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The Influence of Environmental Factors and Organizational Characteristics on Innovations in Family Medicine Practices in Virginia

Debora Goetz Goldberg

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Stephen S. Mick, Ph.D., Dissertation Committee Chair
VCU School of Allied Health Professions
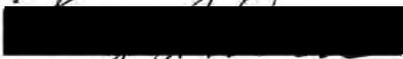
Kelly J. Devers, Ph.D., Dissertation Committee Member
VCU School of Allied Health Professions

Diane Dodd-McCue, Ph.D., Dissertation Committee Member
VCU School of Allied Health Professions

Anton J. Kuzel, M.D., Dissertation Committee Member
VCU School of Medicine

Cecil B. Drain, Ph.D., Professor and Dean
VCU School of Allied Health Professions
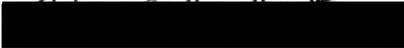
F. Douglas Boudinot, Ph.D., Dean
VCU Graduate School

5-28-08

Date

The Influence of Environmental Factors and Organizational Characteristics on
Innovations in Family Medicine Practices in Virginia

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

By

Debora Goetz Goldberg
BA, Northern Kentucky University, 1988
MBA, MHA, Xavier University, 1992, 1993

Director: Stephen S. Mick, Ph.D.,
Arthur Graham Glasgow Professor and Chair,
Department of Health Administration

Virginia Commonwealth University
Richmond, Virginia
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ABSTRACT

The Influence of Environmental Factors and Organizational Characteristics on Innovations in Family Medicine Practices in Virginia

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Major Director: Stephen S. Mick, Ph.D., Arthur Graham Glasgow Professor and Chair, Department of Health Administration

Family medicine practices are currently threatened by factors such as poor reimbursement, physician stress, shortage of providers, and difficulties in providing prompt access and reliable continuity of care. The external environment faced by family medicine practices is extremely complex and characterized by high pressure from regulatory sources, decreasing reimbursement levels, an increasing rate of change in technologies and care delivery processes, and increasing patient and community expectations. Over the last several years there have been many efforts in family medicine to respond to the challenges presented by the external environment. The majority of these efforts focus on redesigning the delivery of health care services and improving business functionality at the practice level. These innovations include incorporating a patient-centered team approach to providing care, increasing use of advanced technologies,

improving functional office space, emphasizing quality and outcomes, and enhancing practice finances.

This study explored innovations in family medicine practices to redesign the delivery of health care services and improve business functionality. This research also examined whether environmental factors and organizational characteristics influence strategies to redesign the practice of family medicine. The study employed an integrated set of theoretical frameworks from organizational sociology in evaluating the environmental influences on innovative efforts. Institutional theory was used to provide a conceptual framework to explain the connection between innovations in family medicine practices and three institutional forces within the environment: coercive forces, mimetic forces, and normative forces. Resource dependency theory was used to explain physician practice motivators for change based on a dependence on scarce financial, human, and information resources.

The study utilized multiple secondary data sets to define the external environment and an organizational survey of family medicine practices to understand the utilization of innovations and environmental influences. Descriptive statistics and multivariate analysis were used to reveal innovations and to determine the impact of environmental factors on the implementation of redesign strategies. The study results provide essential information on innovations undertaken by family medicine practices in Virginia and how environmental factors and organizational characteristics influence efforts to redesign.

CHAPTER 1 – INTRODUCTION

Introduction to the Study

This study evaluates whether environmental factors and organizational characteristics affect innovation in family medicine practices in Virginia. The study also presents new information on the types and level of redesign strategies undertaken by family medicine practices and their perception of environmental influences. Over the last several years there has been a growing movement to redesign health services in primary care to improve quality of care, access, and business functionality (Bodenheimer, 2003; Institute of Medicine [IOM], 1996; Scherger, 2005; Starfield, 1998). Primary care specialties are faced with pressure to improve services from environmental sources originating from regulatory actions, political movements, stakeholder expectations, professional requirements and standards, and reimbursement systems. The primary care specialty of family medicine has attempted to address challenges related to providing primary care by advocating the adoption of innovative care delivery mechanisms, advanced technologies, effective office systems and functional office space, enhanced business finances, and a patient-centered culture that is focused on quality and outcomes (Graham, Bagley, Kilo, et al., 2004).

