerings decline and, according to structural contingency theory, the factor for the lack of effectiveness is an environmental-structural misfit (Donaldson, 2001).

Effectiveness, or successful performance in the pursuit of missions, is the ultimate theoretical objective of organizations. Structural contingency theory proposes that the manner of aligning an organization in concert with the environment is a primary determinant of effectiveness. The theory also places structure and effectiveness in a position of dependency on the environment. The operating environment creates circumstances that require certain structures that will produce organizational effectiveness.

Application of performance in a study of the health care industry. Researchers using structural contingency frameworks in analyses of the health care industry select economic indicators to measure organizational performance. Young, Beekun and Ginn (1992) gauge hospital performance using financial return on assets (profit margin divided by the monetary value of total assets) in a study of fit between the structure of the hospital board of directors and the organizational strategy. Meyer (1982) uses financial profit or loss to measure the performance of hospitals under various structures in a period of labor environment uncertainty. Swofford (2011) employs hospital profit margin and a composite operational efficiency measure using inputs and outputs such as capital investments, labor costs, operating expenses, patient visits, and procedure volumes.

Applicability of performance to this study of AHCs. For AHCs, effectiveness follows the definitions of the theorists, where clinical enterprise growth in market share and increasing profitability are necessities to fund the research and education operations (Rothman et al., 2015). The academic enterprise, in turn, expands the research programs and educational services, growing the brand value and prestige of the AHC (Pomeroy et al., 2008). The virtuous cycle continues when prestige generates greater patient demand for care at the AHC, which grows clinical market share and profits for re-investment in research and education (Wartman, 2008).

AHCs pursue multiple missions in multiple environments, and confront the challenge of adapting the relationships among the hospital, physician group practice, and medical school to exogenous conditions to operate effectively. AHCs have a history of aligning and re-aligning the organization, attempting to react to environmental conditions for the sake of improving performance (Barrett, 2008; Cairns, 2017; Karpf et al., 2000; Kastor, 2008; Rodin, 2004; Wilemon, 2014). Generating financial resources, strengthening the competitive position clinically and academically, and expanding programs are indicators of effectiveness, and with effectiveness comes organizational viability and continuing pursuit of the clinical and academic missions.

The Conceptual Framework of This Study

Environment, organizational structure, environmental-structural fit, and effectiveness are the structural contingency theory constructs that come together into a conceptual framework within which AHCs can gain insight into how to achieve higher levels of performance. This study uses the framework to test the proposition that AHC effectiveness depends on environmental-structural fit. This section establishes the environmental-structural relationships for this study, builds the theoretical model applicable to AHC characteristics and circumstances, and states the theoretical propositions specific to AHCs.

Environmental-structural relationships for this study. Applying the theoretical constructs of environment, structure, and fit to AHCs requires the establishment of relationships between the types of environments and the categories of organizational alignment. In this study, the theorized relationship is between the relative stability of the clinical and academic environments and the degree of organizational integration among the hospital, physician practice plans, and medical schools. Figure 5 illustrates the first environmental-structural relationship.

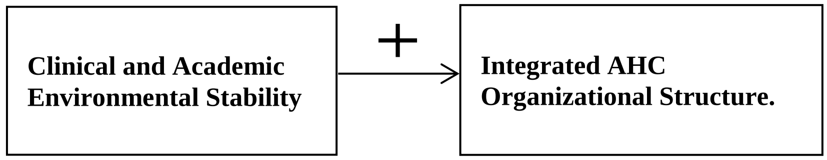

Figure 5. Environmental-Structural Relationship 1.

The initial relationship is that the greater the relative level of clinical (patient care) and academic (research and education) environmental stability, the more likely the AHC hospital, physician group practice, and medical school will adopt an integrated organizational structure to create the environmental-structural fit to maximize the ability to perform successfully across all missions.

The second environmental-structural relationship follows the theoretical logic of the first and remains consistent with the proposition that high levels of performance rely on the organizational alignment fitting the nature of the environment. Figure 6 displays the second environmental-structural relationship.

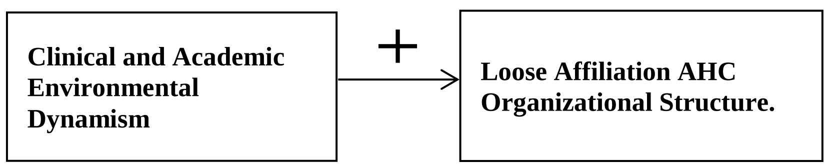

Figure 6. Environmental-Structural Relationship 2.

The second relationship follows the logic that the greater the level of clinical and academic environmental dynamism, the more likely the AHC hospital, physician group practice, and medical school will adopt a loose affiliation structure to create the environmental-structural fit to maximize the ability to perform successfully across all missions.

These relationships between the stability of the environment and the type of organizational structure establish what Donaldson (2001) calls the "fit[s] that affect performance" (p. 10). Those AHCs that adopt the organizational structure that fits the prevailing environmental conditions will perform successfully in accomplishing the clinical and academic missions, as opposed to those AHCs that adopt an organizational structure that is a misfit with prevailing environmental conditions. The following section assembles the relationships into the theoretical model for this study.

The theoretical model. With the definition of organizational effectiveness accompanying an understanding of environments, structures, and fit, and the applicability of these constructs to the operations of AHCs in the propositions from the prior section, a theoretical model emerges. Figure 7 illustrates the elements and relationships that follow the structural contingency theoretical framework.

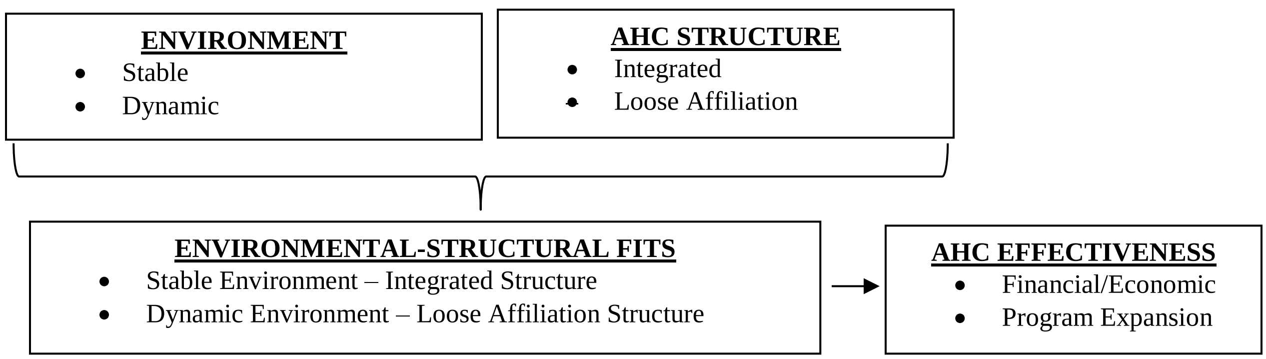

Figure 7. Theoretical Model.

This theoretical model culminates the constructs and propositions of structural contingency theory and provides the fundamental framework for this study. The following section expresses the relationships in the formal language of propositions specific to this study of AHCs.

The structural contingency theory-based propositions for this study. The AHC environment-structural relationships and the structural contingency theoretical model from the previous sections produce the following propositions:

1. AHCs, as structural arrangements of operational units, attempt to organize the hospital, physician group practice, and medical school in a manner that fits the prevailing

environmental conditions to generate higher levels of performance in pursuing the patient care, research, and teaching missions.

   a. AHCs that adopt integrated organizational structures and exist in stable clinical and academic environments generate higher levels of performance in pursuing mission objectives.
   b. AHCs that adopt loose affiliation organizational structures and exist in a dynamic clinical and academic environments generate higher levels of performance in pursuing mission objectives.

2. Conversely, AHCs that adopt an organizational structure that is misaligned (misfits) with the prevailing environmental conditions generate lower levels of performance in pursuing the patient care, research, and teaching missions.
   a. AHCs that adopt integrated organizational structures and exist in dynamic clinical and academic environments generate lower levels of performance in pursuing mission objectives.
   b. AHCs that adopt loose affiliation organizational structure and exist in stable clinical and academic environments generate lower levels of performance in pursuing mission objectives.

The following section brings the two propositions together with the theoretical model into an overall conceptual model for this study.

The Conceptual Model of this Study

Figure 8 depicts the conceptual model for this study. The framework contains the foundational constructs of structural contingency theory and the relationships that comprise the propositions regarding environment, organizational alignment, environmental-structural fit or misfit, and performance. The model establishes the theoretical logic in preparation for developing the hypotheses of this study. This section focuses on solidifying this study of AHCs on the tenets of structural contingency theory, and then the hypotheses follow.

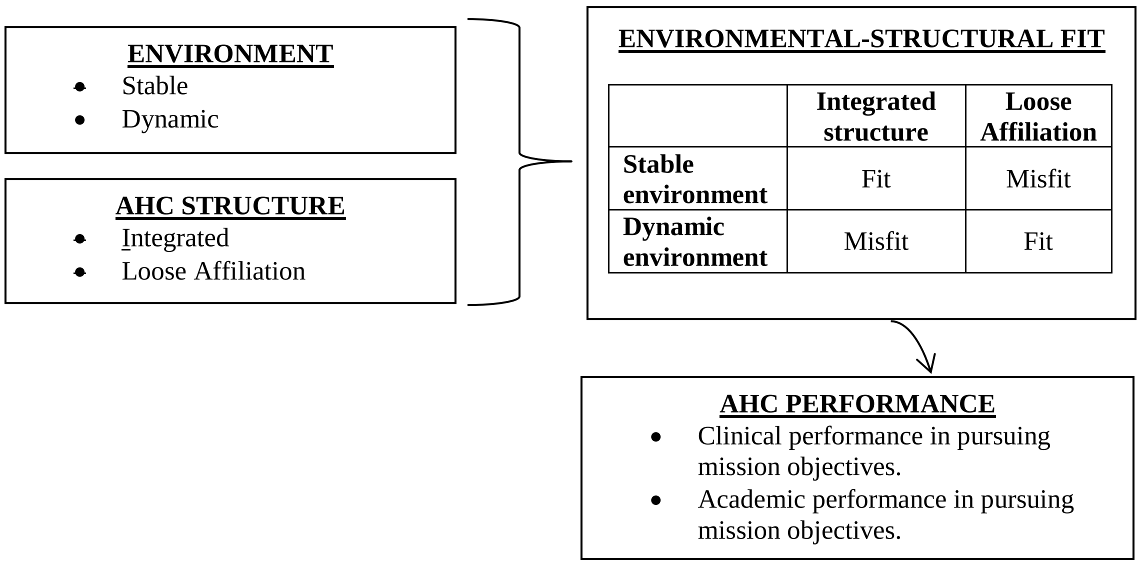

Figure 8. Conceptual Model for the Study.

The conceptual model involves two types of environments. AHCs exist in environments where forces that impact the clinical and academic missions are stable or dynamic. The multiple missions of AHCs are complexities that the conceptual model must accommodate to generate meaningful analytical results from this study. The patient care environment of the clinical mission faces different forces than the research and education environments of the academic mission. The conceptual model involves a distinction between the mission environments consistent with structural contingency theory.

The conceptual model involves two types of organizational structures. AHCs can adopt an integrated or loose affiliation structure among the hospital, physician group practice, and medical school. These categories align with structural contingency theory and the Levine continuum (Figure 1) that is prominent in the literature. The integrated category accommodates the complexities of AHC organizational structures, where two of the three AHC entities can exist in a consolidated manner while the third operates as an affiliate, thus achieving a degree of integration. Two organizational structure categories, accompanying two types of environmental conditions, enables the development of theoretical contingent pairs.

The conceptual model uses a matrix of the environmental and structural categories to create the fit or misfit pairings. The environmental-structural pairings that constitute fits are stable environment with an integrated or consolidated structure and dynamic environment with loose affiliation structure. Any other pairings are misfits. The bi-modal fit or misfit categories become the independent variable in the study, and AHC performance in the mission areas serve as the dependent variables.

The conceptual model uses the prevalent measures of effectiveness or performance in the structural contingency theory literature. Financial profitability, competitive strength, and program expansion indicate the relative performance of AHCs in the environmental-structural fit and misfit categories. The theoretical proposition is that AHCs with organizational structures that fit the prevailing environmental conditions will have a positive relationship with higher levels of performance.

With the conceptual model in place, the next section lists the hypotheses for this study. Given the environmental-structural pairings that generate fit, developing the assertions for statistical testing is straight forward. The hypotheses also include an assertion that recognizes the realities of the financial structure and the virtuous cycle funds flows of AHCs.

Hypotheses

This study intends to test four hypotheses. Each one follows the tenets of structural contingency theory and the conceptual model. The first and second hypotheses focuses on the overall proposition that environmental-structural fit associates with performance. The third hypothesis follows the rationale in the literature that AHC environments are changing, and that structural fit with a dynamic environment is more impactful than fit in a stable environment. The fourth hypothesis acknowledges the reliance of the academic missions on the financial success of the clinical enterprise.

H1: AHCs that have an organizational structure that fits the prevailing environment experience better performance in pursuing the clinical mission than AHCs with a structure that misfits the environment.

H2: AHCs that have an organizational structure that fits the prevailing environment experience better performance in pursuing the academic mission than AHCs with a structure that misfits the environment.

The second hypothesis involves the underlying supposition that successful pursuit of the academic mission relies on the munificence of the clinical environment, which is the result of financial successes from the AHC patient care operations. Testing hypothesis 2 involves using the performance measures from the tests of hypothesis 1 (the dependent variables) as indicators of financial munificence for the tests of hypothesis 2 (independent variables).

H3: AHCs that have an organizational structure that fits a dynamic environment have better performance in pursuing the missions than AHCs with an organizational structure that fits a stable environment.

The inherently delicate financial balancing necessary for successful AHC operations, and the ultimate reliance on clinical funds to flow to the academic missions, leads to the exploration of which environment has the greater impact on AHC performance: the clinical environment only or the combined clinical and academic environment (Miller et al., 2012). The third hypothesis is that organizational fit with the clinical market has stronger influence on the AHC performance.

H4: AHCs that have an organizational structure that fits a prevailing clinical environment have better performance in pursuing the missions than AHCs with an organizational structure that fits a prevailing combined clinical and academic environment.

Chapter Summary

This chapter establishes the theoretical framework for this study of AHC performance in pursuit of the clinical and academic missions. The literature on AHCs in Chapter 2 reveals multiple case studies that reference how changing market and economic environmental forces threaten performance and cause organizational restructuring. The aim of realigning the hospital, physician group practice, and medical school is to synchronize the organization to the prevailing environment to improve performance. A research question for this study is whether or not AHCs achieve this objective. Any study of this question requires a theoretical framework that accommodates the constructs of environment, organizational structure, and performance, as does structural contingency theory.

The core proposition of the theory addresses directly the challenge AHCs face when managing to sustain financial viability while pursuing the clinical and academic missions. The environmental-structural fit is a pre-requisite for successful performance. Structural contingency theory provides the archetypical fits, where integrated structures lead to higher performance in stable environments, and loose affiliation structures lead to higher performance in dynamic environments.

Structural contingency theory also provides a definition of organizational performance readily applicable to AHCs. Economic effectiveness through financial profits, market competitiveness, and program expansion are outcomes that fuel the virtuous cycle and strengthen the inter-dependencies among the patient care, research, and education operations. Growth in these areas can improve the chances for AHC viability and success in the pursuit of the clinical and academic missions.

If environmental-structural fit is the precursor to organizational performance, then the hypotheses to test in this dissertation should follow the sequential logic of the virtuous cycle. This study involves two directional suppositions consistent with the structural contingency sequencing (hypotheses 1 and 2): 1) AHCs that adopt an integrated structure in stable environments experience economic and program growth, and 2) AHCs that adopt a loose affiliation structure in dynamic environments experience economic and program growth. Structural contingency theory acknowledges environmental and organizational complexities and AHCs, with multiple missions and inter-relations among the sub-units, are intricate entities. AHC environments change, and hypothesis 3 emphasizes fit in dynamic conditions. The virtuous cycle attempts to model the operations with the clinical environment at the top. The fourth hypothesis asserts that the organizational fit with the clinical environment produces performance success in both the clinical and academic missions.

The conceptual model for this study is a theoretical foundation for the research design and methods of analysis. Chapter 4 builds a design consistent with the model, and addresses multiple concerns regarding validity. The next chapter also outlines the variables that correspond to the basic theoretical constructs, and creates an analytical approach that makes AHC performance in pursuit of the clinical and academic missions dependent on the environmental-structural fit.

Chapter 4: Methodology

Introduction

This chapter establishes the methodology to test the hypotheses through an observational (non-experimental), correlational, and retrospective research approach (Polit & Beck, 2008). The objective is to measure the strength of association between AHC environmental-structural fit and change in performance using data from 2007 to 2016. This approach does not involve an intervention with control and test groupings, thus the non-experimental design (Polit & Beck, 2008). The initial sections of this chapter explain the research design with the chronological sequencing and overall timeframe of this study, and describe how the plan reflects the principles of structural contingency theory. Subsequent sections discuss the methods to mitigating threats to the validity of the study results; the data in the analysis; the sample of AHCs and the inclusion/exclusion criteria; and the definitions and calculations of the dependent, independent, and control variables. The final sections of this chapter outline the analytical approaches using regression equations, the case for statistical validity, and possible revisions to the model to retain statistical power.

Research Design

This section outlines the research design, and the timeframes of the study and variable measurements. Chronology is fundamental to structural contingency theory, so this section also describes the consistencies between the research design and methods, and the theoretical elements.

Similar to Swofford (2011), this study uses a non-experimental post-test approach with observations across multiple years. Following the structural contingency theory need for a diachronic research design measuring fit before performance (Donaldson, 2001), Swofford (2011) determines fit in a particular year then assesses performance in a subsequent period using a multi-year panel. This study adopts the same approach, measuring AHC environmental-structural fit in the year 2011, and AHC performance toward mission objectives in the years 2013 through 2016. The 2012 one year lag period between environmental-structural fit and organization performance protects the causal inference that "performance is an effect of fit" (Donaldson, 2001, p. 202). The research design for this study appears in Figure 9.

<table>
<tr><th>O</th><th>O</th><th>O</th><th>X</th><th>Lag period.</th><th>O</th><th>O</th><th>O</th></tr>
<tr><td>2007 to 2008</td><td>2008 to 2009</td><td>2009 to 2010</td><td>2011</td><td>2012</td><td>2013 to 2014</td><td>2014 to 2015</td><td>2015 to 2016</td></tr>
<tr><td colspan="3">Measure lagged performance in pursuing clinical and academic missions.</td><td rowspan="3">Determine AHC structure and environmental – structural fit.</td><td rowspan="3">Time period to allow for effects of fit.</td><td colspan="3">Measure performance in pursuing clinical and academic missions.</td></tr>
<tr><td colspan="3" rowspan="2">Measure changes in AHC clinical and academic environments.</td><td colspan="3">Measure controls for factors other than fit that could impact performance.</td></tr>
<tr><td colspan="3">Monitor fit and exclude from sample AHCs that change fit/misfit status.</td></tr>
</table>

X = the measurement of the independent variable, which is environmental-structural fit.
O = observations of AHC performance in pursuing mission objectives.

Figure 9. The Research Design.

The multiple observations are the measurements of annual AHC performance changes in years 2013 to 2014, 2014 to 2015, and 2015 to 2016. This study gauges AHC performance as the three-year average annual change in the observations from 2013 to 2016.

The research design and the analytical techniques follow the counsel of Donaldson (2001) in applying structural contingency theory to empirical study. Donaldson (2001) states that structural contingency theory analyses should measure comprehensively the organizational structural fit to the environment for test subjects over several years to preserve the reliability of any correlation between fit and performance. This study determines organizational structure and the environmental-structural fit using indicators that involve each mission area of AHCs (clinical and academic), thus comprehensively including all operations of AHCs. This study uses the three-year mean value of performance changes across the 2013 to 2016 period as the dependent variable (the overall average annual change during the three-year period) to increase the precision of the measures by mitigating year to year variances due to factors other than fit, such as errors in the AHC reporting of financial results or accounting anomalies for performance in a particular year (Chukmaitov et al., 2009; Swofford, 2011).

Donaldson (2001) counsels controlling for other causes of organizational performance that emanate from the environment, the organization, and the past to prevent the confounding "negative feedback effect" of organizational performance on fit (p. 241). This study controls for environmental and organizational characteristics that have precedence in structural contingency theory analyses, and the research timeframe includes data from 2007-2010 to calculate lagged measures of performance to control for time invariant factors which may impact AHC performance from 2013 to 2016 (Swofford, 2011).

Finally, Donaldson (2001) emphasizes the preservation of the causal inference of fit on performance by the temporal sequence of fit preceding performance. Donaldson (2001) states that studies should account for the fact that performance can have a negative effect on fit, meaning that some degree of positive performance could prolong an organization in a misfit state, even if the level of performance is decreasing. This study calculates the environmental-structural fit in 2011 and allows for a lag period (2012) between fit and performance to ensure the temporal sequence of fit preceding performance. This study also uses the lagged measures of performance from 2007-2010 to control for lingering positive performance preventing an AHC from adopting an organizational structure that fits the environment in 2011.