A greater understanding of how the environment affects utilization of innovations at a physician practice level will provide practices and policy-making organizations better information to make decisions regarding improvement of health services and business

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functions. This study utilized a cross-sectional, non-experimental design to evaluate the influence of environmental factors and organizational characteristics on innovations in family medicine practices. Study hypotheses were drawn from theories in organizational sociology on institutional forces and resource dependencies. The study employed a simple random sampling (SRS) technique to draw a sample from all family medicine practices in the state of Virginia. The study utilized both primary and secondary data sources to capture information on practice characteristics, adoption of innovative strategies, and information on the environment. Descriptive statistics and ordinary least squares regression (OLS) was used to analyze the relationships between variables. Two-stage least squares (2SLS) method was attempted in order to create instrumental variables that counter endogeneity problems.

<div align="center">Background</div>

The IOM report "Crossing the Quality Chasm" (IOM, 2001) and other published research on quality of care (Saaddine, 1990; Saaddine and Engelgau, 2002; O'Conner, 2005) have identified major shortcomings in the United States health care system, many of which occur at the primary care level. Issues in primary care that are thought to be related to quality include:

- Practice Structure and Process Issues - patient's lack of access to services (Huynh, Schoen Osborn et al., 2006), inconsistencies in providing standard of care and evidence-based medicine (Grol & Grimshaw, 2003; McGynn, Asch, Adams, et al., 2003), an inability of providers to coordinate care across health system components (Lipsky & Sharp, 2006), and complexity involved in caring for

individuals with chronic illnesses (Von Korff, Gruman, Schaefer, Curry, & Wagner, 1997);

- Environmental Factors - increasing requirements from the government (CMS, 2005, 2007) and decreasing reimbursement for services (Sandy & Schroeder, 2003);

- Physician Issues - growing dissatisfaction among primary care physicians (Keating, Landon, Ayanian, et al., 2005), and slower growth of earnings for primary care providers than other specialties (Bodenheimer, Berenson, & Rudolf, 2007); and

- Education and Clinical Outcomes - a reduction in the numbers of medical students choosing to enter primary care specialties (Starfield, 1998), a large amount of patients not receiving care according to current scientific evidence, and a large amount of care that is provided is not needed or potentially harmful (Grol & Grimshaw, 2003).

A large part of the health care industry in the United States is made up of small health service organizations such as physician practices. Family medicine and general practice account for almost one quarter of all outpatient visits (National Center for Health Statistics [NCHS], 2002). These practices experience pressure from the external environment to perform and act in specific ways. Numerous government regulations, professional specifications that govern staff and practice activities, third party payer requirements, and patient and stakeholder expectations exert influence on the organizational behavior of practices. In addition to the tremendous pressure from diverse

external elements, family medicine practices also encounter turbulence from the environment. Mick (1990) reported that the underlying forces for change in health care organizations result from turbulence, or shifts, in the environment, such as dramatic changes in reimbursement systems, large infusion of complex technologies, an increase in demand for new technologies and consumer expectations, change in physician practices and attitudes, the aging population, and increasing costs of care. These varied pressures and rapid changes create a complex and unstable environment for family medicine practices.

Family medicine is faced with many challenges and environmental influences that have stimulated the specialty to propose and implement strategies to improve the clinical aspects of physician practice, defined as the processes and systems involved in delivering patient care. Family medicine practices have also implemented strategies to improve business functionality, defined as the organization, physical structure, human resources, financial systems, and accounting aspects of practice management. These clinical and business strategies have focused on improving quality of care, access to services, practices' ability to meet patient needs, and business functions. Efforts to redesign the clinical aspects of family medicine practices fall under the following major categories: patient-centered care, team-based approach to care, provision of a personal medical home for each patient, elimination of barriers to care, use of advanced information systems, whole-person orientation to patient care, care provided within a community context, and emphasis on quality and outcomes. Efforts to redesign the business aspects of care include a focus on performance measurement and management, functional offices that

provide privacy and meet patient's needs, and enhanced practice finances through operating efficiencies and new revenue streams.

Statement of the Problem

Family medicine practices and other organizations involved in setting policy and guidelines for family medicine and primary care need information on the current efforts to redesign aspects of family medicine practice and the influence of environmental factors on organizational changes. There is little published research on strategies to improve quality of care, access and business functionality in physician practices, specifically in family medicine. New information on the efforts to redesign family medicine practices and what environmental pressures influence the adoption of improvement efforts could be useful to disciplines in medicine and in health services research. This information could be used to understand factors that influence a practice's decision to utilize innovations and could assist in the study of improvement efforts in physician practices.

Purpose of the Study and Research Questions

The purpose of this research study is multifaceted. The first goal is to gain knowledge on the clinical and managerial efforts taken by family medicine practices in Virginia to improve delivery of health care services and business functionality. The second and major goal of the study is to determine whether environmental factors and organizational characteristics affect the implementation of redesign strategies in family medicine practices in Virginia. The results of the study will also provide an examination

of whether existing organizational theories sufficiently address organizational behaviors of family medicine practices. The study seeks to answer the following questions:

1.   What efforts have been taken by family medicine practices in Virginia to improve delivery of health care services and business functionality?

    1.1. What innovations are family medicine practices in Virginia using to deliver care and conduct business operations?

    1.2. To what extent have family medicine practices in Virginia implemented innovative strategies and practices?

2.   Are environmental factors and organizational characteristics related to the implementation of innovations in family medicine practices in Virginia?

    2.1. Are specific environmental factors or organizational characteristics associated with the use of innovations in the delivery of care in family medicine practices in Virginia?

    2.2. Are specific environmental factors or organizational characteristics associated with the use of innovations for business functions in family medicine practices in Virginia?

3.   Are current organizational theories sufficient to understand and explain organizational behaviors of family medicine practices?

<div align="center">Theoretical Framework</div>

This study employed an integrated set of frameworks from organizational sociology to evaluate environmental influences on innovations in family medicine practices. The theoretical model includes concepts from institutional theory and resource

dependency theory. Institutional theory is used to explain the connection between innovations undertaken by family medicine practices and forces within the environment that place pressure on practices to change or conform to specific standards. Institutional theory offers a perspective on aspects of the practice's environment that reflects the laws and norms it must consider when making strategic decisions, actions stakeholders may find acceptable, and organizational characteristics stakeholders will recognize (Wells & Banaszak-Holl, 2000). Resource dependency theory is used to explain the response of family medicine practices to resource limitations in order to meet organizational goals and societal expectations. Resource dependency theory stipulates that organizations continuously seek resources from their environment in order to survive (Pfeffer & Salancik, 1978).

Data Sources

This study used both primary and secondary data sources. Several large databases and an organizational survey of family medicine practices were used to define the external environment, determine organizational characteristics and level of innovation, and identify perceptions of environmental factors. The primary data source was a large-scale survey of family medicine practices in Virginia that captured information on practice characteristics, adoption of redesign strategies, and pressures from the environment. Secondary data on the environment were obtained from the Area Resource File (ARF), U.S. Census Bureau, American Medical Association (AMA) data set, and primary care service area (PCSA) data set.

The first phase of data collection was to develop, test, and administer a survey questionnaire to a random sample of family medicine practices in Virginia to capture information on organizational characteristics and innovations in clinical and business processes and practices. Survey methods included the use of a self-administered questionnaire that practices were able to complete on hard copy or through an online survey instrument. Survey questionnaires were mailed to a sample of family medicine practices and were administered at the Summer Meeting of the Virginia Academy of Family Physicians (VAFP) in August, 2007.

Secondary data were extracted from administrative data sets and matched to the sample, which was comprised of the respondents to the practice survey. Data obtained from ARF, PCSA, AMA, and U.S. Census included: health workforce availability, socio-economic indicators, and Medicare and managed care penetration.