Mitigating Threats to Validity

The research design and adherence to the recommended approaches to applying structural contingency theory intend to strengthen the validity of the study results. This section first discusses how the design and methods mitigate threats to inference, or the clear association between AHC environmental-structural fit and performance in pursuit of the three missions (internal validity). Second is an examination of how the design and methods allow for the generalizability of the results (external validity). This section concludes with an outline of how the design and methods contribute to construct validity, or how the study achieves the measurement of the targeted constructs within structural contingency theory.

Internal validity. An intent of this study design is to establish validity of inference, or internal validity, (Polit & Beck, 2008), where the environmental-structural fit of the AHC has the strongest inferential relationship with AHC performance in pursuing mission objectives. The design seeks to minimize the threats to internal validity, the greatest of which are spurious effects of confounding forces (Polit & Beck, 2008). The prominent threats to internal validity are temporal ambiguity, selection, history, maturation, attrition, testing, and instrumentation. This section describes how the design and nature of the study address each of these threats.

Temporal ambiguity refers to Donaldson's (2001) concerns regarding the causal inference of environmental-structural fit on AHC performance. In correlational studies, the research design should address directly the need for the cause to precede the effect (Polit & Beck, 2008). This study calculates AHC environmental-structural fit in 2011, imposes a lag period in 2012 to allow for the effects of fit to occur, and measures AHC performance changes over the 2013-2016 three-year period. The study also attempts to safeguard causal inference by controlling for changes in AHC past performance in the 2007-2010 three-year period.

Selection, or selection-bias, as a threat to internal validity occurs when pre-existing differences between groups in a study impact the outcomes and thus the conclusions (Polit & Beck, 2008). In this study, the two groups are AHCs with and without environmental-structural fits. While the best method of addressing selection-bias is randomly assigning AHCs to the fit and misfit groups, this maneuver is not possible since fit or misfit is the independent variable and an actual condition that is not subject to random assignment. This study, however, removes from the sample AHCs that move from one fit/misfit category to the other from 2011 to 2016, addressing a confounding influence on the causal inference. By removing AHCs that make this change during the study period, the design maintains the integrity of the correlations between fit in 2011 and performance in the 2013 to 2016 period, mitigating selection-bias.

History is the next threat to internal validity that could affect groups in the study differently. The threat of history is when external events occur during the study period that impact AHC environmental-structural fit and performance (Polit & Beck, 2008). This study employs independent control variables for the environment to account for factors other than stability or dynamism, and for AHC organizational size which may influence structural consolidation or loose affiliation (Donaldson, 2001). One event this study does not directly control in the potential impacts of the 2010 enactment of the PPACA. By measuring fit in 2011, this study captures the effects of this environmental regulatory change. Finally, using the three-year average annual change in AHC performance from 2013 to 2016 controls for sudden events that could impact the dependent variables.

Using the three-year average also helps to mitigate the effects of maturation, which is another threat to internal validity. Maturation is change in AHC performance over time due to forces other than the environmental-structural fit (Polit & Beck, 2008). Using multi-year average values to measure relative performance moderates the effects of conditions that may manifest suddenly in any given year, such as labor relation crises or executive leadership changes, or more gradual forces such as economic inflation.

The internal validity threat of attrition, or the reduction of the AHC sample size during the study, is an inherent aspect of this research, with the intentional elimination from the sample of AHCs that change fit/misfit status during the analysis period. Also, AHCs that do not provide data for each year of the study threaten attrition. Descriptive statistics coupled with methods to account for missing data preserve the sample size and lessen the potential impact of attrition effects (Swofford, 2011).

Testing and instrumentation are additional measurement threats to internal validity (Polit & Beck, 2008). Testing refers to the effects of a preliminary evaluation on the performance of research subjects, and is not applicable to this study since no pretest is involved. Instrumentation is when changes in measurement tools introduce bias in a study, or the research subjects have various levels of familiarity with the tools over time and produce responses of differing accuracy (Polit & Beck, 2008). This study utilizes established third-party survey instruments to gather data for the AHC performance indicators, making the research susceptible to instrumentation threats, however the analysis uses the three-year mean values of annual performance changes, which reduces the risks.

External validity. This section discusses threats to external validity, or the generalizability of the results. The intent of this research effort is to inform AHCs of the relationships among organizational structure, market and economic environmental conditions, and performance in pursuit of clinical and academic missions. Effectively accomplishing this goal requires a study sample of AHCs that represents the population of these institutions, and a research design with variables that reflect “real-world circumstances” (Polit & Beck, 2008, p. 302). As subsequent sections establish, the initial sample of this study represents over 87% of the 136 AHCs with accredited medical schools in 2011 (the environmental-structural fit measurement year) within the United States. The multi-site nature of this sample embodies the heterogeneous population of AHCs, strengthening the applicability of the study results across all AHCs. The study methods involve measures of the clinical and academic environmental conditions, and variables representing performance in these mission areas, comprehensively capturing the salient aspects of AHC operations. The patient care, research, and education performance measures (the dependent variables) are isolated to individual AHCs, minimizing the confounding influence of interactions among AHCs.

A more complex circumstance exists with measuring the independent variable exclusively to individual AHCs. Environmental stability or dynamism is one element of the fit/misfit independent variable. The indicators of patient care environmental stability or dynamism are exclusive to individual AHCs, with the exception of the urban markets involving multiple AHCs (i.e. Los Angeles with UCLA and the University of Southern California). The research and education environmental measures, however, are not unique to individual AHCs and instead reflect national conditions. Common environments could create confounding interactions, weakening the statistical strength of the results and thereby threatening external validity. The concern is that all AHCs in the sample experience the same research and education environments simultaneously, creating homogenous conditions and making the distinction in the fit-performance relationship more reliant on the stability of the patient care environment. This situation can complicate the interpretation of the study results, but excluding measures of the research and education environments also threatens external validity by failing to use a design that reflects real-world circumstances.

This study trades-off the potential confounding effects of common simultaneous environments with the preservation of real-world circumstances. A reality is that some AHCs compete for patients within the same market. Unavoidable certainties are that 1) research and education are essential to the academic mission of AHCs (Rahn, 2015), 2) the federal government provides a large proportion of funding for the biomedical and health science research work at AHCs (Clarke et al., 2015), and 3) AHC medical schools compete against each other for NIH, National Science Foundation, and other federal agencies' research grant funding, making the market definition national in scope (Rothman et al., 2015). Predominant sources of medical education funding are also federal programs that provide supplemental reimbursements for clinical care to cover a portion of the instructional costs, so the education market has a national definition as well (Metzler et al., 2012; Holt et al., 2014).

Construct validity. The research design not only seeks to represent the actual operating conditions of AHCs, but also the structural contingency theoretical concepts of environment, structure, and performance. This section describes how the research design and the variables in the analytical model possess construct validity, or the degree to which these elements measure what the study claims to measure (Polit & Beck, 2008).

Establishing construct validity involves a review of AHC conditions, components, and objectives, and creating an association of design elements and variables to the underlying theoretical concepts. The facts are that 1) AHCs pursue mission objectives in markets for patient care services and research and education resources (Chakma, Sun, Steinberg, Sammut & Jagsi, 2014; Daniels & Carson, 2011; Dzau, ElLaissi & Udayakumar, 2015), 2) AHCs engage in these pursuits through organizational structures involving a hospital, a physician group practice, and a medical school (Kastor, 2004), and 3) performance success in these pursuits results in clinical and academic program and financial resource growth (Cutler & Morton, 2013; Dzau et al., 2015; Johnson et al., 2015; Pizzo et al., 2015). Markets, the AHC organizational components, and program/financial growth correspond to the structural contingency theory constructs of environment, structure, and performance respectively. Also, applying structural contingency theory to any analysis requires the temporal sequence of environmental-structural fit before measuring performance (Donaldson, 2001). This study design includes each of these theoretical constructs and meets the temporal sequence requirement. Table 8 outlines the elements of the research design that establish construct validity for this study.

Table 8

The Elements for Construct Validity

Structural Contingency Theory Constructs	**Associated Design and Study Elements**
Missions	Clinical mission (patient care operations).
	Academic mission (research and education operations).
Environment	Stable clinical and academic markets.
	Dynamic clinical and academic markets.
Organizational structure	Integrated AHC structure.
	Loose affiliation AHC structure.
Environmental-structural fit	Environment-structure fit.
	Environment-structure misfit.
Performance	Three-year average change in performance from 2013 to 2016.
Temporal sequence for causal inference	Environmental-structural fit in 2011.
	Lag-period in 2012.
	Performance measurement in 2013-2016.

One particular challenge to construct validity for this and other health care organization studies is defining the AHC patient care market to represent the environment effectively. The primary limitation of health care market definitions in the literature are the use of geopolitical boundaries (French, Langenfeld & McCluer, 2004; Gresenz, Rogowski & Escarce, 2004; Moriya, Vogt & Gaynor, 2010; Town et al., 2007; Yeager, Zhang & Diane, 2015). Patients receive care at local hospitals but travel across geographical boundaries to AHCs for advanced services, complicating the definition of a market (Town et al., 2007).

Despite these limitations, studies of health system competition, consolidation, and performance persist with proxy measures for the geographic boundaries of the patient care markets. Prevalent data sources in empirical research limit market definitions to counties (Frech III et al., 2015; Yeager et al., 2015), Metropolitan Statistical Areas from the United States Census Bureau (Shen, Wu & Melnick, 2010; Yeager et al., 2015), or the Medicare and ZIP code-based Health Service Areas (Moriya et al., 2010; Town et al., 2007). Eschewing "geopolitical boundaries to identify hospital 'markets'," Town et al. (2007) choose a definition that "relies on patient flows" (p. 226). Other scholars view hospital markets as areas from which 75% to 90% of patient admissions originate (Frech III, Langenfeld & McCluer, 2004; Gresenz et al., 2004).

These latter definitions come closest to representing the diffuse geographies that AHCs serve, and mitigates the threat to the construct validity regarding markets. This study employs the Hospital Referral Regions (HRR) from the Dartmouth Atlas of Health Care, which represent geographic areas containing populations who receive advanced care (Dartmouth Atlas of Health Care, 2017). The Dartmouth Atlas accumulates ZIP codes into Health Services Areas (HSAs) that reflect markets for community health care, and then aggregate HSAs into distinct HRRs by tracking where residents of HSAs receive major cardiovascular and neurosurgical procedures. The Dartmouth Atlas uses these two medical procedures as "markers for tertiary care" (Dartmouth Atlas of Health Care, 2017). The HRRs contain at least one hospital that offers tertiary care, and this level of medical service is typical of AHCs. The HRR, therefore, represents the health care market of AHCs in this study and establishes the necessary discrete boundaries of geographical units that can accumulate to as broad a region as necessary to capture a valid level of patient volumes.

Summary on validity. The preceding sections of this chapter establish the research design, chronological sequencing, overall timeframe, and the mitigation measures to multiple threats to internal, external, and construct validity. The design adheres to the fundamental temporal sequencing of structural contingency theory, where environmental-structural fit must precede measures of organizational performance, and follows the accepted recommendations of applying the theory in an analysis. A complication arises with respect to construct validity. The definitions of the research and education markets are not discrete to individual AHCs, creating a confounding effect that could threaten external validity. This study, however, maintains the definitions as trade-offs against another threat to external validity of not reflecting real-world circumstances.

The following sections of this chapter outline the data sources, population of AHCs, and the inclusion criteria for the sample in this study. Throughout these descriptions, references to relevant studies in the literature provide justifications of the elements and approaches.

Data Sources

This study uses secondary retrospective data from six sources to test the hypotheses. The first source is the annual AAMC Council of Teaching Hospitals and Health Systems (COTH) Survey of Hospital Operations and Financial Performance (2007-2016), which contains the data for most of the measures in this study. The AAMC conducts an annual survey of AHCs that gathers information on organizational structural arrangements among hospitals, physician group practices, and medical schools. The survey also gathers data on AHC clinical operational environments and financial performance. The second and third sources are the United States Department of Health and Human Services National Institute of Health (HHS NIH) Research Portfolio Online Reporting Tool, and the Blue Ridge Institute for Medical Research, both of which provide national and AHC level research information. Finally, the fourth, fifth, and sixth sources are the American Hospital Association (AHA), the United States Census Bureau, and the Kaiser Family Foundation, all of which offer information on the characteristics of health care markets. Table 9 summarizes the concepts and data sources for this study.

Table 9

Study Concepts and Sources of Data

Concepts	Data Source
Clinical environment	AHA, AAMC, United States Census Bureau, Kaiser Family Foundation
Academic environment	HHS NIH, Blue Ridge Institute
Organizational structure	AAMC
Clinical mission performance	AHA, AAMC.
Academic mission performance	Blue Ridge Institute

As the previous section on internal validity states, these sources of information utilize established data gathering instruments. The AAMC COTH annual survey has a 30-year history, and employs internal validation checks on data consistency and outliers (Association of American Medical Colleges, Council of Teaching Hospitals and Health Systems, 2007-2016). The American Hospital Association is the source of research data for multiple studies of hospital and health system performance (Bazzoli, 2000; Chukmaitov et al., 2009; Cutler & Morton, 2013; Moriya et al., 2010; Ramamonjiarivelo et al., 2015; Shen et al., 2010; Town et al., 2007; Yeager et al., 2015). The other data sources for this study are repositories of federal government information on research grants, populations, and markets.

Study Population and Sample

The sample is the 101 AHC respondents to the 2011 AAMC COTH annual Survey of Hospital Operations and Financial Performance. The year 2011, again, serves as the point in time where the study assesses contextual-structural fit. This study compiles data for these 101 AHCs from 2007-2010 to measure AHC performance prior to the assessment of the contextual-structural fit in 2011. This study also compiles data from 2013-2016 to gauge performance after determining the contextual-structural fit. The study omits from the sample any AHC that changes from one fit or misfit category to another during the 2011 to 2016 period. The Liaison Committee on Medical Education (2016b) Directory of Accredited Programs lists 136 graduate education programs granting the Medical Doctor degree in 2011. The initial sample in this study represents 74.3% of the 2011 population of AHCs with accredited medical schools.

Variables

This section outlines the variables for the analytical model and establishes further the construct validity of this study by showing uses of the measures in other work. The variables comprise three groups. The first group is the dependent variables representing the construct of AHC performance in the patient care, research, and education operations. The second group involves the elements that create the primary independent variable, which is the environmental-structural fit. This independent variable ultimately becomes a binary measure, where fit equals the value 1 and misfit equals the value 0. The third group is the remaining independent variables that control for other factors that could impact the AHC environmental-structural relationships and performance toward mission objectives. Table 10 is a list of all variables in the study categorized by group (type), theoretical construct, AHC operating area, and data source.

Table 10

The Variables in the Study

Variable Group (Type)	Theoretical Construct	Operating Area	Variable Description	Data Sources
Dependent	Organization performance: annual average change from 2013 to 2016	Patient care	Proportional change in hospital market share	AHA
			Proportional change in hospital total financial margin	AAMC
		Research	Proportional change in medical school NIH R01 grant funding	Blue Ridge Institute
			Proportional change in the percentage of medical school faculty with NIH R01 grants	Blue Ridge Institute
		Education	Proportional change in number of GME intern and residency positions or FTEs	AAMC
Independent: environmental-structural fit (1) or misfit (0)	Environmental stability or dynamism	Clinical	Patient care market concentration level (HHI)	AHA
			Proportional change in managed care market penetration	AAMC
		Academic	Proportional change in national NIH R01 grant success rate	HHS NIH
	Organization structure	Patient care, research, and education	Integrated	AAMC
			Loose affiliation	
Independent controls	Environment	Clinical	Medicaid expansion state, yes (1), no (0)	Kaiser Family Foundation
			Proportional change in per capita income	US Census and Bureau of Labor and Statistics
			Proportional change in population size	
			Proportional change in population over age 65	
			Proportional change in unemployment rate	
		Academic	Proportional change in hospital market share	AHA
			Proportional change in hospital total financial margin	AAMC
	Organization size	Patient care, research, and education	Proportional change in number of hospital staffed beds	AAMC
			Proportional change in number of faculty/physicians	
	Prior performance: annual change from 2007 to 2010	Patient care	Proportional change in hospital market share	AHA
			Proportional change in hospital total financial margin	AAMC
		Research	Proportional change in medical school NIH R01 grant funding	Blue Ridge Institute
			Proportional change in the percentage of medical school faculty with NIH R01 grants	Blue Ridge Institute
		Education	Proportional change in number of GME intern and residency positions or FTEs	AAMC

Dependent variables: AHC performance in pursuing the clinical and academic missions. Five dependent variables measure AHC performance in the patient care, research, and education operations. The dependent variables are continuous measures gauging changes in AHC clinical and academic financial and program growth during the period of 2013 through

2016. The analysis measures rates of growth or decline as proportional changes from the preceding year during the study period, and then calculates a three-year annual average change rate for each AHC.

The performance dependent variables measuring patient care operations area are: 1) the proportional changes in each AHC hospital's share of the health care market for clinical services, and 2) the proportional changes in the total margin or profitability of each AHC hospital. A growing market share is when a greater number of people seek care at the AHC than other competing hospitals and clinics, and demonstrates advances in the clinical mission (Cutler & Morton, 2013; Hibbard et al., 2005; Nonnemaker & Griner, 2001; Szabat & Walsh, 2007). An increasing total margin for the AHC hospital is a measure of financial ability to fund AHC patient care operations and, through the virtuous cycle and funds flows, to resource the academic mission (Bazzoli et al., 2000; Ramamonjiarivelo et al., 2015; Rothman et al., 2015; Thorpe et al., 2001; Wartman, 2008).

Market share is the percentage of patient care an AHC hospital provides out of all the clinical services rendered in a competitive region (Farris, Bendle, Pfeifer & Reibstein, 2010). Calculating the AHC hospital market share in this study involves a two-phase process. First, this study defines the AHC hospital market as the Dartmouth Atlas Health Referral Region (HRR) for each AHC hospital. The annual AHA survey collects and categorizes patient volume data by HRR for hospitals within the HRRs. In the second phase of determining market share, this study calculates the percentage of adjusted admissions for the AHC hospitals in the sample within the respective HRRs. This percentage represents the market share for the AHC hospital. Using adjusted admissions adds to construct validity since the measure adjusts inpatient volume with an estimate of outpatient services, which would include the care occurring in the physician group practice clinics (Huerta, Ford, Peterson & Brigham, 2008; Thorpe, Florence & Seiber, 2000). The formula for adjusted admissions is total patient admissions plus admissions times the ratio of outpatient revenue to inpatient revenue (Dartmouth Atlas of Health Care, 2017). The dependent variable is the three-year average annual proportional rate of change in AHC hospital market share from 2013 to 2016.

The second dependent variable in the clinical mission area is the AHC hospital total financial margin, or annual revenues minus expenses divided by total annual revenue (Gapenski & Pink, 2011). The total financial margin represents all sources of income for the AHC hospital, both revenue from direct patient care and proceeds from non-operating activities, such as interest on investments or income from the sale of assets (Gapenski & Pink, 2011). Total financial margin also reflects all operating costs, including non-cash expenses such as asset depreciation (Gapenski & Pink, 2011), and includes the effects of AHC decisions regarding investments and financing through interest earned and interest costs respectively (White, Sondhi & Fried, 2003). While some researchers advocate using profitability measures based strictly on cash in-flows and out-flows (McCue & Thompson, 2011), the total margin is a comprehensive measure of financial performance, capturing all sources of funds and representing the cost of the facility and equipment intensive operations of hospitals. Interest on loans, depreciation expenses, and non-operating income are parts of the costs of operating AHCs and the resources available to support the clinical and academic missions. The dependent variable is the three-year average annual proportional rate of change in total financial margin of each AHC hospital in the sample from 2013 to 2016. In cases where the total margin is negative in any given year, this study uses the absolute value of the proportional change to represent performance improvements when the AHC goes from a loss in one year to less of a loss in a subsequent year.

The performance dependent variables measuring research operations are 1) the three-year average annual proportional rate of change in the AHC medical school's NIH R01 grant sponsorship funding level, and 2) the three-year average annual proportional rate of change in the percentage of AHC medical school faculty members with NIH R01 grants. NIH R01 funding and the number of faculty awarded NIH R01 grants are traditional indicators of research success at AHC medical schools (Goldstein et al., 2015; Johnson et al., 2015; Keroack et al., 2011; Miller, 1999; Pomeroy et al., 2008; Souba et al., 2007). The annual dollar value of new NIH R01 awards provides resources to AHC medical schools to advance the academic research mission, and increases in the percentage of medical school faculty earning NIH R01 grants indicate programmatic growth of the AHC research enterprise.

The NIH is the major source of funding for bio-medical and clinical research in the United States, and increases in the annual dollars an AHC attracts from the NIH indicates the medical school's ability to achieve break-through discoveries to benefit human health (Clarke et al., 2015). The NIH R01 award is for faculty/investigator-initiated projects from experienced scientists who progressed beyond early career development grants, and therefore serves as a measure of research excellence and advancement at AHC medical schools (Gerin & Kapelewski, 2011; Hromas et al., 2012). The dependent variable is the three-year average annual proportional change in NIH R01 grant funding for each AHC medical school in the sample from 2013 to 2016.

Earning an increasing level of NIH R01 funding requires AHCs to employ faculty scientists who can produce a viable research proposal (Clarke et al., 2015). Scientists and researchers can earn more than one R01 grant simultaneously, so the dollar level alone may only measure the research success of a narrow sub-set of faculty members in particular specialties, and not indicate general research program growth at the AHC. Measuring the change in the percentage of faculty as the principal investigator with an R01 grant, however, captures the breadth of the research enterprise at AHC medical schools, and indicates the expanse of bio-medical and health scientific programming. The dependent variable is the three-year average annual proportional change in the percentage AHC faculty members with NIH R01 grants from 2013 to 2016.