Research Contributions

The purpose of this study is to understand the influence of the environment and organizational characteristics on innovations in family medicine practices in Virginia. Although there is a recent focus on organizational research at the medical practice level, past research has been largely limited to qualitative approaches (Borkan, Miller, Neher, et al., 1997; Crabtree, Miller, Tallia, et al., 2005; Saba, Wong, Schillinger, et al., 2006; Solberg, Hroscikoski, Sperl-Hillen, et al., 2006; Lipsky & Sharp, 2006). Health services research on the influence of environmental factors and organizational characteristics on improvement efforts has concentrated on hospitals and integrated delivery systems. The evaluation of environmental influences and organizational characteristics on

improvement efforts and redesign strategies in family medicine practices has been unexplored.

This study makes a significant contribution to the study of physician practices. The use of quantitative research methods will lead to a more in-depth understanding of the external environment and organizational characteristics associated with strategic efforts to redesign family medicine practices. The model may be used in future research to study innovative clinical and business strategies to improve performance at the physician practice level. The study contributes to the existing knowledge in family medicine by providing information on the influence of environmental factors on efforts to redesign and improve family medicine practices in Virginia. This knowledge provides family medicine practices with information to develop effective strategies for implementing organizational change efforts and quality improvement activities to improve quality of care, access, patient satisfaction and business functionality.

Overview of Remaining Chapters

The remaining five chapters of the document provide detailed information on the literature review, theoretical foundations, methodology, data analysis and findings, and discussion of results. The literature review covers multiple topics that provide a history and background on the specialty of family medicine, the environmental influences on family medicine practices, and redesign strategies and models designed to improve quality of care, access, and performance. The chapter on the theoretical framework provides an in-depth review of the organizational theories utilized to explain the relationships tested. The methodology section presents comprehensive information on the

research design, data sources, sample and population, statistical techniques, limitations of the study and other methodological aspects. The data analysis and results section present the study findings. The report ends with a discussion of the results and how this information can assist family medicine practices and other organizations in understanding environmental influences on innovations.

CHAPTER 2 - LITERATURE REVIEW

Introduction

This chapter reviews the existing literature on the history and current situation of family medicine practice in the United States. The political, regulatory, and cultural environment of family medicine is explored to provide an in-depth description of the pressures placed upon family medicine practices to redesign service delivery, advance quality of care, and improve business functionality. Previous research and developments in both primary care and family medicine are discussed to show the full range of issues and challenges facing family medicine practices and the need for redesign. Special attention is given to quality of care issues, since the government and key stakeholder groups consider quality of care a critical aspect of the advancement of health care in this country. Multiple models for redesign of the broader health system, primary care sector, and those specifically for family medicine practices are discussed. The chapter concludes by explaining the need for understanding environmental pressures on family medicine practices and the influence of these pressures on efforts to redesign.

The literature search was conducted through electronic databases including PubMed, ProQuest, InfoTrac, and the internet. Key words used in the search included: issues in primary care and family medicine, history of primary care and family medicine, quality of care in family medicine, quality improvement in primary care, organizational

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redesign in physician offices, and health care delivery redesign. The review included academic journals, key reports from the Department of Health and Human Services (DHHS) and the Institute of Medicine (IOM), and relevant books published within the last ten years. A majority of the articles used in the literature review are from journals in medical specialties such as family medicine, internal medicine, and primary care. A review of the literature in these areas provides information on how primary care and family medicine evolved, its current role in the health care system, issues that impact the delivery of care in family medicine, and how practices have made organizational changes and improvements to advance quality of care and business functionality. This in-depth literature review demonstrates that there are few empirical studies on the environment of family medicine practices and how the environment influences organizational decision making and engagement in efforts to improve quality of care and business functionality. In response to this gap, expert opinions from researchers and practitioners in health services research and primary care, as well as information from key organizations and government agencies in health care, are provided to support concepts and ideas presented in this document.

History of Primary Care and Family Medicine

Evolution of Primary Care

The origins of primary care date back to 1920 in Great Britain where three major levels of health services were formed: primary health centers, secondary health centers, and teaching hospitals (Starfield, 1998). At the time, functions and formal linkages among the three levels were conceptualized from a broad public health perspective.