Finally, the performance dependent variable measuring education operations is the three-year average annual proportional rate of change in the number of AHC medical school and hospital direct graduate medical education (GME) residency positions (full time equivalency positions or FTE). Graduate medical education "stands at the nexus in the education of the physician, linking undergraduate medical school education to a future career… (Pizzo et al., 2015, p. 103)." Increases or decreases in the number of GME residency FTEs measures the success of medical education and resource management at AHCs (Pizzo et al., 2015; Rodin, 2004). AHC medical schools, faculty/physician group practices, and hospitals that increase the number of GME residency FTEs in different health specialties possess the resources and operational ability to conduct such programs, and the number of filled GME training positions serves as an outcome measure of effectiveness (Chen, Petterson, Phillips, Mullan, Bazemore & O'Donnell, 2013).

GME residency programs, under the guidance and oversight of medical schools and occurring in the hospital and ambulatory care settings of AHCs, receive funding from supplemental payments for treating Medicare patients. Medicare provides over $3.0 billion annually to teaching hospitals for direct graduate medical education residency training, and over $7.0 billion each year for indirect medical education costs for the added expenses of providing physician training (Association of American Medical Colleges, 2016; Gold et al., 2015). Federal law limits the number of Medicare fundable residents for each hospital (Centers for Medicare and Medicaid Services).

This cap on the number of federally funded GME residents at any one institution has compelled AHCs to invest institutional resources to expand the size of the educational programs. In 2016, The AHC hospitals participating in the AAMC COTH survey exceed the Medicare residency cap by 100 FTEs on average (Association of American Medical Colleges, 2017). The source of funding for these additional positions can originate from other revenues within the medical school, but typically comes from the clinical operating margin via the virtuous cycle (Wartman, 2008). Therefore, the growth in GME programming and participation is an indication of AHC purposeful investment in the academic education mission. This study measures the proportional change in the number of the direct GME residency FTEs for each AHC in the sample from 2013 to 2016, and calculates the overall three-year average annual proportional change for each AHC.

In summary, the dependent variables in this study measure the rate of growth or decline of AHC performance across the clinical and academic missions. For the patient care operation, positive performance is growing the hospital market share and total margin. For the research effort, positive performance is growing the level of medical school NIH R01 funding and the relative number of faculty that earn such sponsorship. For education operations, positive performance is growing the number of medical school/hospital GME residents.

Independent variable: environmental-structural fit. The main independent variable in this study is the environmental-structural fit or misfit of AHCs in 2011, which is a binary measure where fit equals the value 1 and misfit equals the value 0. This analysis determines fit or misfit according to whether the environment or market within which the AHC functions is stable or dynamic, and whether the AHC has a consolidated or loosely affiliated organizational structure among the hospital, physician group practice, and medical school. AHCs that integrate two of the three organizational entities fall into the consolidated category. Table 11 shows the matrix that determines fit and misfit for this study according to the propositions of structural contingency theory (Donaldson, 2001).

Table 11

Matrix for Environmental-Structural Fit and Misfit

ENVIRONMENTAL-STRUCTURAL FIT

	Integrated structure	**Loose Affiliation**
Stable environment	Fit	Misfit
Dynamic environment	Misfit	Fit

Fit occurs in two of the four combinations between environmental stability and organizational structure. According to structural contingency theory, AHCs that operate in stable environments should adopt an integrated structure to improve performance (Lawrence & Lorsch, 1967). Also, AHCs in dynamic environments should adopt a loose affiliation structure to improve performance (Lawrence & Lorsch, 1967). The remaining two environment-organizational structure combinations are environmental-structural misfits.

The first step in determining environmental-structural fit or misfit is to classify each AHC environment. The following sections describe how this study defines and calculates clinical, academic, and then overall environmental stability or dynamism.

Clinical environment stability or dynamism. The first AHC environment for consideration is the health care markets of the clinical enterprise. Two environmental forces that can influence an AHC's pursuit of the clinical mission are 1) the level of market competition for patients with other providers (Alexander et al., 1997; Daniels & Carson, 2011), and 2) changes in competition between providers and payers with the growing presence of managed care coverage in the market (Mallon, 2003; Thorpe et al., 2001; Wartman, Zhou & Knettel, 2015). Survey research suggests that competition for patients among acute care providers can influence strategic alignment decisions at AHCs (Szabat & Walsh, 2007). Also, competition for advantageous financial arrangements with payers serves as the rationale for AHC organizational changes (Levine et al., 2008; Mallon, 2003). Two variables represent these clinical environmental forces. The first is the Herfindahl-Hirschman Index (HHI) which measures the degree of health care provider competition in a market. The second is changes in the percentage of AHC hospital revenue that originates from managed care payers, which gauges the level of reliance AHCs have on this source of funding.

The HHI is a common measure of health care competition (Cutler & Morton, 2013; Frech et al., 2015; Gresenz et al., 2004; Mas, 2013; Moriya et al., 2010; Thorpe et al., 2001;Yeager et al., 2015). The HHI determines the concentration of providers within a market and measures shifts in competition confronting AHCs (Hirschman, 1964; Rhoades, 1993; Yeager et al., 2015). The formula is the sum of the squared values of hospital market shares within a market, multiplied by the value 10,000 (Cutler & Morton, 2013). This study calculates the HHI values for the AHC hospital AHA/Dartmouth Atlas Health Referral Region market in 2011, at this one point in time. HHI values of 1,500 or less signify an un-concentrated market and a competitive or dynamic hospital environment (Cutler & Morton, 2013; U.S. Department of Justice and the

Federal Trade Commission, 2010). HHI values greater than 1,500 signify concentrated markets and a less competitive or stable hospital environment (Cutler & Morton, 2013; U.S. Department of Justice and the Federal Trade Commission, 2010).

The second indicator of clinical environment stability is the proportional rate of change in the percentage of AHC hospital revenue that originates from managed care payers (Dranove, Simon & White, 1998). Over the last two decades, changes in reimbursements for medical services with the emergence of managed care organizations threaten AHC profitability and the ability to flow funds to the teaching and research missions (Fein, 2000; Szabat & Walsh, 2007; Wartman et al., 2015). The growing or ebbing presence of managed care reimbursements illustrate the degree of price competition AHCs encounter with fixed-reimbursement payers of health care services within a market (Gaynor, 2006; Mallon, 2003; Ramamonjiarivelo et al., 2015; Thorpe et al., 2001).

This study uses the three-year average annual proportional rate of change in the percentage of each AHC hospital's patient revenue from managed care payers from 2007 to 2010 as the basis to assess the degree of stability in the revenue and payer environment in 2011. If the absolute annual rate of change in the percentage of revenue from managed care payer values from 2010 to 2011 is greater than the three-year annual average absolute proportional rate of change values from 2007 to 2010, then the AHC operates in a more volatile and dynamic environment than in the recent past. If the 2010 to 2011 absolute rate of change in the percentage of relative managed care payer revenue is equal to or less than the absolute three-year average annual deviation, then the clinical environment is unchanged or less volatile and thus stable.

In this study, an AHC is in a dynamic clinical environment if either of the two indicators of clinical environment stability produce dynamic results. This approach assumes that competition with health care providers or managed care payers can disrupt stable environments for AHCs (Barrett, 2008; Cairns et al., 2017; Kastor, 2008; Kastor, 2010). Either condition can occur to create a dynamic environment, otherwise the individual AHC clinical environments are stable.

Academic environmental stability or dynamism. While calculating the stability or dynamism of the clinical environment occurs at the individual AHC level, determining the conditions of the academic environment happens at a universal level. The federal government is a significant source of funding for AHC medical schools, which compete with each other in a single environment for these resources, thus all experience stability or dynamism simultaneously. The variable to measure the academic environment is research focused, since grants and contracts represent close to half of medical school annual income from the academic sources (Liaison Committee for Medical Education, 2016a). While education is a principal operation for AHC medical schools and part of the academic environment, student tuition and fees represent less than four percent of annual medical school revenue sources (Liaison Committee for Medical Education, 2016a). Changes in the education environment have relatively little impact on AHC academic resources, and this study focuses on the volatility of the market for research grants. Therefore, the annual proportional change in national NIH R01 grant success rate gauges the academic environment stability or dynamism.

Federal NIH grants play an essential role in an AHC's pursuit of the academic mission (Gerin & Kapelewski, 2011; Hromas et al., 2012), and this study uses annual changes in the competition for NIH grant funding as the basis for the variable measuring the research environment. The NIH R01 grant in particular is “the major funding mechanism for investigator-initiated projects” at medical schools (Hromas et al., 2012, p. 2343), and the variable gauging the stability or dynamism of the research environment is the annual proportional change in the national NIH R01 success rate.

This study uses the three-year average annual proportional rate of change of the national NIH R01 success rate from 2007 to 2010 as the basis to assess the degree of stability of the academic resource environment in 2011 for all AHCs. If the absolute annual proportional rate of change in the success rate from 2010 to 2011 is greater than the three-year annual average absolute proportional rate of change in the success rate from 2007 to 2010, then all AHCs operates in a more volatile and dynamic academic environment than in the recent past. If the 2010 to 2011 absolute rate of change in the success rate is equal to or less than the absolute three-year average annual deviation, then the academic environment is unchanged or less volatile and thus stable.

Overall environmental stability or dynamism. Determining each AHC’s overall environmental stability or dynamism involves combining the results from the clinical and academic environmental condition calculations. Three possible combinations can emerge: 1) both the clinical and academic environments are stable, 2) both the clinical and academic environments are dynamic, or 3) one of the environments is stable and the other dynamic. The first set of outcomes result in an overall stable AHC environment, and the second and third set of outcomes result in an overall dynamic AHC environment. Therefore, this study assumes that if either of the clinical or academic environments are dynamic, then the AHC is in a dynamic environment and the organizational fit is a loose affiliation structure (Donaldson, 2001).

Overlapping environments. While attempts to discern the intricacies of the AHC missions and segregate the components of the clinical and academic environments may offer analytical insights into the complexities of AHC operations, any study of academic medicine should at least acknowledge the interdependencies among the patient care, research, and teaching operations and environments (Rahm, 2015; Rothman et al., 2015; Wartman, 2015). Changes in the stability of the clinical environment could impact the stability of the academic environment and AHC achievement of the academic mission given the medical school reliance on clinical funds (Kennedy et al., 2007; Nonnemaker & Griner, 2001). Potential decreases in clinical income due to greater market competition from other providers and payers may impact research and education operations regardless of the stability of the academic environment. Also, changes in the academic environment may simply intensify the need for AHCs to grow the financial surplus from the patient care operations (Enders & Conroy, 2014; Levin, Maddrey & Bagnall, 2010). AHCs need clinical income to cover the inherent financial losses for research and education, which may exist regardless of the munificence of the academic environment (Rahm, 2015; Rothman et al., 2015; Wartman, 2015). One hypothesis of this study attempts to address this situation, testing whether the status of the clinical environment has a greater impact on AHC organizational structure and mission achievement relative to the status of the academic environment.

AHC organizational structure. Following the calculations of the 2011 AHC environments, this study examines the AHC organization structure in 2011 to determine environmental-structural fit. This section outlines the methods of examining the AHC organizational alignments among the hospital, physician group practice, and medical school. AHC organizational structures fall into one of two categories: consolidated or loose affiliation.

These categories associate with the stable and dynamic environments respectively to create the environmental-structural fits.

The AAMC annual COTH Survey of Hospital Operations and Financial Performance, offers information on AHC organizational structures that gauge the level of integration among the hospital, physician group practice, and medical school. The AAMC survey data coincides with the five Levine organizational alignments as discussed in Chapter 2 (Barrett, 2008), enabling this study to categorize AHCs into the integrated or loose affiliation organizational structures (refer to Figure 1). The AAMC information contains survey questions that produce yes or no responses to the following possible organizational alignments for AHCs, grouped accordingly:

Integrated

A. The university with the medical school owns the hospital through legal control, and either the university or the hospital owns the physician group practice.
B. The hospital own the physician group practice, but the university/medical school is a separate legal entity.
C. The university/medical school owns the physician group practice, but the hospital is a separate legal entity.
D. The university/medical school owns the hospital, but the physician group practice is a separate legal entity.

Loose Affiliation

E. The university/medical school, the hospital, and the physician group practice are under separate, independent ownership arrangements.

This general taxonomy is similar to those in prior studies of AHCs and other health care organizations (Bazzoli et al., 1999; Bazzoli et al., 2000; Chukmaitov et al., 2009; Keroack et al., 2011).

Environmental-structural fit or misfit. With the individual AHC environment and organizational structure information, this study creates the main independent variable in the research model. This study aligns the AHC 2011 organizational structural type with the AHC 2011 environmental status to determine a contextual-structural fit or misfit. Table 12 illustrates how structure fits environment consistent with structural contingency theory (as outlined in Table 11).

Table 12

Combinations of Structure, Environment, and Fit or Misfit

2011 AHC Organization Description	2011 AHC Organization Structure	2011 AHC Clinical/Academic Environment Description	2011 AHC Overall Environment	Environmental-Structural Fit (1), Misfit (0)
Common Ownership (A, B, C, and D)	Integrated	Stable/Stable	Stable	Fit (1)
		Stable/Dynamic	Dynamic	Misfit (0)
		Dynamic/Dynamic	Dynamic	Misfit (0)
Three separate entities (E)	Loose affiliation	Stable/Stable	Stable	Misfit (0)
		Stable/Dynamic	Dynamic	Fit (1)
		Dynamic/Dynamic	Dynamic	Fit (1)

This study involves three forms of the environmental-structural fit variable. The first form is fit or misfit of AHCs in the combined clinical and academic environment, serving as the primary independent variable testing hypotheses 1 and 2. The second form focuses on environmental type sub-groups, measuring fit or misfit in dynamic environments and fit or misfit in stable environments. The second form tests hypothesis 3. The third form focuses on mission environment sub-groups, measuring fit or misfit in the clinical environments and fit or misfit in the academic environment. This third form tests hypothesis 4. Each of these forms of the environmental-structural fit independent variable appear in the regression formulas later in this chapter.

Independent variables: academic environment munificence. Testing hypothesis 2, which states that environmental-structural fit leads to better performance in pursuit of the academic missions, requires independent variables representing the munificence of the environment. Structural contingency theory treats the construct of munificence as a "moderator" of organizational change (Donaldson, 2001, p. 20). For AHCs, a significant producer of economic resources that impacts environmental munificence is the clinical operation (Wartman, 2015). The economics of funds flow and the virtuous cycle begins with clinical operations financial surpluses and investments in the academic mission to facilitate research and education funding and program growth (Kennedy et al., 2007; Pomeroy et al., 2008; Rothman et al., 2015; Wartman, 2008). Testing hypothesis 2 involves reclassifying the dependent variables measuring performance in pursuit of the clinical mission as independent variables impacting performance in pursuit of the academic mission. The three-year average annual proportional rate of change in AHC hospital market share from 2013 to 2016, and the three-year average annual proportional rate of change in total financial margin of each AHC hospital from 2013 to 2016 accompany environmental-structural fit as independent variables testing performance in pursuit of the academic mission (hypothesis 2).

Control variables. This section describes the control variables in this study that represent factors that could impact AHC performance from 2013 to 2016 outside of the environmental-structural fit independent variable. The control variables include past performance from 2007 to 2010, organization structure in terms of size, and elements in the clinical environment that the environmental-structural fit calculation does not overtly capture.

Variables within these three areas have precedence in structural contingency theory analysis or studies involving health care systems, which adds to construct validity.

Empirical work in the structural contingency theory tradition utilizes control variables to account for latent factors that impact the relationship between contextual-structural fit and organizational performance (Donaldson, 2001; Swofford, 2011). The time sequencing inherent in examining environmental conditions, organization structural adaptation, and the resulting performance requires lagged dependent (performance) measures to control for alterations in AHC financial and operational outcomes beyond the influence of environmental-structural fit (Donaldson, 2001). The measures of AHC performance in pursuit of the clinical and academic missions are susceptible to underlying factors such as changes in organizational culture, political climate, or institutional resource decisions to emphasize one mission over another (Swofford, 2011). The controls for the measures of AHC performance are values of the dependent variables preceding the environmental-structural fit measurement in 2011. This study uses three-year annual average proportional rate of change values of the dependent variables on AHC performance, but from 2007 through 2010 as controls for latent factors.

Joining these lagged measures in the analytical models are proposed controls for changes in organizational size, which could potentially influence AHC performance levels. Donaldson (2001) discusses at length the impact organizational size has on the environmental-structural fit to performance relationship. This study utilizes the three-year average annual proportional rate of change in the number of hospital staffed beds and medical school faculty members from 2013 to 2016 to represent adjustments in the capacity capability of the clinical and academic operations respectively, and to control for the effects of organizational size on performance (Bazzoli et al., 2000; Mas, 2013; Ramamonjiarivelo et al., 2015; Swofford, 2011; Yeager et al., 2015). The change in the number of AHC hospital staffed beds controls for organizational size in the tests of hypothesis 1, and the change in the number of AHC medical school faculty controls for organizational size in the tests of hypothesis 2. The number of faculty include all employees of the AHC with faculty appointments at the medical school in both the clinical and basic science departments. The faculty in both types of departments represent the entire academic enterprise of the AHC. Greater capacity in the clinical and academic enterprises could influence AHC market share, total margin, NIH funding and programming, and GME intern and resident FTE outside of the environmental-structural fit, hence the presence of organizational size controls in the model.

Confounding forces exist in the various markets and communities of AHCs that could influence performance in pursuit of the clinical mission. Changing levels of per capita income, population, age distribution, and unemployment are trends in demographic conditions that impact clinical markets (Bazzoli et al., 2000; Ramamonjiarivelo et al., 2015). This study proposes control variables for each of these factors. Three-year average annual proportional rates of change from 2013 to 2016 for AHC market per capita income, population size, and unemployment rate are in the analytical model. Also in the model is the three-year average annual proportional rate of change in the population over age 65 from 2013 to 2016, representing a demographic shift that can change the payer mix from commercial insurance to the less lucrative Medicare or Medicare managed care coverage. Each of these indicators control for clinical environmental factors not present in the environmental-structural fit calculations that could impact changes in AHC performance in pursuit of the clinical mission.

The control for confounding factors in the academic environment that impact AHC pursuit of the research and teaching missions already exists in the analytical model as the organizational size variable. Changes in the number of AHC medical school faculty control for the academic enterprise size as well as the environmental characteristics that can influence changes in the number of researchers and the level of NIH R01 funding (the dependent variables measuring AHC performance in the academic missions). Faculty size addresses the capacity of medical schools to allocate time and resources toward research and graduate medical education, which are two of the dependent variables measuring performance. Universities and AHCs can create environments that involve expanding the faculty in anticipation of academic mission growth, or in response to emerging staffing capacity challenges.

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Research Schematic

Bringing all of the variables and methodological steps together into a single depiction produces the overall research schematic in Figure 10.

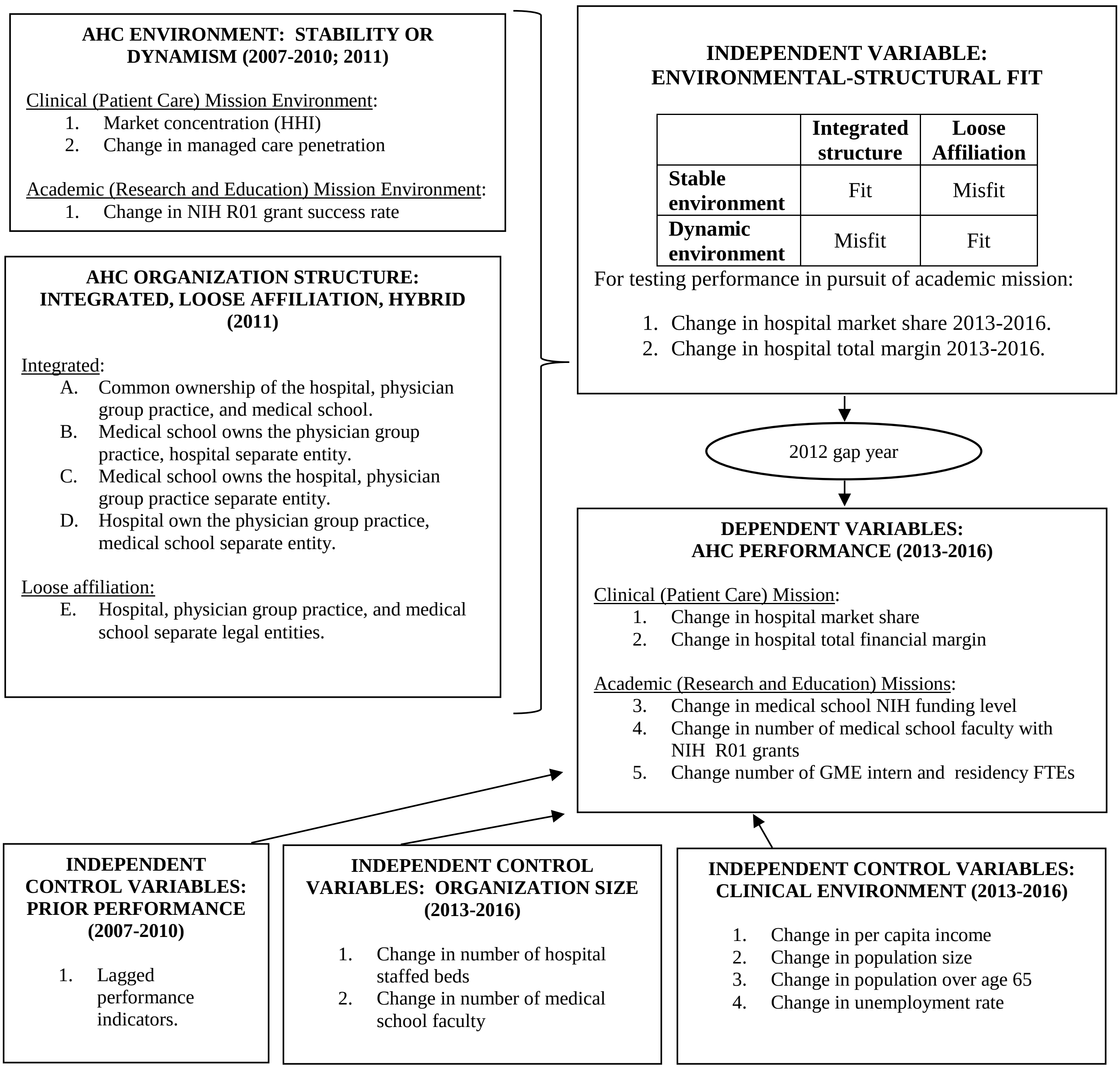

Figure 10. Research Schematic.

Analytic Method

This section outlies the specific analytical model for this study. The research effort employs ordinary least squares multiple regression analyses to test the hypotheses, which are restated below:

H1: AHCs that have an organizational structure that fits the prevailing environment experience better performance in pursuing the clinical mission than AHCs with a structure that misfits the environment.

H2: AHCs that have an organizational structure that fits the prevailing environment experience better performance in pursuing the academic mission than AHCs with a structure that misfits the environment.

H3: AHCs that have an organizational structure that fits a dynamic environment have better performance in pursuing the missions than AHCs with an organizational structure that fits a stable environment.

H4: AHCs that have an organizational structure that fits a prevailing clinical environment have better performance in pursuing the missions than AHCs with an organizational structure that fits a prevailing combined clinical and academic environment.

This section provide justifications for using regression analysis in this study by discussing the statistical validity of the technique in relation to the hypothesis testing. Subsequent sections include the steps to mitigate the threats to achieving statistically valid results, and the outline of the general regression formula.

Statistical validity. This study pursues statistical validity, or the ability to produce accurate and reliable outcomes from a particular statistical test (Vogt, 1993). Regression analysis is an appropriate statistical technique for this study given the natures of the research questions and hypotheses. This dissertation explores whether AHC environmental-structural fit associates with improving performance in pursuing the clinical and academic missions. Regression analysis reveals this type of relationship, assessing the strength of covariation between dependent and independent variables, and then the "importance of … the independent [variable] to the relationship" (Tabachnick & Fidell, 2007, p. 118). The strength of the association between environmental-structural fit and AHC performance controlling for other independent factors, and the importance of fit to improving performance outcomes are effective tests of the hypotheses of this study, which assert that certain structures in specific environments produce improving results. Tabachnick and Fidell (2007) write, "[r]esearchers often use regression to perform what is essentially a covariates analysis in which they ask if some critical variable (or variables) adds anything to a prediction equation for a dependent variable after other independent variables – the covariates – have already entered the equation" (p. 118).

The objective of regression analysis is to determine a set of coefficients of the independent variables that bring the dependent variables values resulting from the equation "as close as possible" to the actual observed dependent variable values (Tabachnick & Fidell, 2007, p. 118). The goal of this study is to see if the coefficient for environmental-structural fit (the dichotomous variable where the value of 1 equals fit and the value of 0 equals misfit) has a strong influence on changes in the AHC performance indicators, explaining some portion of the variance between the observed and predicted values of the performance independent variables. Accomplishing these objectives requires the research design and methodology to manage "practical matters" regarding regression analysis, and this study uses examinations of descriptive statistics to address such issues (Tabachnick & Fidell, 2007, p. 123).

Descriptive statistics: outliers and distributions. Prior to running the regression models, this study compiles and analyzes descriptive statistics of each dependent and control variable, and profiles those AHCs in dynamic environments versus stable environments, AHCs with integrated organizational structures versus loose affiliations, and AHCs that fit the prevailing environmental conditions (combined and clinical only) versus those that misfit the environmental conditions. The "preliminary" examinations of the variables have three objectives: 1) reveal any "errors and anomalies", 2) "understand the distribution of each of the variables" independently, and 3) identify any correlations among the variables (Vittinghoff, Glidden, Shiboski & McCulloch, 2005, p. 7). Almost all of the dependent and control variables are continuous, so the applicable descriptive statistics are the measures of central tendency, standard deviation, and distribution. Errors and anomalies include extreme or missing values, and skewness or kurtosis in the distribution of the values. The profiles of AHCs in dynamic environments versus stable environments, integrated organizational structures versus loose affiliations, and fit versus misfit the environmental conditions include comparisons of the mean values of each dependent and control variable.

Extreme or missing values (outliers) affect regression coefficient values, potentially distorting the independent-dependent variables relationship and threatening statistical validity (Vittinghoff et al., 2005). This study guards against outlying values by using relative measures or proportional changes for the continuous variables, and three-year annual averages to mitigate extreme values. As an additional safeguard, this studies involves examinations of the standard deviations of values from the mean. Treating outliers or missing values typically involves deleting the case from the sample, rescoring the extreme value or calculating the missing value using historic information or comparisons to similar subjects in the sample, or transforming the extreme value such as a conversion to a logarithmic scale (Tabachnick & Fidell, 2007). This study examines extreme and missing values and considers transforming since removing AHCs threatens the statistical power of the model with respect to an adequate sample size.

Abnormal distributions of the variable values also can impact coefficient values, distort the relationships between the independent and dependent measures, and threaten statistical validity (Vittinghoff et al., 2005). Descriptive statistics reveal skewness or kurtosis in the distributions. If such conditions exist then this study considers transforming the values to a logarithmic scale, which would create more normal distributions.

Sample size. The most significant threat to the statistical validity of this study is inadequate sample size. While the sample of 101 AHCs in this study represents 74.3% of the accredited medical schools in 2011, the research model is close to a cases-to-independent variable ratio that creates weak analysis results (Tabachnick & Fidell, 2007). The required sample size for regression models depends on:

- the desired power of the analysis (the probability of detecting a relationship between the independent and dependent variables),
- the alpha level (the probability of committing a type I error or falsely concluding a relationship exists between environmental-structural fit and performance),
- the beta level (the probability of committing a type II error or falsely concluding a relationship does not exist between environmental-structural fit and performance),
- the anticipated effect size (the strength of the relationship, or the proportion of the variability in performance explained by environmental-structural fit), and
- the number of independent variables (Tabachnick & Fidell, 2007, Vogt, 1993).

The objective of this study is to test the hypotheses with enough statistical power to explain the change in the performance variables using environmental-structural fit as the primary independent variable. This would signify that fit has an influence on performance. The targeted alpha value is 0.05 denoting a confidence interval of 95%, and the desired beta value is 0.20. These parameters fit standard expectations of multiple regression according to Tabachnick and Fidell (2007), who use the statistical work of Green (1991) to support the following rule of thumb formula to determine a minimal sample size given the number of independent variables:

$$\text{Sample size} \geq 50 + 8 * (\text{number of independent variables}).$$

Working from the known sample of 101 AHCs in 2011 and the above formula, the study should use no more than six or seven independent variables: $101 \geq 50 + 8$ (6.375 independent variables). The current research design could involve regression models with up to eight independent and control variables together. Knowing, however, that the number of AHCs in the sample may decline given the exclusion criteria, the study must contemplate reducing the number of control variables to achieve the desired statistical power.

Multicollinearity. The next concern regarding statistical validity is multicollinearity, or high correlations among the independent and control variables (Vogt, 1993). The sample size considerations may condense the number of control variables and thereby reduce the overall risk of multicollinearity. Still, this study examines Pearson correlation values among the independent and control variables to determine matrix to determine the degrees of association and whether any are over-lapping and distorting to the analyses (Tabachnick & Fidell, 2007).

Post estimation analyses. The final tests for statistical validity in this study involve examinations of residuals to evaluate assumptions of normality, linearity, and homoscedasticity, and correlations among the coefficients of the regression outcomes (Tabachnick & Fidell, 2007).

The assumptions of regression analysis are that the residual values, or the differences between the observed and predicted performance dependent variable values,

- have a normal distribution around the predicted values,
- have a linear or straight-line relationship with the predicted values, and
- the variance around the predicted values is homoscedastic or approximately the same for all predicted values (Tabachnick & Fidell, 2007).

If the regression output meets these standards then no adjustments to the model are necessary. Failures of normality (through either skewness or kurtosis), linearity, or homoscedasticity can impact the estimates of the variances of variables, and the study may need to transform values to logarithmic scales to mitigate these issues (Vittinghoff et al., 2005). Output testing also examining the standard errors of the regression coefficients for each variable. Correlations among the variable coefficients would produce large standard errors, potentially rendering the coefficients statistically insignificant (Tabachnick & Fidell, 2007).

Regression formulae and analytical approach. The general regression formula to test hypothesis 1 is as follows:

$$\bar{Y}C_{i\ 2013\text{-}2016} = \beta_0 + \beta_1 F_{i\ 2011} + \beta_2 \bar{Y}CL_{i\ 2007\text{-}2010} + \beta_3 COS_{i\ 2013\text{-}2016} + \beta_4 CE_{i\ 2013\text{-}2016} + \varepsilon_i$$

Formula 1. Test of Hypothesis 1.

$\bar{Y}C_{i\ 2013\text{-}2016}$ is the average annual proportional rate of change in the dependent clinical performance variable for AHC i in the years 2013 to 2016, $F_{i\ 2011}$ is the independent environmental-structural fit or misfit variable for AHC i in year 2011, $\bar{Y}CL_{i\ 2007\text{-}2010}$ is the lagged control variable of the average annual proportional rate of change in the clinical performance measure for AHC i in years 2007 to 2010, $COS_{i\ 2013\text{-}2016}$ is the average annual proportional rate of change in the clinical organization size control variable for AHC i in years

2013 to 2016, $CEi_{\ 2013\text{-}2016}$ is the average annual proportional rate of change in the clinical environment control variable for AHC i in years 2013 to 2016, and εi is the error term.

The general regression formula to test hypothesis 2 is as follows:

$$\bar{Y}Ai_{\ 2013\text{-}2016} = \beta_0 + \beta_1 Fi_{\ 2011} + \beta_2 \bar{Y}ALi_{\ 2007\text{-}2010} + \beta_3 AOSi_{\ 2013\text{-}2016} + \beta_4 CEMi_{\ 2013\text{-}2016} + \varepsilon i$$

Formula 2. Test of Hypothesis 2.

$\bar{Y}Ai_{\ 2013\text{-}2016}$ is the average annual proportional rate of change in the dependent academic performance variable for AHC i in the years 2013 to 2016, $Fi_{\ 2011}$ is the independent environmental-structural fit or misfit variable for AHC i in year 2011, $\bar{Y}ALi_{\ 2007\text{-}2010}$ is the lagged control variable of the average annual proportional rate of change in the academic performance measure for AHC i in years 2007 to 2010, $AOSi_{\ 2013\text{-}2016}$ is the average annual proportional rate of change in the academic organization size control variable for AHC i in years 2013 to 2016, $CEMi_{\ 2013\text{-}2016}$ is the average annual proportional rate of change in the clinical munificence environment control variable for AHC i in years 2013 to 2016, and εi is the error term.

The regression analyses for hypotheses 1 and 2 involve a dependent performance variable and the corresponding lagged performance measure as one of the independent variable controls. For instance, if the independent variable is the average annual proportional rate of change in AHC hospital total margin from 2013 through 2016, then the corresponding lagged measure control variable is the average annual proportional rate of change in AHC hospital total margin from 2007 through 2010. Testing hypotheses 1 and 2 involves regression analyses for each of the performance dependent variables. AHCs with organizational structures that fit the prevailing environment ($Fi = 1$) should have a positive and stronger relationship to performance than AHCs that have structures that misfit with the environment ($Fi = 0$).

This study is looking for the following results to reject the nulls of hypotheses 1 and 2:

- A positive coefficient (β_1) for the dichotomous (1 = fit, 0 = misfit) environmental-structural fit/misfit independent variable.
- The coefficients, particularly β_1, are statistically significant.
- A squared multiple correlation (R^2) that accounts for the variance in the values of the independent performance variables at a "meaningful" level, using the F-ratio to test the significance of R^2 (Tabachnick & Fidell, 2007; Vittinghoff et al., 2005, p, 19).

These findings would reveal the relationships between AHC environmental-structural fit and the direction and strength of performance in pursuit of the clinical and academic missions.

Testing hypothesis 3, which asserts that fit in a dynamic environment produces positive and better performance than that fit in a stable environment, involves adding independent variables to the regression equation representing the combinations of the prevailing environments and structures in 2011. The first step involves grouping the AHCs by the prevailing 2011 environmental-structural combinations and then adjusting the regression equations for the dependent clinical performance variables as follows:

$$\bar{Y}Ci_{\,2013\text{-}2016} = \beta_0 + \beta_1 FDi_{\,2011} + \beta_2 FSi_{\,2011} + \beta_3 \bar{Y}CLi_{\,2007\text{-}2010}$$
$$+ \beta_4 COSi_{\,2013\text{-}2016} + \beta_5 CEi_{\,2013\text{-}2016} + \varepsilon i$$

Formula 3. First Test of Hypothesis 3.

$\bar{Y}Ci_{\,2013\text{-}2016}$ is the average annual proportional rate of change in the dependent clinical performance variable for AHC i in the years 2013 to 2016, $FDi_{\,2011}$ is the independent fit variable for AHC i in dynamic environments in year 2011, $FSi_{\,2011}$ is the independent fit variable for AHC i in stable environments in year 2011, $\bar{Y}CLi_{\,2007\text{-}2010}$ is the lagged control variable of the average annual proportional rate of change in the clinical performance measure for AHC i in years 2007 to 2010, $COSi_{2013\text{-}2016}$ is the average annual proportional rate of change in the clinical organization size control variable for AHC i in years 2013 to 2016, $CEi_{2013\text{-}2016}$ is the average annual proportional rate of change in the clinical environment control variable for AHC i in years 2013 to 2016, and εi is the error term. The regression formula for the dependent academic performance variables is as follows:

$$\bar{Y}Ai_{2013\text{-}2016} = \beta_0 + \beta_1 FDi_{2011} + + \beta_2 FSi_{2011} + \beta_3 \bar{Y}ALi_{2007\text{-}2010}$$
$$+ \beta_4 AOSi_{2013\text{-}2016} + \beta_5 CEMi_{2013\text{-}2016} + \varepsilon i$$

Formula 4. Second Test of Hypothesis 3.

$\bar{Y}Ai_{2013\text{-}2016}$ is the average annual proportional rate of change in the dependent academic performance variable for AHC i in the years 2013 to 2016, FDi_{2011} is the independent fit variable for AHC i in dynamic environments in year 2011, FSi_{2011} is the independent fit variable for AHC i in stable environments in year 2011, $\bar{Y}ALi_{2007\text{-}2010}$ is the lagged control variable of the average annual proportional rate of change in the academic performance measure for AHC i in years 2007 to 2010, $AOSi_{2013\text{-}2016}$ is the average annual proportional rate of change in the academic organization size control variable for AHC i in years 2013 to 2016, $CEMi_{2013\text{-}2016}$ is the average annual proportional rate of change in the clinical munificence environment control variable for AHC i in years 2013 to 2016, and εi is the error term. The second step is to run the regression analysis for each dependent performance variable.

This study is looking for the following results to reject the null of hypothesis 3:

- A positive β_1 coefficient for the dichotomous (1 = fit, 0 = misfit) environmental-structural fit/misfit independent variable in dynamic environments.
- The β_1 coefficient is statistically significant.
- A likelihood ratio test comparing β_1 to β_2, where $\beta_1 > \beta_2$.

- A squared multiple correlation (R^2) that accounts for the variance in the values of the independent performance variables at a "meaningful" level, using the F-ratio to test the significance of R^2 (Tabachnick & Fidell, 2007; Vittinghoff et al., 2005, p, 19).

These findings would reveal if fit in a dynamic environment associates with better performance than fit in a stable environment.

Testing hypothesis 4, which asserts that the fit to the clinical environment alone is associates with better performance than fit to the combined clinical and academic environment, requires multiple steps. The first step is to isolate the clinical environment and re-determine fit for each AHC. The second step is to add a variable to the regression equation representing fit or misfit to the clinical environment. The formula for the dependent clinical performance variables is as follows:

$$\bar{Y}Ci_{\ 2013\text{-}2016} = \beta_0 + \beta_1 FCi_{\ 2011} + \beta_2 Fi_{\ 2011} + \beta_3 \bar{Y}CLi_{\ 2007\text{-}2010}$$
$$+ \beta_4 COSi_{\ 2013\text{-}2016} + \beta_5 CEi_{\ 2013\text{-}2016} + \varepsilon i$$

Formula 5. First Test of Hypothesis 4.

$\bar{Y}Ci_{\ 2013\text{-}2016}$ is the average annual proportional rate of change in the dependent clinical performance variable for AHC i in the years 2013 to 2016, $FCi_{\ 2011}$ is the independent fit variable for AHC i in clinical environments in year 2011, $Fi_{\ 2011}$ is the independent environmental (combined clinical and academic)-structural fit or misfit variable for AHC i in year 2011, $\bar{Y}CLi_{\ 2007\text{-}2010}$ is the lagged control variable of the average annual proportional rate of change in the clinical performance measure for AHC i in years 2007 to 2010, $COSi_{\ 2013\text{-}2016}$ is the average annual proportional rate of change in the clinical organization size control variable for AHC i in years 2013 to 2016, $CEi_{\ 2013\text{-}2016}$ is the average annual proportional rate of change in the clinical environment control variable for AHC i in years 2013 to 2016, and εi is the error term. The formula for the dependent academic performance variables is as follows:

$$\bar{Y}Ai_{2013\text{-}2016} = \beta_0 + \beta_1 FCi_{2011} + \beta_2 Fi_{2011} + \beta_3 \bar{Y}ALi_{2007\text{-}2010}$$
$$+ \beta_4 AOSi_{2013\text{-}2016} + \beta_4 CEMi_{2013\text{-}2016} + \varepsilon i$$

Formula 6. Second Test of Hypothesis 4.

$\bar{Y}Ai_{2013\text{-}2016}$ is the average annual proportional rate of change in the dependent academic performance variable for AHC i in the years 2013 to 2016, FCi_{2011} is the independent fit variable for AHC i in clinical environments in year 2011, Fi_{2011} is the independent environmental (combined clinical and academic)-structural fit or misfit variable for AHC i in year 2011, $\bar{Y}ALi_{2007\text{-}2010}$ is the lagged control variable of the average annual proportional rate of change in the academic performance measure for AHC i in years 2007 to 2010, $AOSi_{2013\text{-}2016}$ is the average annual proportional rate of change in the academic organization size control variable for AHC i in years 2013 to 2016, $CEMi_{2013\text{-}2016}$ is the average annual proportional rate of change in the clinical munificence environment control variable for AHC i in years 2013 to 2016, and εi is the error term. The second step is to run the regression analysis for each dependent performance variable.

This study is looking for the following results to reject the null of hypothesis 4:

- A positive β_1 coefficient for the dichotomous (1 = fit, 0 = misfit) environmental-structural fit/misfit independent variable in clinical environments.
- The β_1 coefficient is statistically significant.
- A likelihood ratio test comparing β_1 to β_2, where $\beta_1 > \beta_2$.

- A squared multiple correlation (R^2) that accounts for the variance in the values of the independent performance variables at a "meaningful" level, using the F-ratio to test the significance of R^2 (Tabachnick & Fidell, 2007; Vittinghoff et al., 2005, p, 19).

These findings would reveal if fit to the clinical environment associates with better performance than fit to the combined clinical and academic environment.

Chapter Summary

This chapter outlined the methodology to test the hypotheses consistent with structural contingency theory constructs and propositions. This study follows a non-experimental/post-test, correlational, and retrospective design with a particular chronology. The time sequence follows the theoretical framework and attempts to protect the causal inference that AHC performance from 2013 to 2016 is an effect of environmental-structural fit in 2011. The analytical model complies with structural contingency theory by involving independent control variables that capture environmental demographics and organizational size measures not directly involved in the process to determine environmental-structural fit. The model also includes an independent control variable measuring the performance dependent variables from 2007 to 2010, the period prior to the environmental-structural fit measurement year of 2011. Thus, the design and methods achieve a substantial degree of structural contingency theory construct validity.

This study uses multiple regression as the analytical technique to test the hypotheses. Chapter 5 shows the results of the descriptive statistics, multiple regression models, and the hypotheses tests.

Chapter 5: Results

Introduction

This chapter discusses the treatment of the variables in the study and the results of the statistical analyses to test the hypotheses. The first section shows how this study creates the environmental-structural fit independent variable, and discusses the situation complicating the testing of hypotheses 3 and 4. The second section begins the examinations of descriptive statistics for the dependent and control variables. The third section contains the results of the hypothesis testing and demonstrates why this study is unable to examine hypotheses 3 and 4 using the regression models.

Creating the Environmental-Structural Fit Independent Variable

Determining whether an AHC's organizational structure fits the environment following the descriptions in Chapter 4 involves three steps. The first is to establish if the AHC has an integrated or loose affiliation alignment among the hospital, physician group practice, and medical school. The second is to determine the whether the clinical and academic environmental conditions are stable or dynamic. The third is to build the contingent pairs between structure and environment and determine if each AHC has environmental-structural fit or misfit.

Before performing any of these steps, however, this study examines the data from the AAMC COTH survey, which is the source of the AHC structure and environment information. Incomplete survey data causes a reduction in the study sample size. Fifteen of the 101 AHCs that participate in the 2011 AAMC COTH survey do not submit organizational category information in at least five of the years in the study period of 2007 to 2016. This analysis removes those cases from the sample. Missing survey data to determine the environmental conditions further reduces the sample size. Information gaps exist with the AHC proportional change in managed care penetration, one of the independent variables determining the stability or dynamism of the clinical environment. Seven AHCs have multiple consecutive years of missing data and this study removes these cases from the sample. The resulting data set is a sample of 79 AHCs that have adequate information to determine the types of organizational structure and environment, and eventually environmental-structural fit or misfit. Appendix A contains descriptions of other data management steps addressing missing values and survey response inconsistencies.

Determining the AHC organizational structures. Using the methodology in Table 12 from Chapter 4, this study categorizes each AHC in the sample as having an integrated or loose affiliation organizational structure among the hospital, physician group practice, and medical school. The AAMC COTH survey requests AHCs to disclose the ownership relationship between the medical school (university) and hospital, and the economic relationship between the hospital and the physician group practice. The survey responses allow for five organizational categorizations (A through E), and this study groups the categories into integrated structures or loose affiliations. Table 13 outlines the information.

Table 13

AHCs by Organizational Category

AAMC COTH Categorizations	Number of AHCs in the Sample	Groupings	Count
A. University (medical school) owns hospital, and either own faculty/physician group practice.	8	Integrated Structure	47
B. Hospital owns faculty/physician group practice, university (medical school) separate	16		
C. University (medical school) owns faculty/physician group practice, hospital separate	0		
D. University (medical school) owns hospital, faculty/physician group practice separate	23		
E. University (medical school), hospital, and faculty/physician group practice independent entities	32	Loose Affiliation Structure	32
Totals	**79**		**79**

The categorizations result in 47 AHCs (59% of the sample) with at least two of the three organizational entities in an integrated structural arrangement and 32 AHCs (41% of the sample) with all three entities in a loose affiliation. The single largest arrangement of those AHCs with an integrated structure has the medical school and hospital together with the physician group practice separate (n = 23). None of the integrated AHCs in the sample have the medical school and physician group practice together, with the hospital separate.

Calculating environmental stability or dynamism. The second step in establishing environmental-structural fit is to determine if the AHC environment is stable or dynamic. This study defines the AHC environment as having clinical and academic components, where either patient care market concentration (competition among providers) or changes in managed care payer penetration (competition between providers and payers) measure the clinical environment, and the change in NIH R01 grant award success rates (competition among medical schools) measures the academic environment. Given the concurrent pursuit of the clinical and academic missions at AHCs, if either environment is dynamic then the total combined environment for the AHC is dynamic.

This study assesses the clinical environment in the year 2011 using the HHI value of the AHC hospital AHA/Dartmouth Atlas Health Referral Region market, and the change in the percentage of AHC hospital revenue that originates from managed care payers (the rate of change from 2010 to 2011 compared to the three-year average annual change from 2007 to 2010). Table 14 shows the results.

Table 14

2011 Clinical Environments Summary

N = 79	**HHI > 1,500 Stable**	**HHI ≤ 1,500 Dynamic**	**Totals**	**Managed Care Stable**	**Managed Care Dynamic**	**Totals**	**Total Clinical Environ. Stable**	**Total Clinical Environ. Dynamic**	**Totals**
AHC Count	24	55	79	55	24	79	13	66	79
Percent of Total	30%	70%	100%	70%	30%	100%	16%	84%	100%

Following established standards assessing market competition, HHI values greater than 1,500 signify a highly concentrated and thus stable market, and values less than or equal to 1,500 signify a competitive or dynamic market (Cutler & Morton, 2013; U.S. Department of Justice and the Federal Trade Commission, 2010). Of the 79 AHCs in the sample, 24 or 30% operate in a stable clinical environment and 55 or 70% operate in a dynamic clinical environment as defined by provider market concentration measured through the HHI in the year 2011. Looking at provider to payer competition in 2011 as measured by the change in the percentage of revenue from managed care sources, 55 AHCs or 70% of the sample operate in a stable clinical environment and 24 or 30% operate in a dynamic clinical environment. If either measure (HHI or change in the percentage of revenue from managed care sources) indicates a dynamic clinical environment, then the overall clinical environment is dynamic. This condition results in 13 AHCs or 16% of the sample operating in stable clinical environments and 66 AHCs or 84% of the sample operating in dynamic clinical environments.

The next phase to determine the environmental conditions of AHCs is to gauge the stability or dynamism of the academic environment. This study measures the academic environment for AHCs in 2011 using the national annual new NIH R01 grant award success rate. The change in the success rate from one year to the next indicates the level of competitiveness of the academic environment. This study compares the absolute annual growth or decline of the award success rate from the 2010 to 2011 with the absolute three-year average annual growth or decline from 2007 to 2010. Using the absolute value of the 2007 to 2010 change rates establishes a threshold of volatility, and if the absolute change from 2010 to 2011 is less than that threshold, then the academic environment is stable. If the absolute change from 2010 to 2011 is greater than the threshold, then the academic environment is dynamic. Table 15 shows the results.

Table 15

Analysis of New NIH R01 Grant Award Success Rates (NIH Research Portfolio Online Reporting Tools)

New NIH R01 Grant Awards Success Rates	**2007**	**2008**	**2009**	**2010**	**2011**
New NIH grant award success rates	19.2%	19.0%	17.8%	17.8%	15.1%
Annual growth/decline rates	----	-1.0%	-6.3%	0.0%	-15.2%
Absolute values of annual growth/decline rates		1.0%	6.3%	0.0%	15.2%
3-year annual average of absolute values for 2007 to 2010 vs. 2010 to 2011				2.5%	15.2%
Since the 2010 to 2011 absolute change of 15.2% is greater than the absolute average annual change from 2007 to 2010 of 2.5%, the environment is relatively dynamic.					

The three-year absolute average change in the NIH R01 award success rate from 2007 to 2010 is 2.5%. The absolute annual change in the award success rate from 2010 to 2011 is 15.2% which is well above the immediately preceding three-year period. In fact, the competition for NIH R01 grant awards abruptly intensifies in 2011, dropping to 15.1%. This result indicates a relatively dynamic academic environment for all AHCs in the sample in 2011.

The step is to combine the clinical and academic conditions. This study weighs equally the clinical and academic conditions when determining the overall stability or dynamism of the AHC environment in 2011, due to the importance of both mission areas. Since the academic environment is dynamic in 2011, so is the combined environment. Therefore, all AHC environments are dynamic given the assumption of equally weighing the mission-based environments in the analytical model.

Building fit and misfit between environment and structure. Creating the environmental-structural fit independent variable involves building the contingent pairs between environment and structure. The combined clinical and academic environments for all AHCs in the sample are dynamic, therefore no stable environments exist involving both clinical and academic conditions. Those AHCs with a loose affiliation organizational structure are fits with the combined environment, and those with an integrated structure as misfits with the combined environment. Table 16 displays the structural contingency theory environmental-structural matrix and includes the counts of AHCs from the sample in each category.

Table 16

Fit and Misfit for the Combined Clinical and Academic Environment

Combined Clinical and Academic Environment, and AHC structure, 2011.	**Integrated Structure**	**Loose Affiliation Structure**	**Totals**
Stable environment	Fit [0]	Misfit [0]	**0**
Dynamic Environment	Misfit [47]	Fit [32]	**79**
Totals	**47**	**32**	**79**

Within the dynamic combined clinical and academic environment, 32 AHCs (or 41% of the sample) have a loose affiliation structure and fit the environment. The remaining 47 AHCs (or 59% of the sample) have integrated structures and misfit the dynamic combined environment.

Descriptive Statistics, Outliers, and Transformations of the Dependent Variables

This section discusses the descriptive statistics of the dependent and control variables for the entire sample of 79 AHCs. The purpose of examining descriptive statistics among the dependent and control variables is to reveal any outliers, anomalous distributions of values, or errors that may distort the hypothesis testing. This effort also investigates any correlations among the variables. The results warrant transforming the dependent variable values, and this section describes the technique. Appendix B shows a comparison of mean values for the variables in different groupings of AHCs into dynamic environments and stable environments, integrated organizational structures and loose affiliations, and AHCs that fit and misfit the combined clinical and academic environmental conditions.

Dependent variables. The dependent variables in this analysis are measures of AHC performance across the clinical and academic mission areas, and in many instances contain negative values. The data are three-year averages of annual change rates from 2013 to 2016, so the measures are proportional changes. The dependent variables also have intermittent missing data, including hospital total operating margin and the number of hospital interns and residents. The patterns of this missing data are random, and this study relies on two-year average change rates where data for a third year is missing (Swofford, 2011). Table 17 contains the descriptive statics for the dependent variables.

Table 17

Descriptive Statistics for the Dependent Variables (Untransformed)

Dependent Variable [2013 to 2016 Average Annual Proportional Rate of Change] N = 79	**Mean**	**Standard Deviation**	**Minimum Value**	**Maximum Value**	**Skewness**	**Kurtosis**
Hospital Market Share	0.019	0.059	-0.141	0.359	2.317	13.757
Hospital Total Margin	0.915	13.044	-42.390	105.748	6.360	56.349
Medical School NIH R01 Funding	0.031	0.061	-0.181	0.201	-0.037	2.062
Medical School Percent of Faculty with NIH R01 Funding	-0.031	0.055	-0.174	0.165	0.713	2.153
Interns and Residents	-0.040	0.157	-0.526	0.433	-1.447	3.151

The mean values for average proportional rates of change in AHC hospital market share, total margin, and medical school NIH R01 funding are positive, while the average rates of change in the percentage of medical school faculty with NIH R01 grant funding and the number of interns and residents are negative. The distributions of the dependent variables are non-normal, with kurtosis and skewness values significantly different from zero (alpha level at 0.01 due to the small to moderate sample size) (Tabachnick & Fidell, 2007) for the measures of performance in the clinical mission area (average annual rate changes in AHC hospital market share and total margin). The descriptive statistics of the dependent variables also reveal outliers. One AHC had an average annual rate change in hospital market share value that was 2.8 standard deviations from the mean. Another AHC had an average annual rate of change in hospital total margin value that was 8.1 standard deviations from the mean. Two AHCs had average annual rates of change in interns and residents that were 2.3 and 2.9 standard deviations from the mean respectively. This circumstance could produce an underestimate of the variable variance, and warrants transformation to mitigate the non-normal distributions and other effects of outlying values (Tabachnick & Fidell, 2007).

The primary concern with transforming the dependent variable values in this study is the presence of both positive and negative changes in AHC performance. Yeo and Johnson (2000) have a derivation of the Box-Cox transformation that involves converting negative values using common logarithmic scales. For values greater than zero, the formula is log (value +1), and for values less than zero the formula is –log (-value + 1) (Yeo & Johnson, 2000, p. 956). This study transforms all of the dependent variables using this approach.

Control variables. The time sequencing inherent in structural contingency theory-based analyses requires lagged performance measures to control for alterations in AHC financial and operational outcomes beyond the influence of environmental-structural fit (Donaldson, 2001). Thus, this study includes control variables measuring AHC performance during the time period of 2007 to 2010 preceding the environmental-structural fit measurement in 2011. Table 18 displays the descriptive statistics for the lagged performance control variables.

Table 18

Descriptive Statistics for the Lagged Performance Control Variables

Control Variables [2007 to 2010 Average Annual Proportional Rate of Change] N = 79	**Mean**	**Standard Deviation**	**Minimum Value**	**Maximum Value**
Hospital Market Share	0.020	0.055	-0.194	0.233
Hospital Total Margin	0.776	3.474	-6.146	20.096
Medical School NIH R01 Funding	0.019	0.082	-0.428	0.227
Medical School Change in Percent Faculty with NIH R01 Funding	-0.028	0.075	-0.412	0.188
Interns and Residents	0.009	0.051	-0.324	0.100

Other variables in the analytical model control for the effects of changes in organizational size (clinical organizational size through rate of change in hospital bed count, and academic organizational size through rate of change in the number of medical school faculty), demographics of the various hospital markets (rates of change in population, population over the age of 65, per capita income, and unemployment rate), and whether or not the AHCs operate in a state that implements expanded Medicaid coverage during the 2013 to 2016 study period. Table 19 displays the descriptive statistics for the organizational size and market demographic control variables.

Table 19

Descriptive Statistics for Organizational and Demographic Control Variables

Control Variable [2013 to 2016 Average Annual Proportional Rate of Change] N = 79	**Mean**	**Standard Deviation**	**Minimum Value**	**Maximum Value**
Hospital Bed Count	0.026	0.086	-0.170	0.675
Medical School Faculty Count	0.019	0.033	-0.071	0.141
Hospital Market Population	0.006	0.007	-0.005	0.026
Hospital Market Population Over Age 65	0.032	0.009	0.017	0.063
Hospital Market Per Capita Income	0.018	0.008	-0.009	0.033
Hospital Market Unemployment Rate	-0.124	0.042	-0.223	-0.012

The descriptive statistics for the control variables show both growth and declines among the measures. For the AHCs in the sample, the past performance lagged control variables show average annual rate of change increases in hospital market share, hospital total margin, medical school NIH R01 funding, and the number of interns and residents from 2007 to 2010. The average annual rate of change in the percentage of medical school faculty with NIH R01 funding is negative. Rates of change in hospital bed count, the number of medical school faculty, hospital market population, hospital market population over the age of 65, and hospital market per capita income also show average annual rate increases from 2013 to 2016. The average annual rates of change in the average hospital market unemployment rate from 2013 to 2016 is negative.

The remaining control variable is whether the AHC exists in a state that implements expanded Medicaid coverage for citizens before 2013. Forty-six AHCs reside in Medicaid expansion states and 33 AHCs do not (Kaiser Family Foundation, 2016). This is a bivariate measure with the value 1 equaling a Medicaid expansion state and the value 0 reflecting a non-Medicaid expansion state.

Correlations. The next phase of examining the descriptive statistics in this study is determining the level of correlation among the independent and control variables. The largest correlation among the control variables at 0.863 ($p < 0.000$) is between the average proportional rate of change in medical school NIH R01 funding from 2007 to 2010 and the average proportional rate of change in the percentage of medical school faculty with NIH R01 grants during the same time-period. These two lagging indicators, however, have corresponding dependent variables measuring performance in the 2013 to 2016 time-period, and thus are in separate regressions. The second largest correlation at 0.840 ($p < 0.000$) is between the control variables of average proportional rate of change in hospital market population from 2013 to 2016, and the average proportional rate of change in hospital market population over the age of 65 during the same period. Since one measure is a sub-group of the other, this correlation justifies the elimination of the population over age 65 control variable. The remaining correlations are relatively modest, and are not substantial enough to change the analytical models of this study. Appendix C describes the remaining correlations.

Regression Models Testing Hypotheses 1 and 2

This section contains the results from testing hypotheses 1 and 2. The analyses focus on each dependent variable separately, and involve multiple models for each control variable because of the sample size limitations. To maintain statistical power (alpha of 0.05, beta of 0.20), this study applies the Green (1991) and Tabachnick and Fidell (2007) formula to determine a minimal sample size given the number of independent/control variables. The formula is sample size ≥ 50 + 8 * (number of independent/control variables). This formula results in four (3.65) independent/control variables for the regression formulas in this study, therefore the regression models now contain one independent and three control variables to test the hypotheses. The models also seek to maintain adherence to structural contingency theory, retaining the controls for lagged performance, organizational size, and environmental conditions that could impact performance (Donaldson, 2001). Thus, the independent variable is AHC environmental-structural fit, one control variable is the lagged performance of the AHC, a second control represents clinical or academic organizational size, and a third control variable represents environmental conditions.

Testing hypothesis 1: fit performs better than misfit in pursuit of the clinical mission. This section contains the results for testing hypothesis 1, where the regression models involve the variables related to the clinical mission. The dependent variables measuring performance in the patient care operation are the average proportional change in AHC hospital market share and total margin. The control variable for organizational size is the average proportional rate of change in the count of AHC hospital staffed beds. The control variables for clinical environmental conditions are whether or not the AHC resides in a state that expanded Medicaid, and the average proportional rates of change in AHC hospital market population size, per capita income, and unemployment rate. Since the sample size limits the number of independent and control variables to four per regression model, the tests for hypothesis 1 involve eight equations. Table 20 outlines each model.

Table 20

The Models for Testing Hypothesis 1

Average Proportional Rate of Change Clinical Performance Dependent Variable for AHC i ($\bar{Y}$Ci)		**Independent Variable, Fit for AHC i (Fi)**	**Control, Average Proportional Rate of Change in the Lagged Clinical Performance for AHC i ($\bar{Y}$CLi)**	**Control, Average Proportional Rate of Change in Clinical Organization Size for AHC i (COSi)**	**Control, Average Proportional Rate of Change in Clinical Environment Demographics for AHC i (CEi)***
$\bar{Y}$Ci 2013-2016	**$= \beta 0$**	**$+ \beta_1$ Fi 2011**	**$+ \beta_2$ $\bar{Y}$CLi 2007-2010**	**$+\beta_3$ COSi 2013-2016**	**$+\beta_4$ CEi 2013-2016**
Hospital market share		Environmental – Structural Fit	Hospital market share	Hospital staffed beds	Medicaid expansion state
Hospital market share		Environmental – Structural Fit	Hospital market share	Hospital staffed beds	Hospital market population size
Hospital market share		Environmental – Structural Fit	Hospital market share	Hospital staffed beds	Hospital market per capita income
Hospital market share		Environmental – Structural Fit	Hospital market share	Hospital staffed beds	Hospital market unemployment rate
Hospital total margin		Environmental – Structural Fit	Hospital total margin	Hospital staffed beds	Medicaid expansion state
Hospital total margin		Environmental – Structural Fit	Hospital total margin	Hospital staffed beds	Hospital market population size
Hospital total margin		Environmental – Structural Fit	Hospital total margin	Hospital staffed beds	Hospital market per capita income
Hospital total margin		Environmental – Structural Fit	Hospital total margin	Hospital staffed beds	Hospital market unemployment rate

***** All control variables are average annual proportional changes from 2013 to 2016 except Medicaid expansion state.

Average proportional rate of change in AHC hospital market share from 2013 to 2016. This section contains the results from testing hypothesis 1 using the average proportional rate of change in AHC hospital market share from 2013 to 2016 as a dependent variable. Table 21 displays the regression models and the coefficients corresponding with each independent and control variable.

Table 21

Testing Hypothesis 1 for Average Rate of Change in AHC Hospital Market Share

Hospital Market Share is the Average Annual Proportional Rate of Change from 2013 to 2016 n = 79	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Adjusted R^2 Values	0.114**	0.110**	0.107**	0.113**
Independent Variable				
Environmental-Structural Fit 2011	0.031**	0.029**	0.032**	0.028**
Control Variables (Average Proportional Rates of Change)				
Market Share 2007-2010	0.024	0.013	0.023	-0.007
Hospital Staffed Beds 2013-2016	0.148**	0.158**	0.138*	0.137*
Medicaid Expansion State (yes or no)	0.013			
Market Population 2013-2016		-0.887		
Market Per Capita Income 2013-2016			-0.929	
Market Unemployment Rate 2013-2016				-0.158
Constant	-0.007	0.007	0.018	-0.016
* p < 0.10 ** p < 0.05				

Plots of the predicted and actual residuals show normal distributions around predicted values for the dependent variable, a linear relationship with the predicted values, and homoscedastic variances to predicted values.

The results support the rejection of the null for hypothesis 1 when measuring AHC performance using the average proportional rate of change in AHC hospital market share from 2013 to 2016. All four regression models have statistically significant R^2 values, explaining 10.7% to 11.4% of the variance of the dependent variable. Environmental-structural fit has statistically significant coefficient values in each regression model, and the coefficient value is positive (within a 95% confidence interval). In Model 1, AHCs with fit associate with a 3.1% higher average annual growth rates in hospital market share than AHCs in a misfit arrangement, controlling for changes in organization size and market demographics. In Models 2, 3, and 4, the higher market share growth rates are 2.9%, 3.2%, and 2.8% respectively. Organizational size, or the average proportional rate of change in hospital staffed beds, is the only control with statistically significant coefficients. In Model 1, a percentage growth rate increase of hospital beds increases the average annual rate of growth in hospital market share by 14.8%. In Models 2, 3, and 4, the higher market share growth rates are 15.8%, 13.8%, and 13.7% respectively.

Average proportional rate of change in AHC hospital total margin from 2013 to 2016. This section contains the results from testing hypothesis 1 using the average proportional rate of change in AHC hospital total margin from 2013 to 2016 as a dependent variable. Table 22 shows the regression models and the coefficients corresponding with each independent and control variable. Plots of the predicted and actual residuals show normal distributions around predicted values for the dependent variable, a linear relationship with the predicted values, and homoscedastic variances to predicted values.

Table 22

Testing Hypothesis 1 for Average Proportional Rate of Change in AHC Hospital Total Margin

Hospital Total Margin is the Average Annual Proportional Rate of Change from 2013 to 2016 n = 79	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Adjusted R^2 Values	0.272**	0.262**	0.257**	0.243**
Independent Variable				
Environmental-Structural Fit 2011	-0.228	-0.173	-0.250	-0.196
Control Variables (Average Proportional Rates of Change)				
Market Share 2007-2010	0.008	0.010	0.010	0.010
Hospital Bed Count 2013-2016	-5.740**	-5.970**	-5.491**	-5.559**
Medicaid Expansion State (yes or no)	-0.336			
Market Population 2013-2016		21.532		
Market Per Capita Income 2013-2016			22.125	
Market Unemployment Rate 2013-2016				-1.174
Constant	0.459**	0.119	-0.143	0.099
* p < 0.10 ** p < 0.05				

The results with the average proportional rate of change in AHC hospital margin as the dependent variable do not support rejecting the null for hypothesis 1. While the regression models are statistically significant, the coefficients for environmental-structural fit are not.

Testing hypothesis 2: fit performs better than misfit in pursuit of the academic mission. This section reports the results from testing hypothesis 2. The regression models involve the variables related to the academic mission. Two dependent variables measure performance in the research operation, 1) the average proportional rate of change in AHC medical school NIH R01 funding, and 2) the average proportional rate of change in the percentage of faculty with NIH R01 funding. The dependent variable measuring performance in the education operation is the average proportional rate of change in the number of interns and residents. The control variable for organizational size is the average proportional rate of change in the count of AHC medical school faculty. The control variables measuring academic environmental munificence are the average proportional rate of change in AHC hospital market share from 2013 to 2016, and the average proportional rate of change in AHC hospital total margin from 2013 to 2016. These are the dependent variables from testing hypothesis 1, and here these measures represent the ability of the clinical operation to flow resources in support of the academic mission. Since the sample size limits the number of independent and control variables to four per regression model, the tests for hypothesis 2 involve six equations. Table 23 outlines each model.

Table 23

The Models for Testing Hypothesis 2

Average Proportional Rate of Change, Academic Performance Dependent Variable for AHC i (ȲAi)		Independent Variable, Fit for AHC i (Fi)	Control, Average Proportional Rate of Change in Lagged Academic Performance for AHC i (ȲALi)	Control, Average Proportional Rate of Change in Academic Organization Size for AHC i (AOSi)	Control, Average Proportional Rate of Change in Clinical Environmental Munificence for AHC i (CEMi)
ȲAi 2013-2016	**= β0**	**+ β1 Fi 2011**	**+ β2 ȲALi 2007-2010**	**+β3 AOSi 2013-2016**	**+β3 CEMi 2013-2016**
Medical school NIH R01 funding		Environmental – Structural Fit	Medical school NIH R01 funding	Medical school faculty count	Hospital market share
Medical school NIH R01 funding		Environmental – Structural Fit	Medical school NIH R01 funding	Medical school faculty count	Hospital total margin
Percentage of medical school faculty with NIH R01 funding		Environmental – Structural Fit	Medical school faculty with NIH R01 funding	Medical school faculty count	Hospital market share
Percentage of medical school faculty with NIH R01 funding		Environmental – Structural Fit	Medical school faculty with NIH R01 funding	Medical school faculty count	Hospital total margin
Interns and residents		Environmental – Structural Fit	Interns and residents	Medical school faculty count	Hospital market share
Interns and residents		Environmental – Structural Fit	Interns and residents	Medical school faculty count	Hospital total margin

Average proportional rate of change in AHC medical school NIH R01 grant funding from 2013 to 2016. This section describes the tests of hypothesis 2 using the academic mission performance dependent variable of average proportional rate of change in AHC medical school NIH R01 grant funding from 2013 to 2016. Plots of the predicted and actual residuals show normal distributions around predicted values for the dependent variable, a linear relationship with the predicted values, and homoscedastic variances to predicted values. Table 24 shows the results for each regression model.

Table 24

Testing Hypothesis 2 for Rate of Change in AHC Medical School NIH R01 Funding

Medical School NIH R01 Funding is the Average Annual Proportional Rate of Change from 2013 to 2016 n = 79	**Model 1**	**Model 2**
Adjusted R^2 Values	0.085**	0.076**
Independent Variable		
Environmental-Structural Fit 2011	0.039**	0.033**
Control Variables (Average Proportional Rates of Change)		
NIH R01 Funding 2007-2010	0.045	0.063
Faculty Count 2013-2016	0.354*	0.304
Hospital Market Share 2013-2016	-0.135	
Hospital Total Margin 2013-2016		-0.005
Constant	0.009	0.010

* $p < 0.10$
** $p < 0.05$

The results support the rejection of the null for hypothesis 2 when measuring AHC academic performance using the average proportional rate of change in AHC medical school NIH R01 funding from 2013 to 2016. Both regression models have statistically significant R^2 values, explaining 7.6% and 8.5% of the variance of the dependent variable. Environmental-structural fit has statistically significant coefficient values in each regression model, and the coefficient value is positive (within a 95% confidence interval). In Model 1, AHCs with fit have an association with a 3.9% higher average annual rate of growth in medical school NIH R01 funding than AHCs in a misfit arrangement, controlling for changes in organization size and market demographics. In Model 2, the higher market share growth rate is 3.3%. Organizational size, or the average rate of change in the medical school faculty count, is the only control with a statistically significant coefficient, and this occurs only in Model 1. A percentage increase in the rate of growth of medical school faculty decreases the average annual rate of growth in medical school NIH R01 funding by 13.5%. Average proportional rates of change in hospital market share and total margin, measuring environmental munificence, have negative associations with the dependent variable in both models, but the coefficients are not statistically significant.

Average proportional rate of change in the percentage of AHC medical school faculty with NIH R01 grant funding from 2013 to 2016. This section describes the tests of hypothesis 2 using the academic mission performance dependent variable of the average proportional rate of change in the percentage of AHC medical school faculty with NIH R01 grant funding from 2013 to 2016. Plots of the predicted and actual residuals show normal distributions around predicted values for the dependent variable, a linear relationship with the predicted values, and homoscedastic variances to predicted values. Table 25 shows the results for each regression model.

Table 25

Testing Hypothesis 2 for Rate of Change in Percent Faculty with NIH R01 Funding

Percent of Medical School Faculty with NIH R01 Funding is the Average Annual Proportional Rate of Change from 2013 to 2016 n = 79	**Model 1**	**Model 2**
Adjusted R^2 Values	0.169**	0.183**
Independent Variable		
Environmental-Structural Fit 2011	0.023*	0.022**
Control Variables (Average Proportional Rates of Change)		
Percent of Faculty with NIH R01 Funding 2007-2010	0.002	0.024
Medical School Faculty Count 2013-2016	-0.612**	-0.597**
Hospital Market Share 2013-2016	0.051	
Hospital Total Margin 2013-2016		-0.007
Constant	-0.028**	-0.026**
* p < 0.10 ** p < 0.05		

The results support the rejection of the null for hypothesis 2 when measuring AHC academic performance using the average proportional rate of change in the percentage of AHC medical school faculty with NIH R01 funding from 2013 to 2016. Both regression models have statistically significant R^2 values, explaining 16.9% and 18.3% of the variance of the dependent variable. Environmental-structural fit has statistically significant coefficient values in each regression model, and the coefficient value is positive (within a 95% confidence interval). In Model 1, AHCs with fit have an association with a 2.3% higher average annual rate of growth in the percentage of medical school faculty with NIH R01 funding than AHCs in a misfit arrangement, controlling for changes in organization size and market demographics. In Model 2, the higher market share growth rate is 2.2%. Organizational size, or the average rate of change in medical school faculty count, is the only control with a statistically significant coefficient in both models and is negative. In Model 1, a percent increase in the average annual rate of growth in medical school faculty count associates with a 61.2% decrease in the average annual rate of growth in the percentage of medical school faculty with NIH R01 funding. In Model 2 the decrease is 59.7%. Average proportional rates of change in hospital market share and total margin, measuring environmental munificence, have coefficients that are not statistically significant.

Average Proportional Rate of Change in AHC Residents and Interns from 2013 to 2016. This section describes the tests of hypothesis 2 using the academic mission performance dependent variable of the average proportional rate of change in AHC residents and interns from 2013 to 2016, which represents the AHC education operation. Plots of the predicted and actual residuals show clustered values for the dependent variable, indicating non-normal distributions (Tabachnick & Fidell, 2007). Table 26 shows the summary results for each regression model.

Table 26

Testing Hypothesis 2 for Rate of Change in AHC Residents and Interns

Interns and Residents is the Average Annual Proportional Rate of Change from 2013 to 2016 n = 79	**Model 1**	**Model 2**
Adjusted R^2 Values	-0.018	0.008
Independent Variable		
Environmental-Structural Fit 2011	-0.011	0.011
Control Variables (Average Proportional Rates of Change)		
Interns and Residents 2007-2010	-0.247	-0.096
Medical School Faculty Count 2013-2016	0.297	0.368
Hospital Market Share 2013-2016	0.380	
Hospital Total Margin 2013-2016		0.030*
Constant	-0.038*	-0.044**
* $p < 0.10$ ** $p < 0.05$		

None of the results in Table 26 allow for the rejection of the null to hypothesis 2 with the average proportional rate of change in AHC residents and interns as the dependent variable. The adjusted squared multiple correlation (adjusted R^2) values are close to zero or negative, indicating the insignificance of the independent and control variables in the analysis (Tabachnick & Fidell, 2007).

Hypotheses 3 and 4

This section discusses the efforts to create the necessary samples of AHC groupings to test hypotheses 3 and 4, and how the results of these efforts are not adequate for the regression models. The first part of this section describes the need to redefine environment and structure to produce the AHC groupings to test hypotheses 3 and 4. The second part of this section focuses on the conditions that preclude testing of hypothesis 3, and the third discusses the conditions that preclude the testing of hypothesis 4.

Creating the samples to test hypotheses 3 and 4. The combined clinical and academic environment and the results of the environmental-structural fit/misfit exercise in Table 16 enable the testing of hypotheses 1 and 2, but the lack of variation in the academic environment prevents the testing of hypothesis 3 and provides only part of the information necessary to test hypothesis 4. Hypothesis 3 predicts that AHCs in a fit arrangement with a dynamic environment perform better than those with a fit arrangement in a stable environment, and hypothesis 4 predicts that fit in the clinical-only environment generates better performance that fit in the combined environment. To create an adequate number of stable environments to test hypotheses 3 and 4, this study changes the definition of environment using only the clinical forces. Thus, only HHI values in 2011 and the change in managed care penetration are the measures of environmental stability or dynamism. The results are 13 AHCs in stable conditions and 66 AHCs in dynamic conditions.

These adjustments to the definition of environment causes changes in the definition of structure. Since the clinical-only environment excludes the forces of the academic mission, the AHC organizational structure should focus only on the clinical operations of the hospital and physician group practice. Integrated structures are now categories A and B, and loose affiliations become categories C, D, and E (see Table 13). The results of this change are 24 AHCs with integrated structures and 55 AHCs with loose affiliations.

Creating the environmental-structural fits with these modifications produces samples of AHCs in the groupings necessary to consider hypotheses 3 and 4. Five AHCs fit the stable clinical-only environment and 47 fit the dynamic clinical-only environment. Table 27 shows the distribution of fit and misfit AHCs.

Table 27

Fit and Misfit for the Clinical-Only Environment and Clinical Structure

Clinical-Only Environment, and AHC Clinical Structure, 2011.	**Integrated Structure**	**Loose Affiliation Structure**	**Totals**
Stable environment	Fit [5]	Misfit [8]	**13**
Dynamic Environment	Misfit [19]	Fit [47]	**66**
Totals	**24**	**55**	**79**

Testing hypothesis 3 involves a sample of 52 AHCs, comparing performance of five AHCs with fit in a stable environment to 47 AHCs with fit in a dynamic environment.

Testing hypothesis 4 involves comparing performance of the 52 AHCs with fits in the clinical-only environment (Table 27) with the 32 AHCs with fits in the combined clinical and academic environment (Table 16). Fits in the clinical-only environment use only the hospital and physician group practice to determine structure, and fits in the combined environment use the hospital, physician group practice, and medical school to determine structure. A complication arises, however, when AHCs have fits in both environmental circumstances. Twenty-eight AHCs fit both the clinical-only environment and the combined only environment. Removing these cases creates a sample of 28 AHCs to test hypothesis 4, comparing the performance of 24 unique AHCs that fit the clinical-only environment (and not the combined) with four unique AHCs that fit the combined environment (and not the clinical-only).

Hypothesis 3: fit in dynamic clinical-only environments performs better than fit in stable clinical-only environments. This section discusses the original models to test hypothesis 3 and the complications that prevent the exercise from occurring. What follows is a brief review of the intended regression equations, and a description of the sample size limitations including concerns regarding consistency with structural contingency theory-based analyses. This section concludes with a simple comparison of mean values of the dependent variables between the two groups of AHCs in hypothesis 3.

The third hypothesis directly compares AHC performance in organizational-structural fit arrangements in the stable and dynamic environments. The original models contain two variables representing fit in dynamic and stable environments respectively, and three control variables (see Formulas 3 and 4 in Chapter 4). This study intends to perform a likelihood ratio test to compare the coefficient of the fit-dynamic environment independent variable to the coefficient of the fit-stable environment independent variable, rejecting the null to hypothesis if the former coefficient is greater than the latter coefficient. The sample size of 53 AHCs from Table 27 to test hypothesis 3 (five AHCs fit the stable environment and 47 fit the dynamic environment), however, cannot accommodate any independent and control variables in the regression model following the sample size standard of Green (1991) and Tabachnick and Fidell (2007): sample size ≥ 50 + 8 * (number of independent variables), 52 ≥ 50 + 8 * (0.250 independent variables).

Given the sample size constraints, this study cannot test hypothesis 3 using the multiple regression models in Formulas 3 and 4, which contain the necessary independent and control variables necessary to apply structural contingency theory. Environmental-structural fit is an essential theoretical construct and independent variable, and so are controls for past performance, organizational size, and market demographics (Donaldson, 2001). Tests of structural contingency propositions should inter-relate these constructs in an analysis that accounts for simultaneous effects, and the sample size limits preclude the presence of the necessary independent and control variables.

Thus, this study attempts a minimal analysis to gain some insight into the research question behind hypothesis 3. Performing a simple comparison of the transformed dependent performance variable mean values between the fit group in the stable environment to the fit group in the dynamic environment produces the results in Table 28.

Table 28

Comparison of Means, AHCs That Fit the Clinical-Only Environment

Transformed Dependent Variables (Average Annual Three-Year Proportional Rates of Change from 2013 to 2016)	**Fit Stable Clinical-Only Environment** Mean Values (n = 5)	**Fit Dynamic Clinical-Only Environment** Mean Values (n = 47)
Dependent Variables		
Hospital Market Share	-0.010	0.028
Hospital Total Margin	0.312	0.053
Medical School NIH R01 Funding	0.019	0.036
Medical School Percent Faculty with NIH R01 Funding	-0.046	-0.025
Interns and Residents	-0.009	-0.038

* $p < 0.10$
** $p < 0.05$

Setting aside for a moment the statistical concerns regarding adequate sample sizes and the lack of a model testing the associations among dependent, independent, and control variables, this simple comparison of mean values for the dependent performance variables produces data showing fit in the dynamic environment outperforms fit in the stable environment in the average proportional rates of change in AHC hospital market share, medical school NIH R01 funding, and percentage of medical school faculty with NIH R01 funding. None of the differences in mean values are statistically significant.

In conclusion, the sample size limitations preclude this study from testing hypothesis 3 using the statistical models consistent with the propositions of structural contingency theory. Unfortunately, the same circumstances exist regarding the testing of hypothesis 4.

Hypothesis 4: fit in clinical-only environments performs better than fit in combination clinical and academic environments. This section, similar to the preceding discussion, addresses the original models to test hypothesis 4 and the complications that prevent the exercise from occurring. What follows is a brief review of the regression equations and a description of the sample size limitations. This section concludes with a simple comparison of mean values of the dependent variables between the two groups of AHCs for hypothesis 4.

Testing hypothesis 4 compares AHCs that the fit to the clinical-only environment with AHCs that fit the combined clinical and academic environment. The hypothesis asserts that fit in the clinical-only environment associates with better performance than fit to the combined clinical and academic environment. The foundation for this assertion is that fit to the clinical environment is more important to performance for the AHC given the reliance of the academic mission on funds flows from the patient care operations.

The original model contains two independent variables, representing fit in the clinical-only environment and fit in the combined clinical and academic environment, and three control variables (see Formulas 5 and 6 in Chapter 4). This study intends to perform a likelihood ratio test to compare the coefficient of the fit-clinical-only environment independent variable to the coefficient of the fit-combined environment independent variable, rejecting the null to hypothesis if the former coefficient is greater than the latter coefficient.

As with the testing of hypothesis 3, sample size limitations preclude the testing of hypothesis 4. The small sample size fails to meet a minimum multiple regression threshold level using the Green (1991) and Tabachnick and Fidell (2007) standard: sample size ≥ 50 + 8 * (number of independent variables), 28 ≥ 50 + 8 * (-2.75 independent variables). Negative 2.75 independent variables is unworkable.

Performing a simple comparison of the dependent performance variable mean values between the fit group in the clinical-only environment to the fit group in the combination environment produces the results in Table 29.

Table 29

Comparison of Means, AHCs That Fit Clinical-Only or Combined Environment

Transformed Dependent Variables (Average Annual Three-Year Proportional Rates of Change from 2013 to 2016)	**Fit Clinical-Only Environment** Mean Values (n = 24)	**Fit Combined Environment** Mean Values (n = 4)
Dependent Variables		
Hospital Market Share	0.007	0.029
Hospital Total Margin	0.317	-0.636
Medical School NIH R01 Funding	0.020	0.067
Medical School Percent Faculty with NIH R01 Funding	-0.040	0.006
Interns and Residents	-0.037	-0.046

* $p < 0.10$
** $p < 0.05$.

Again, setting aside for a moment the statistical concerns regarding adequate sample sizes and the lack of a model testing the associations among dependent, independent, and control variables, this study can observe that fit in the clinical-only environment outperforms fit in the combined environment in the average proportional rates of change in AHC hospital total margin and interns and residents. None of the differences in mean values are statistically significant.

In conclusion, the sample size limitations preclude this study from testing hypothesis 4 using the statistical models that comply with the propositions of structural contingency theory.

Chapter Summary

This study attempts to create models of analysis that offer insights into how the alignment of organizational structure to environmental conditions at AHCs relate to performance in the pursuit of the clinical and academic missions. Following the propositions of structural contingency theory, this study endeavors to test four hypotheses, two of which assert that environmental-structural alignment or fit generates better performance than misalignment or misfit, and two of which contend that aligning with dynamic and clinically oriented environments is more influential on performance than aligning with stable environments and ones that include academic forces. This study produces mixed results when testing the first two hypotheses, and encounters inadequate sample sizes to test the latter two hypotheses.

This chapter outlines the methods of preparing and managing the data, calculating the components of the environmental-structural fit independent variable, and testing the hypotheses using multiple regression analysis. Maintaining an adequate sample size is a prevalent theme throughout the effort. Ultimately, the analyses testing hypotheses 1 and 2 involve 79 AHCs, but when this study sub-divides the sample to test hypotheses 3 and 4, the number of AHCs in the analyses could not support the presence of the independent and control variables necessary to comply with the tenets of structural contingency theory and the multiple regression technique.

This study finds mixed results for hypotheses 1 and 2. For the AHC clinical mission, environmental-structural fit has a positive and statistically significant association with growth in the hospital market share, controlling for changes in organizational size and demographic factors in the hospital market, including whether or not the AHC operates in a Medicaid expansion state. This study could not reject the null for hypothesis 1 when measuring the effect of environmental-structural fit on the average proportional rate of change in hospital total margin. For the AHC academic mission research operations, environmental-structural fit has a positive and statistically significant association with the AHC medical school average proportional rates of change in NIH R01 funding and the percentage of faculty with NIH R01 funding, controlling for organizational size and environmental munificence. This study could not reject the null for hypothesis 2 when measuring the effect of environmental-structural fit on academic mission educational operations with the dependent variable of the average proportional rate of change in the number of interns and residents.

The next chapter of this dissertation discusses the findings of this study. Chapter 6 addresses the five research questions and four hypotheses, comments on structural contingency theory and the implications of the analytical results for AHCs. Finally, the chapter concludes with the implications of the findings for academic medicine and suggestions for future research.

Chapter 6: Conclusions and Implications

This chapter discusses the findings of this study, putting the results in the context of previous empirical research and structural contingency theory. The first section reviews each research question and hypothesis. The second section is a commentary on the application of structural contingency theory and a critique of the constructs and propositions. The third section addresses several implications of the findings on AHCs. The fourth section outlines the limitations of this study with respect to the methods, theoretical framework, and ability to capture the operational and organizational nature of AHCs. The fifth section discusses how the limitations lead to suggestions for future research. The final section concludes this dissertation.

Discussion of the Findings

The purpose of this study is to analyze the relationships among environments, organizational structures, and the pursuit of the clinical and academic missions at AHCs. Five research questions and four hypotheses set the direction of the analysis, and the following narrative discusses each one.

Research question 1. The first research question is whether AHCs adopt organizational structures appropriate to environmental conditions. Drawing upon the constructs of structural contingency theory, this study shows that 47 of the 79 AHCs in the sample have environmental-structural fits when measuring the stability or dynamism of the environment combining clinical and academic conditions (see Table 16). This study uses a bimodal model for structure and environment, classifying each in one of two categories. Structures are either integrated or loosely affiliated, and environments are either stable or dynamic. These classifications allow this study to create the theoretical contingent pairs that produce environmental-structural fit and address the first research question. While this approach may appear overly simple, the model is consistent with the methods of prior research and the structural contingency theory definitions of the constructs.

The literature on AHCs involves complex notions of structure, but empirical research typically uses the two category approach. Kastor (2004) and Levine (Barrett, 2008) conceptualize an organizational continuum for AHCs, where a hospital, physician group practice, and medical school integrate or affiliate to certain degrees. Kirch et al. (2005) and Levine et al., (2008) describe AHC organizational forms with nuance where, for example, the hospital and physician group practice are separate, but the hospital employs the physicians or the physicians have dual employment arrangements with the medical school. While AHCs can adopt as many as five combinations in Levine's continuum of alignments (see Figure 1), this study follows Wartman (2008), who simplifies AHC structures into the two categories of integrated and split/splintered (loose affiliation). Keroack et al. (2011), Livingston (2001), and Nonnemaker and Griner (2001) apply the two-category approach to structure in empirical research of AHCs as well.

Using the two categories of structure also is consistent with structural contingency theory. Burns and Stalker (1961) define structure two ways: mechanistic or integrated and organic or loosely affiliated. Donaldson (2001) recommends this direct delineation of organizational forms in research applications of structural contingency theory.

Similar to the definition of structure, the simple characterization of environment as either stable or dynamic is consistent with past research and the standards of structural contingency theory. Rahm (2015) and Rothman et al. (2015) observe that AHCs operate in a singular complex environment combining the clinical and academic missions. While past studies of

AHCs focus only on the clinical economic conditions (Nonnemaker & Griner, 2001; Szabat & Walsh, 2007), such an approach omits the academic presence, which generates economic value to the clinical enterprise (Wartman, 2008), and so this study uses a combined clinical and academic environment. Characterizing a complex environment simply as stable or dynamic also is consistent with prior studies that emphasize the effects of environmental change on AHC strategies involving reorganizations (Barrett, 2008; Cairns et al., 2017; Kastor, 2008; Mallon, 2003; Pizzo, 2008). AHCs experiencing changing environments are transitioning from more stable conditions, and this logical sequence is the foundation for classifying environments as either stable or dynamic in structural contingency theory. Market stability or dynamism are the theoretical contingencies that characterize environments (Dess & Beard, 1984; Donaldson, 2001; Pennings, 1975).

Finally, for this study to address the first research question in the context of prior research and structural contingency theory, the AHC structure and environment must meet in contingent pairs. The literature on AHCs associates an integrated structure with a stable environment to build clinical market share and cross-subsidize academic efforts (Barrett, 2008; Daniels & Carson, 2011; Wartman, 2010). An integrated structure in a stable environment is a theoretical fit for the same reasons (Burns & Stalker, 1961). The literature on AHCs also associates a loose affiliation structure with dynamic environments to enable flexible and timely strategic responses to conditions (Barrett, 2008; Keroack et al., 2011). A loose affiliation structure in a dynamic environment is a theoretical fit for the same purposes (Burns & Stalker, 1961; Drazin et al., 2014).

In conclusion, the definitions and categories in this study for structure, environment, and fit are consistent with prior studies of AHCs and the constructs of structural contingency theory, enabling the analysis of the first research question. Fifty-nine percent of the AHCs in the sample of this study are in a fit arrangement. Therefore, this study offers evidence that AHC organizational structures fit the environment.

Research question 2 (hypothesis 1). The second research question, which shapes the first hypothesis, is whether AHCs in an environmental-structural fit associate with better performance in pursuing the clinical mission than AHCs in a misfit arrangement. The results of this study suggest that AHCs with fit have a greater rate of growth in hospital market share than AHCs in a misfit arrangement (see Table 21). The analysis, however, does not find a relationship between fit and a better rate of growth in hospital total margin (see Table 22).

The mixed results from testing hypothesis 1 could originate from a lack of specificity regarding the type of patient fueling the rate of growth in market share. This study presumes that greater market share makes an AHC more competitive (Kaiser, 2015). However, if a hospital attracts a greater number of patients that have Medicare or Medicaid coverage or with low acuity levels, then the hospital's total margin could decline (McCue & Thompson, 2011; Stimpson et al., 2014). Medicare and Medicaid reimbursements are typically fifty percent lower than payments from commercial insurers, and the margins for lower acuity cases are narrow or even negative compared to episodes of care such as surgeries or complex diagnostic testing (Stimpson et al., 2014; Rothman et al., 2015).

Thus, a growing market share may not serve as a good indicator of AHC hospital success in pursuing the clinical mission. Structural contingency theory asserts that temporal sequencing is necessary, where environmental conditions lead to organizational change, and if the restructuring fits the environment, then better performance will follow (Donaldson, 2001; Lawrence & Lorsch, 1967; Kaiser, 2015). The performance indicators also could come in sequence, where market share increases occur first then total margin growth would follow. This study, which measures changes in both market share and total margin simultaneously across the same three-year period, did not allow the time for this sequencing scenario to occur, which could explain the mixed results.

The mixed results from testing hypothesis 1 also could indicate that AHCs may face competing priorities among the hospital, physician group practice, and medical school rather than operate synergistically. In this study, a loose affiliation is the organizational structure that fits the dynamic combined environment, and therefore the AHC entities may function with a degree of independence pursing different priorities that deplete the hospital total margin. This outcome could occur if, for instance, the medical school prioritizes research that does not translate to the clinical operations and halts the virtuous cycle.

Research question 3 (hypothesis 2). The third research question, which shapes the second hypothesis, is whether AHCs with an environmental-structural fit associate with better performance in pursuing the academic mission than AHCs with environmental-structural misfit. The results of this study show that fit relates to greater growth rates in both medical school NIH funding and the percentage of faculty with NIH funding than misfit (see Tables 23 and 24). The analysis, however, does not find a relationship between fit and the rate of growth of interns and residents, which is the performance indicator of education operations (see Table 26). The models testing hypothesis 2 contain variables controlling for changes in environmental munificence from 2013 to 2016, which is the ability of the AHC hospital to resource the academic mission through a growing market share and total margin. Only the coefficient for the rate of growth in hospital total margin in the model for interns and residents is statistically significant.

The results from testing hypothesis 2 could reflect different research operations strategies of the AHC medical school. The tactics could focus on growing NIH R01 funding over other types of grants, and supporting faculty capable of qualifying as principal investigators to earn NIH R01 awards (Hromas et al., 2012). The analysis involving the growth rate of NIH R01 funding shows a positive association with increases in the rate of growth of medical school faculty (see Table 24), demonstrating success in such an effort, as would an increase in the percentage of faculty with NIH R01 funding (Clarke et al., 2015; Mitka, 2007; Rodin, 2004). However, the model using the percentage of faculty with NIH R01 awards produces a statistically significant and negative coefficient for the rate of change in medical school faculty count (see Table 25). This outcome indicates that increases in the rate of growth in medical school faculty counts decrease the rate of growth in the percentage of faculty with NIH R01 funding. While this circumstance appears inconsistent with strategies to grow NIH R01 funding, the situation could indicate hiring fewer NIH R01 funded faculty, but those recruits with NIH R01 funding have multiple awards with large dollar amounts.

The results of the model measuring the medical school education operation of the academic mission, while not statistically significant, also could reflect operational priorities within AHCs. The proportional rate of change in interns and residents measures instructional program growth or contraction at AHCs (Holt et al., 2014), and the theoretical proposition is that environmental-structural fit generates resources that foster education operation expansion. The results of this study, however, do not support this assertion (see Table 25). Possible reasons for this outcome lie in the multiple and overlapping operations of the AHC. Interns and residents comprise the graduate medical education effort, which tends to occur in an apprenticeship arrangement with physicians in the clinical setting (Chen et al., 2013; Pizzo et al., 2015). If an

AHC emphasizes clinical productivity and growth, then physicians may focus more on the efficiency of patient care and lower the distraction of teaching by limiting the number of interns and residents in the clinical setting (Stimpson, et al., 2014). Weakening this claim, however, is the result of a positive and statistically significant coefficient for the change in hospital total margin, where a percentage increase in the growth rate of total margin increases the growth rate of interns and residents by 3.0%.

Research question 4 (hypothesis 3). The fourth research question, which shapes hypothesis 3, is whether fit in a dynamic environment is more impactful on AHC performance that fit in a stable environment. The case study literature contains numerous examples of how changes in the economic environment prompt AHCs to reconsider organizational alignments among the clinical and academic entities (Cairns et al., 2017; Kastor, 2008; Levine et al., 2008; Mallon, 2003). The implication is that the ability to adapt to changing circumstances is essential for AHC viability, and therefore fitting a dynamic environment is more impactful on performance than fitting an unchanging stable environment.

Estimating the multivariate analytical model to test hypothesis 3 is not possible in this study. The sample size limitations preclude the use of the statistical models which are consistent with structural contingency theory. Even a simple comparison of mean values of the performance indicating dependent variables does not produce statistically significant differences (see Table 28).

Research question 5 (hypothesis 4). The fifth and final research question, which shapes hypothesis 4, is whether fit in the clinical-only environment is more impactful on AHC performance than fit in the combined clinical and academic environment. The economic virtuous cycle at AHCs begins with financial surpluses from patient care operations, and then follows with an investment in the academic enterprises (Kennedy et al., 2007; Rahn, 2015; Rothman, et al., 2015, Wartman, 2008) (see Figure 2). Without the funds flow from hospital and physician group practice clinical activities, the medical school loses up to 40% of annual operating revenue (Liaison Committee on Medical Education, 2016a) (see Table 2). Fit to the clinical-only environment, therefore, appears as the financial priority and hypothesis 4 makes that assertion.

As with hypothesis 3, estimating the multivariate analytical model to test hypothesis 4 is not possible in this study. Again, sample size limitations preclude the use of the regression models which are consistent with structural contingency theory. Also, a simple comparison of mean values for the dependent variable performance indicators between the two groups of AHCs fails to produce statistically significant differences (see Table 29).

Commentary on Structural Contingency Theory

This section describes how this study of AHCs uses the structural contingency theory framework to contribute to the body of research on health care organizations. The discussion begins with how AHCs are health systems suited to the theory, then describes how the methods in this study conform to Donaldson's (2001) principles on using the theory in research. This section continues with a critique of structural contingency theory constructs in this application involving AHCs, and concludes with a confirmation of the theory's primary proposition.

Suitability of AHCs to the theory. Hospitals and health systems involve organizational entities performing different functions that can assume a variety of forms, thus making these institutions suitable subjects for testing structural contingency theory propositions (Bazzoli, 2000; Swofford, 2011). AHCs bring the additional structural element of a medical school to the array of entities health systems seek to organize into a functioning and successful structure. This dissertation, receiving inspiration from the multiple case studies of AHCs responding to market and regulatory changes with reorganizations, offers insights into the success of these efforts using the structural contingency theory framework.

Conforming to the principles of using the theory in research. While the theory is highly flexible, allowing adaptations to the definitions of the constructs for a variety of uses in empirical research, this study joins Swofford (2011) in using Donaldson's (2001) guidance for application to ensure consistent testing of theory-based hypotheses. This study measures environmental-structural fit over several years to preserve the reliability of any correlation between fit and performance, determines fit using indicators that involve each mission area of the organization, uses a multi-year mean value of performance rates of change to mitigate year to year variances due to factors other than fit, controls for other causes of performance that emanate from the environment, the organization, and past performance, and allows for a lag period between fit and performance to ensure the temporal sequence of fit preceding performance (Donaldson, 2001).

Critiquing the theory in this application involving AHCs. AHCs, however, present complications to the theoretical constructs of environment and structure. Using simple definitions may not capture accurately the actual conditions of AHCs. A few examples support this assertion.

Environments for AHCs can exist as circumstances in the present, conditions anticipated for the future, and the products of organizational change. This study determines the existing stability or dynamism of the environment by examining the competitive climate already in place. AHCs also can anticipate environmental changes and make preemptive organizational structure changes. Vanderbilt University, for instance, changes the organizational structure of the AHC in expectation of clinical and academic environmental changes (Wilemon, 2014). AHCs also can cause the environmental disruption with a pre-emptive organizational change that fits the anticipated conditions. Penn State brings Geisinger Health into the market through a merger, changing the clinical climate while moving to a loose affiliation arrangement within the AHC (Mallon, 2003).

AHCs also have complications with respect to organizational arrangements. This study categorizes structure as either integrated or a loose affiliation, complying with what Swofford (2011) calls “the traditional formulation” (p. 170). This approach, however, belies the complex nature of AHC arrangements. The hospital and medical school may operate as separate legal entities but have a single Dean/Chief Executive Officer leader with the ultimate authority to make strategic and financial decisions for both enterprises (Kirch et al., 2005). Also, AHCs can develop structures that integrate the hospital, physician group practice, and medical school, but also add legally separate clinical subsidiaries under different management to create a network of patient care (Levine et al., 2008). Classifying the organizations in these examples as integrated or loose affiliations is not a simple exercise.

While the versatility of the structural contingency theory allows for different notions of measuring environmental conditions and organizational alignments (Burns & Stalker, 1961; Fennell & Alexander, 1987), the “traditional formulation” may lead to faulty categorizations (Swofford, 2011. p. 170). Such inaccuracies may contribute to the mixed results of this study.

Confirming the theory’s primary proposition. The findings that support the assertions of hypotheses 1 and 2, however, also support structural contingency theory’s primary proposition that environmental-structural fit leads to stronger organizational performance in pursuit of mission objectives. In the prevailing dynamic combined clinical and academic environment, AHCs with loose affiliation organizational structures show better performance. These findings join the literature supporting structural contingency theory, and also offer AHCs insight into ways of maintaining organizational viability and perpetuating the patient care and research operations.

Implications for Academic Health Centers

The results of this dissertation provide practical insights regarding what considerations should occur when contemplating the alignment of hospitals, physician group practices, and medical schools to improve performance in pursuing the clinical and academic missions. The findings, therefore, are a contribution to the case studies and prior research on AHCs.

The results of this study support the conclusion that AHC structures should align with the characteristics of the environment to grow hospital market share for patients and medical school NIH R01 research funding. During the research time period, the combined clinical and academic environment is dynamic and AHCs that adopt a loose affiliation structure, where the hospital, physician group practice, and medical school operate as related but autonomous organizations perform better in the pursuit of the clinical and academic missions than AHCs in a misfit arrangement.

These findings support the claims in the literature. Multiple case studies exist of AHCs making organizational changes in response to increasing competition for patients with other providers, declining reimbursements for services, and diminishing funding for research (Barrett, 2008; Cairns et al., 2017; Kastor, 2004; Karpf et al., 2007; Mallon, 2003). The future viability of AHCs relies on effective reorganizations that facilitate the economic virtuous cycle and funds flow among the clinical and academic missions (Kennedy et al., 2007; Wartman, 2008). Prior research confirms that increasing competition triggers AHCs to make organizational changes, but does not associate the type of structure with the environment or show that the reorganization relates to performance using multivariate quantitative analytical methods (Nonnemaker & Griner, 2001; Szabat & Walsh, 2007). This study of AHCs contributes to this research by addressing these gaps.

Limitations of the Study

While this study makes a contribution to the research on AHCs, several theoretical and practical weaknesses exist. The limitations of this study involve methods, structural contingency theory, and the nature of AHC organizations and operations. This section discusses each of these topics.

Limitations regarding methods. The methodological limitations of this study involve five areas: 1) the use of a non-experimental design, 2) the choice of the timeline, 3) surveys as the sources of data, 4) the sample size and the inabilities to test hypotheses 3 and 4, and 5) the necessary modifications of the regression models.

The first limitation with respect to methods is using a non-experimental design, which precludes the ability to establish causation (Polit & Beck, 2008). At best, this study tests models of analysis to reveal relationships or associations between the independent variable of fit with the dependent variables of clinical and academic performance measures, controlling for other factors. This is the nature of social science research, where the conditions necessary for experimental design, such as manipulating the independent variable among control and test groups, are beyond the researcher's abilities (Polit & Beck, 2008). The non-experimental design in this study shows correlations between fit and performance, but threats to internal and external validity are present. The main design threat to internal validity is temporal ambiguity, where fit must precede performance. While the design attempts to mitigate this threat with a gap year between fit and performance, this step does not guarantee an adequate period for the impacts of fit to take place. The threat to external validity is the definition of the academic environment, which is not specific to individual AHCs. This study trades off the potential confounding effects of this circumstance with models that attempt to reflect real-world conditions of AHCs where all medical schools compete with each other for NIH R01 funding.

The second limitation regarding methods is the choice of the timeline for this study. Although an intention is to capture the effects of the implementation of the PPACA of 2010 in the environment, selecting 2011 as the year to measure environmental-structural fit is arbitrary. AHCs in a fit arrangement in 2011 could have established the condition several years before, and thus changes in the performance measures could occur prior to the 10-year study period of 2007 to 2016. Additionally, the year 2007 marks the beginning of the 18-month economic Great Recession, where unemployment, the loss of health care insurance coverage, the devaluation of financial assets, and increases in hospital bad debt occur simultaneously (Shortt, 2014). The impacts of this economic down-turn could influence the results of this study as hospitals and health systems experience financial hardships at different rates in various parts of the country where the recession fluctuates in intensity (Shortt, 2014). This study attempts to control for economic conditions of the markets with variables measuring changes in unemployment and per capita income, but only in the years 2013 to 2016, missing the pre-recession period and the effects of almost three years of the post-recession recovery.

The third methodological limitation is the use of surveys as sources of data, exposing this study to a threat on internal validity. Patterns of instrumentation error exist, where values change significantly from one year to the next and then back to levels more consistent with historic trends. Also, not all AHCs submit survey responses for each year in the 2007 to 2016 period. This study attempts to mitigate these issues by using multi-year averages for variable values, assuming that missing data is consistent with preceding and subsequent years, or removing cases from the sample. Nonetheless, instrumentation error remains a threat to internal validity.

A fourth limitation with respect to methods is the challenge of maintaining an adequate sample size. The population of AHCs in 2011 is 136 organizations (Liaison Committee on Medical Education, 2016b), 101 AHCs participate in the 2011 AAMC COTH survey, and 79 AHCs provide data from 2007 to 2016 that meet the inclusion criteria for this study. While the final sample size of 79 AHCs accounts for 58% of the AHC population, the number of cases permits only four independent and control variables at a time in regression models involving the entire sample and prompts changes to the equations (Green, 1991). Further, having only 79 AHCs in the study precludes the sub-divisions of the sample necessary to test hypotheses 3 and 4 with the environmental-structural fit independent variable and the past performance, organizational size, and market demographic control variables necessary for analytical models consistent with structural contingency theory.

The fifth and final limitation is the need to adapt the regression models, threatening consistency with the context of structural contingency theory. The restriction of using only four independent/control variables in any one model prevents this study from testing multiple environmental characteristics simultaneously. For example, in no single model testing hypothesis 1 do Medicaid expansion, change in market population, change in market per capital income, and change in market unemployment rate all serve as controls accompanying change in organizational size, lagged performance indicators, and environmental-structural fit as predictors of performance in pursuit of the clinical mission. This situation limits the ability of this study to account for all “contingent factors” including “environmental uncertainty” in a robust fashion (Donaldson, 2001, p. 17).

Limitations regarding theory. This section broadens the discussion of the limitations of this study as a function of challenges with the tenets of structural contingency theory. Four areas of consideration exist: 1) reasons other than the external environment may cause AHC reorganizations, 2) structural contingency theory does not establish definitively how fit improves performance, 3) this study, following the definitions of structural contingency theory, may inadequately define market dynamism, and 4) some of the findings of this study appear to challenge the theoretical contingent pairs.

First, the theoretical framework of this dissertation relies on external environmental conditions determining effective organizational structures with respect to performance, but AHCs change structures for reasons other than exogenous circumstances. For example, Kastor (2004) documents how clashes among executive leaders drive the University of Pennsylvania and Johns Hopkins University to alter the organizational arrangements between the clinical and academic enterprises. In these instances, a misfit arrangement with the external environment may exist, but performance could improve by altering the organizational structure to mitigate unfavorable internal environmental conditions. By not accounting for such a circumstance, this study could produce a false positive outcome, such as misfit with external conditions associating with better performance. Structural contingency theory accommodates the notion of intra-organizational contingencies and conflict resolution, but this study does not involve variables measuring these conditions (Donaldson, 2001; Lawrence and Lorsch, 1967).

Second, this study also does not produce results that offer insights into how environmental-structural fit leads to better performance, but as Swofford (2011) states, this circumstance is more a limitation of structural contingency theory. The theoretical proposition assumes that AHCs in the dynamic combined environment pursue structural differentiation by adopting organic or loose configurations to facilitate timely responses to changing circumstances (Burns & Stalker, 1961). The theoretical requirement, therefore, is that organizations take actions beyond restructuring to connect fit with performance. The concept of tactical actions after fit is elusive in structural contingency theory, and is more of an assumption than a construct (Swofford, 2011). This study does not involve variables measuring this assumed additional step to achieving better performance, and in the operational realities of AHCs, this omission is a limitation of the findings (Barrett, 2008; Mallon, 2003).

The third limitation regarding theory is the definition and measurement of market dynamism in this study. Structural contingency theorists define environments or markets as "differing technical or economic conditions outside" of the organization (Lawrence & Lorsch, 1967, p. 15). This study measures those conditions by existing hospital market concentration, changes in managed care penetration, and changes in the intensity of competition for NIH R01 research funding. This study does not account for the ability of AHCs to anticipate changes in these measures and make pre-emptive organizational structural changes. Clinical market movements may occur that do not change provider concentration, such as a health system outside of an AHC's market acquiring hospitals inside the market (Kuhrt, 2017; Mallon, 2003). While this event keeps the hospital market concentration constant, AHC leaders could perceive the transaction as a competitive threat and initiate organizational changes in response. This study does not capture such a dynamic.

The fourth and final limitation of this study with respect to structural contingency theory involves the contingent pairs of dynamic environments fitting loose affiliation structures and stable environments fitting integrated structures. The findings from testing hypothesis 1 conflict when changing the measure of performance in pursuit of the clinical mission. AHCs in a loose affiliation structure fitting the dynamic market have an association with greater positive change in hospital market share (see Table 21). The coefficients for fit in these results are statistically significant. AHCs in an integrated structure mis-fitting the dynamic environment, however, perform better than fit AHCs with respect to hospital total margin (see Table 22). While the coefficients for fit in the latter results are not statistically significant, these two findings still limit the strength of this study to conclude that environmental-structural fit leads to better performance in the clinical mission.

Limitations regarding the nature of AHCs. This discussion on the limitations of this study concludes with two final points regarding the applicability of the findings to the actual operations of AHCs: 1) the difference between organizational structure and functional alignment, and 2) the practicality of combining the clinical and academic environments.

First, this study does not make a distinction between organizational structure and functional alignment. While AHCs can assume a loose affiliation structure, operations among the hospital, physician group practice, and medical school can function in an integrated manner. Keroack et al. (2011) describe functional alignment as operational collaborations among the three AHC entities with such efforts as financial management, information systems, and capital planning. The questions that arise are whether any operational difference exists between functional alignment and an integrated structure, and could functionally aligned AHCs in a loose affiliation arrangement fit a stable environment or misfit a dynamic environment. This circumstance could at least partially explain the contradictory results of the hypothesis 1 testing, but this study does not confirm or reject this conclusion.

Second, AHCs may not respond to clinical and academic environments simultaneously. Hypotheses 1 and 2 assume that AHCs operate in a single environment with clinical and academic components, and that performance in pursuit of the clinical and academic missions involves a common economy reliant on funds flows. AHCs may make resource decisions separately after the funds flows. For example, an AHC may decide to construct a new hospital wing regardless of the facility conditions of the medical school and the competitiveness of the academic environment, or may face the trade-off decision of a new hospital wing versus a new medical school laboratory building if a combined clinical and academic environment is competitive. This study accounts only for the latter situation. AHCs may not achieve the synergies of two mission areas working in concert, but operate with competing institutional pressures where increasing funding for the clinical enterprise means decreasing funding for the academic enterprise.

Summary on the limitations of this study. This section documents multiple limitations of this study, involving the methods, theoretical framework, and the practical nature of AHCs. Methodological limitations exist in the use of non-experimental design, the timeline of the study, the use of surveys as data sources, the inadequate sample size to test hypotheses 3 and 4, and the need to modify the regression models. Theoretical limitations include accounting for causes other than environmental conditions that compel AHC reorganizations, the process behind how environmental-structural fit leads to better performance, the adequacy of the definition of market dynamism, and the certainty of the environment-structural contingent pairs that associate with performance. Finally, limitations are present as to whether this study captures the true nature of AHCs with respect to organizational structure versus functional alignment and the practicality of combining the clinical and academic environments. All of the limitations in this section serve as the foundations for future study, and the following section discusses recommendations for further research.

Suggestions for Future Research

This study has four suggestions for additional research that explore questions as to how AHC environments and organizational structures inter-relate to maximize performance in pursuit of the clinical and academic missions.

First, a larger longitudinal dataset involving all of the now 155 accredited medical schools and clinical enterprise affiliates (Liaison Committee on Medical Education, 2020), and more years of AHC operations would permit testing alternative measures of environmental-structural fit, allow more complex multivariate models, and potentially enable the testing of hypotheses 3 and 4. Creating a larger sample size also can involve tracking AHC environmental and organizational changes across decades to accumulate fit and misfit cases under the varying market conditions.

The second suggestion is to define AHC organization structure and environmental change to capture functional alignments and market movements. The definition of an integrated AHC could go beyond a structural arrangement of the hospital, physician group practice, and medical school and capture the realities of functional alignments among the operations of each entity that lead to the benefits of a consolidated organization, such as economies of scale. Keroack et al. (2011) demonstrate that researchers can create these more nuanced definitions of structure for AHCs. Environmental change also can benefit from a redefinition to reflect actual conditions confronting AHCs. Researchers will have to conduct a retrospective examination of market movements that do not immediately create actual change in provider or payer consolidation, but generate anticipatory and pre-emptive moves by AHC leadership.

The third suggestion is to add an intermediary measure between environmental-structural fit and performance that captures the organizational actions necessary to achieve the theoretical benefits. This recommendation joins previous observations regarding perceived gaps in structural contingency theory after empirical research (Swofford, 2011). After reorganizing to an integrated structure, an AHC may fail to create operational efficiencies by consolidating duplicate functions or not realize economies of scale through greater purchasing or negotiating power (Dafny et al., 2017; Frech III et al., 2015; Gal-Or, 1999; Gaynor, 2006). In this example, fit may not lead to better performance with respect to measures such as change in hospital total margin. Adding a variable in between fit and performance in a theoretical sequence of actions would strengthen the ability of empirical research to draw more definitive conclusions on the relationships among environment, organizational structure, and performance.

The fourth suggestion is to develop more AHC-specific variables measuring the condition of the academic environment. This study aggregates all AHCs into a single competitive environment for NIH resources. While all medical schools receive NIH grants from the same source, not all medical schools enter into the application process under the same conditions (Holt et al., 2014; Hromas et al., 2012). Some medical schools receive higher levels of funds from the clinical enterprise than others, enabling the investments in early career investigators to generate preliminary research results that attract NIH funding, or providing resources to renovate laboratory space, acquire advanced technology, and offer pre-award administrative support that help faculty earn grants or attract new faculty with existing grant funding to join the medical school. This study attempts to represent the munificence of the academic environment in the testing of hypothesis 2 through control variables reflecting the funds flow from the clinical enterprise, but future research should include more direct measures of the actual annual funding levels from the clinical total margin to the medical school. This step would allow for more precise measurement of the academic environment specific to the AHC medical school, and thereby strengthen the analytical ability of future models.

Conclusion

This study advances the literature on how AHCs can adapt to changing environmental conditions to ensure future viability and continue to advance the clinical and academic missions. This study moves beyond the case studies of individual AHCs, the research involving only the clinical mission area or omitting the effects of environmental changes, and analytical models that produce simple correlations. This study captures the characteristics of the AHC missions and functions more comprehensively, involving variables that represent the patient care and bio-medical and health sciences research and education operations. The analysis involves a representative sample size of AHCs, and employs multivariate regression models to capture the complex environments and indicators of performance across the mission areas. The results of this analytical effort support the conclusion that AHCs in an environmental-structural fit arrangement in 2011 perform better than AHCs in a misfit arrangement in the clinical mission area, increasing the rate of growth in hospital market share during the 2013 to 2016 period while controlling for change in organizational size and environmental demographic conditions. This study also supports the conclusion that AHCs in an environmental-structural fit arrangement in 2011 perform better than AHCs in a misfit arrangement in the research operation of the academic mission area, increasing the rate of growth in medical school NIH R01 funding and the percentage of faculty with NIH R01 funding during the 2013 to 2016 period while controlling for change in organizational size and environmental munificence from the clinical enterprise.

This study contributes to the literature by applying a theoretical framework to the study of AHC environments, structures, and performance. The constructs and propositions of structural contingency theory are directly applicable to the study of institutions that contend with complex environments, involve different organizational units, and pursue multiple missions. The application of the theory is particularly appropriate for institutions that use organizational restructuring as a response to environmental conditions. This study is one more contribution to the body of work using structural contingency theory and offering support to the proposition that fit improves performance.

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Appendix A: Description of Data Management Steps

The AAMC COTH survey information contains several instances where a single year response is missing regarding AHC organizational structure. If AHCs give responses in the preceding and subsequent years that were identical, then this study assumes that the missing data is the same response as well. A few AHCs submit responses stating that the organization changes structure after 2011 from a loose affiliation to an integrated arrangement and back to loose affiliation in a three-year period. This study assumes that these circumstances are due to instrumentation or responder error, and retains the AHCs in the sample as having a loose affiliation structure. Finally, in 14 cases the AHC changes organizational structure in 2014, 2015 or 2016, (those that change in 2014 or 2015 retain the new structure through 2016). The AHCs that change in 2015 and 2016 remain in the sample given the structural contingency theory concept of a gap period, where the effects of organizational change on performance occur after an intermittent year (Donaldson, 2001). Thus, the effects of the organization change on the dependent variable performance indicators would happen after 2016 and therefore not compromise the integrity of this study's results. Those AHCs that change structure in 2014 remain in the study, but the performance indicators are two-year means instead of three; a technique found in Swofford (2011).

The AAMC COTH survey also has missing data regarding AHC managed care payer penetration. Measuring this clinical environmental condition involves using three-year averages, so where data is missing in a single year, this study relies on a two-year average (Swofford, 2011).

Appendix B: Descriptive Statistics for the Various Groupings of AHCs in the Sample

This appendix provides supplemental information comparing the mean values of the transformed dependent variables and the control variables between AHCs within five groupings: 1) integrated versus loose affiliation structures, 2) stable versus dynamic clinical only environments (since the combined environment is dynamic for all AHCs in the sample thus no comparisons can occur between different types of the combined environment), 3) environmental-structural fits versus misfits in the combined environment 4) environmental-structural fits versus misfits in the clinical only environments, and 5) AHCs in Medicaid expansion states versus those that are not.

Of the 79 AHCs in the sample, 47 have integrated structures and 32 have loose affiliations, and Table 30 shows the comparison of mean values of the transformed dependent variable and the control variables between these groups, signifying if any differences are statistically significant.

Table 30

Comparison of Means, AHCs with Integrated Structures and Loose Affiliations

Variables (Average Annual Three-Year Proportional Rates of Change)	**Integrated Structure** Mean Values (n = 47)	**Loose Affiliation Structure** Mean Values (n = 32)
<u>Transformed Dependent Variables (2013-2016)</u>		
Hospital Market Share **	0.004	0.038
Hospital Total Margin *	0.182	-0.190
Medical School NIH R01 Funding	0.017	0.049
Medical School Percent of Faculty with NIH R01 Funding	-0.041	-0.013
Interns and Residents	-0.031	-0.034
<u>Control Variables: Lagged Performance 2007-2010</u>		
Hospital Market Share	0.027	0.010
Hospital Total Margin	1.184	0.178
Medical School NIH R01 Funding	0.022	0.013
Medical School Percent of Faculty with NIH R01 Funding	-0.026	-0.032
Interns and Residents	0.003	0.018
<u>Control Variables: Organization Size and Market Demographics 2013-2016</u>		
Hospital Bed Count	0.013	0.045
Medical School Faculty/Physician Count	0.022	0.016
Hospital Market Population	0.006	0.006
Hospital Market Per Capita Income	0.017	0.020
Hospital Market Unemployment Rate	-0.121	-0.130
* p < 0.10 ** p < 0.05		

The descriptive statistics for the transformed values of the dependent variables show that the AHCs with loose affiliation structures have a statistically significant higher mean in the average proportional rate of change in hospital market share, and a lower mean in the average proportional rate of change in hospital total margin than AHCs with integrated structures. The mean for average proportional rate of change in hospital total margin for AHCs with loose affiliations is actually negative.

Of the 79 AHCs in the sample, 66 are in a dynamic clinical-only environment and 13 are in a stable clinical-only environment (see Table 27). Table 31 shows the mean values of each variable for these two groups.

Table 31

Comparison of Means, AHCs in Stable and Dynamic Clinical-Only Environments

Variables (Average Annual Three-Year Proportional Rates of Change)	**Stable Clinical-Only Environ.** Mean Values (n = 13)	**Dynamic Clinical-Only Environ.** Mean Values (n = 66)
Transformed Dependent Variables (2013-2016)		
Hospital Market Share	0.010	0.020
Hospital Total Margin	-0.068	0.051
Medical School NIH R01 Funding	0.039	0.028
Medical School Percent of Faculty with NIH R01 Funding	-0.025	-0.030
Interns and Residents	-0.012	-0.036
Control Variables: Lagged Performance 2007-2010		
Hospital Market Share	0.024	0.020
Hospital Total Margin	2.144	0.507
Medical School NIH R01 Funding	0.013	0.020
Medical School Percent of Faculty with NIH R01 Funding	-0.034	-0.027
Interns and Residents	0.013	0.008
Control Variables: Organization Size and Market Demographics 2013-2016		
Hospital Bed Count	0.012	0.028
Medical School Faculty/Physician Count	0.015	0.020
Hospital Market Population	0.006	0.006
Hospital Market Per Capita Income	0.019	0.018
Hospital Market Unemployment Rate	-0.131	-0.123
* p < 0.10 ** p < 0.05		

No variables have statistically significant differences in mean values between the AHCs in stable and dynamic clinical-only environments.

Within the sample of 79 AHCs, 32 have a loose affiliation structure that fits the combined environment, which is dynamic for the entire sample, and 47 have an integrated structure which is a misfit with the combined environment (see Table 16). Table 32 shows the mean values of each variable for these two groups, signifying if any differences are statistically significant.

Table 32

Comparison of Means, AHCs That Fit and Misfit the Combined Environment

Variables (Average Annual Three-Year Proportional Rates of Change)	**Fit Combined Environ.** Mean Values (n = 32)	**Misfit Combined Environ.** Mean Values (n = 47)
Transformed Dependent Variables (2013-2016)		
Hospital Market Share **	0.038	0.004
Hospital Total Margin *	-0.190	0.182
Medical School NIH R01 Funding	0.049	0.017
Medical School Percent of Faculty with NIH R01 Funding	-0.013	-0.041
Interns and Residents	-0.034	-0.031
Control Variables: Lagged Performance 2007-2010		
Hospital Market Share	0.010	0.027
Hospital Total Margin	0.178	1.184
Medical School NIH R01 Funding	0.013	0.022
Medical School Percent of Faculty with NIH R01 Funding	-0.032	-0.026
Interns and Residents	0.018	0.003
Control Variables: Organization Size and Market Demographics 2013-2016		
Hospital Bed Count	0.045	0.013
Medical School Faculty/Physician Count	0.016	0.022
Hospital Market Population	0.006	0.006
Hospital Market Per Capita Income	0.020	0.017
Hospital Market Unemployment Rate	-0.130	-0.121

* $p < 0.10$
** $p < 0.05$

AHCs in the fit category have a statistically significant higher mean in the dependent variables of the average proportional rate of change in hospital market share. Misfit AHCs have a statistically significant higher mean in the average proportional rate of change of hospital total margin.

Of the sample of 79 AHCs, 52 fit the clinical-only environments and 27 are in a misfit arrangement (see Table 27). Table 33 shows the mean values of each variable for these two groups, signifying if any differences are statistically significant.

Table 33

Comparison of Means, AHCs That Fit and Misfit the Clinical-Only Environment

Variables (Average Annual Three-Year Proportional Rates of Change)	**Fit Clinical-Only Environ.** Mean Values (n = 52)	**Misfit Clinical-Only Environ.** Mean Values (n = 27)
Transformed Dependent Variables (2013-2016)		
Hospital Market Share **	0.030	0.007
Hospital Total Margin *	-0.051	0.103
Medical School NIH R01 Funding **	0.041	0.020
Medical School Percent of Faculty with NIH R01 Funding **	-0.021	-0.037
Interns and Residents	-0.024	-0.040
Control Variables: Lagged Performance 2007-2010		
Hospital Market Share	0.012	0.027
Hospital Total Margin	0.859	0.703
Medical School NIH R01 Funding	0.018	0.019
Medical School Percent of Faculty with NIH R01 Funding	-0.031	-0.026
Interns and Residents	0.015	0.004
Control Variables: Organization Size and Market Demographics 2013-2016		
Hospital Bed Count	0.039	0.014
Medical School Faculty/Physician Count	0.022	0.017
Hospital Market Population	0.007	0.005
Hospital Market Per Capita Income **	0.020	0.017
Hospital Market Unemployment Rate	-0.129	-0.120

* p < 0.10
** p < 0.05

AHCs in the fit category have statistically significant higher means in the dependent variables of average proportional rate of change in hospital market share and medical school NIH R01 funding. Among the control variables, the only statistically significant difference in mean values between the fit and misfit groups is the average proportional rate of change in hospital market per capital income.

Finally, of the sample of 79 AHCs, 46 reside in Medicaid expansion states and 33 are states that did not expand Medicaid during the study period. Table 34 shows the mean values of each variable for these two groups, signifying if any differences are statistically significant.

Table 34

Comparison of Means, AHCs in Medicaid to Non-Medicaid Expansion States

Variables (Average Annual Three-Year Proportional Rates of Change)	**Medicaid Expansion State** Mean Values (n = 46)	**Non Medicaid Expansion State** Mean Values (n = 33)
Transformed Dependent Variables (2013-2016)		
Hospital Market Share	0.020	0.015
Hospital Total Margin	-0.042	0.133
Medical School NIH R01 Funding	0.026	0.035
Medical School Percent of Faculty with NIH R01 Funding	-0.031	-0.027
Interns and Residents	-0.033	-0.032
Control Variables: Lagged Performance 2007-2010		
Hospital Market Share	0.021	0.020
Hospital Total Margin	0.729	0.843
Medical School NIH R01 Funding **	0.002	0.042
Medical School Percent of Faculty with NIH R01 Funding	-0.040	-0.012
Interns and Residents	0.007	0.013
Control Variables: Organization Size and Market Demographics 2013-2016		
Hospital Bed Count	0.016	0.039
Medical School Faculty/Physician Count	0.016	0.024
Hospital Market Population **	0.004	0.009
Hospital Market Per Capita Income	0.018	0.019
Hospital Market Unemployment Rate *	-0.132	-0.114
* $p < 0.10$ ** $p < 0.05$		

Among the control variables, the only statistically significant differences in mean values for AHCs in Medicaid expansion states and non-Medicaid expansions states are in the average proportional rate of change in medical school NIH R01 funding from 2007 to 2010, the average proportional rate of change in hospital market population, and the average proportional rate of change in hospital market unemployment rate.

Appendix C: Descriptive Statistic Correlations

Environmental-structural fit in 2011 (the independent variable) has negative relationships with several of the lagged (2007 to 2010) performance control variables, particularly the average proportional rate of change in hospital total margin ($p < 0.056$) and the average proportional rate of change in the percentage of medical school faculty with NIH R01 grants ($p< 0.088$). States that expanded Medicaid have a negative correlation with the average proportional rates of change in hospital market population (-0.353, $p < 0.001$) and hospital market unemployment rate (-0.212, $p > 0.031$) from 2013 to 2016. Other negative correlations among the control variables include the average proportional rate of change in hospital market share and the average proportional rate of change in hospital market unemployment from 2013 to 2016 (-0.231, $p < 0.02$), and the average proportional rate of change in hospital market per capita income and the average proportional rate of change in the hospital market unemployment rate (-0.249, $p < 0.013$). Other positive correlations among the control variables include the average proportional rate of change in the percentage of medical school faculty with NIH funding and the average proportional rate of change of interns and residents (0.221, $p < 0.025$), and the average proportional rates of change in hospital beds and the two measures of hospital market population (total population, 0.260, $p < 0.010$; population over 65, 0.205, $p < 0.035$). Also, the average proportional rate of change in the medical school faculty count has a positive correlation with the average proportional rate of change in total medical school NIH R01 funding (0.268, $p < 0.008$).

Vita

Eric John Strucko was born on March 31, 1965 in Denville, New Jersey. He graduated from Randolph High School, Randolph, New Jersey in 1983. He received his Bachelor of Arts in Political Science and Business Administration from Vanderbilt University, Nashville, Tennessee in 1987. He earned a Masters of Public Administration from George Washington University, Washington, D.C., in 1992, a Masters in Public Policy from Georgetown University, Washington, D.C., in 1995, an Associates of Applied Sciences in Emergency Medicine Services from the Piedmont Virginia Community College, Charlottesville, Virginia, in 2007, and a Masters of Public Health from the University of Virginia, Charlottesville, Virginia, in 2012. Eric has served as the Director of Budget of the University of Virginia Medical Center, the Chief Financial Officer of the University of Virginia Physicians Group, the Associate Vice President for Finance and Business and Controller of the Penn State University College of Medicine, and as the Senior Vice President and Chief Financial Officer of Penn State Health and the Milton S. Hershey Medical Center, the Academic Medical Group, and the Community Medical Group.

Eric's history of public service includes serving Virginia as a Nationally Registered EMT-Paramedic and volunteer firefighter, an appointee to the Albemarle County, Virginia Planning Commission, and an elected member of the Albemarle County, Virginia School Board.

Eric is the husband of Laurie (Burke) Strucko, and is the father of David Strucko, a fourth-year student at James Madison University in Harrisonburg, Virginia, and Claire Strucko, an entering first-year student at Penn State University at University Park, State College, Pennsylvania.