In the United States, the Committee on the Costs of Medical Care concluded in 1932 that physician groups should provide medical services and attempts should be made to restore the general practitioner to the central place in medical practice (Falk, Rorem, & Ring, 1932). The World Health Organization (WHO) (1978) further advanced the concepts of primary care to include: health education, maternal and child health, immunization and family planning, prevention of local endemic diseases, appropriate treatment of common diseases and injuries, promotion of sound nutrition, environmental sanitation, and other public health issues. More recently, the IOM (1994; 1996) came out with an updated definition that is aligned with the socioeconomic and political structure in the United States and includes the concepts of integrated and accessible health care services, ongoing clinician-patient partnership, and care in the context of family and community (IOM, 1994). Among the available definitions for primary care (IOM, 1994; 1996; Starfield, 1998; Vuori, 1984; WHO, 1978), the most relevant for this study is from Starfield: "the delivery of first-contact medicine; the assumption of longitudinal responsibility for the patient regardless of the presence or absence of disease; and the integration of physical, psychological, and social aspects of health..." (Starfield, 1998, p 12). Most definitions of primary care include the concepts of promoting, maintaining, and improving health; person-focused care; the provision of care over time; and coordination and integration of care with other providers (Starfield, 2001).

There is considerable agreement among researchers and policymakers across countries that primary care should be the foundation of a well-designed health care system (Lohr, Vanselow, and Detmer, 1996; Huynh, Schoen, Osborn, & Holmgren, 2006;

Starfield, 1998; Vuori, 1984). This agreement, however, does not carry over into the organizational mechanisms best suited to pursuing or achieving this common belief. Primary care is delivered through a wide range of institutional, financial, professional, and clinical configurations. Developments in primary care have led to redesign, or reform, in some countries from a system that focuses on illness and cure to a system that focuses on health, prevention, care, and cure (Starfield, 1998). These innovations emphasize health promotion, and continuous and comprehensive care rather than the treatment of specific problems and episodic care. Another characteristic of redesign efforts is one that removes the "hub" of care from specialists to a system that balances patient care between primary care practitioners and specialists. Other aims of redesign in primary care emphasize moving the responsibility of health toward multidisciplinary collaboration, community participation, and patient self-responsibility for care (Vuori, 1984).

Primary care in the United States can be characterized by type of specialist, information on visits, most common illness-related diagnoses, and services ordered for patient care. Approximately 20 to 30% of physicians in practice today are primary-care specialists (Lawrence, 2002). The recognized primary care specialties are family medicine, general internal medicine, and general pediatrics. A number of groups also consider obstetrics and gynecology a primary care specialty (Lipsky & Sharp, 2006). During 2002, the National Ambulatory Medical Care Survey (NAMCS) administered by the National Center for Health Statistics (NCHS) reported an estimated 890 million visits to physician offices in the United States; primary care visits accounted for 62.7%

(Woodwell & Cherry, 2004). Of the 558 million primary care visits, 75% were to the patient's designated primary care provider. The major reasons for primary care visits were acute conditions (41.5%), chronic conditions (29.6%), and preventive care (23.3%). The average face-to-face duration of appointments was 17.4 minutes. The top five illness-related diagnoses reported for primary care visits were: hypertension, acute upper respiratory infections, diabetes mellitus, otitis media (middle ear infections), and arthropathies (pathology of the joints). The most common services provided in primary care physician practices were: general medical examination, blood pressure check, urinalysis, complete blood count (CBC), diet/nutrition counseling, and exercise counseling. The reported dispositions of visits were: return for an appointment (53.4%), return if needed (33.4%), and referred to another physician (8%) (CDC NCHS, 2002).

A major influence on the evolution of primary care in the United States was the advancement of managed care practices. Managed care's focus on cost-effective care for populations was envisioned as a major stimulus to promote primary care (Sandy & Schroeder, 2003). The growth of managed care, particularly capitation, was envisioned to create new incentives for primary care by increasing the income, status, and reputation of practitioners and promoting comprehensive and cost-effective care. Although managed care was able to bring attention to the need for primary care services, many primary care physicians found it difficult to manage care under capitation financing. The financing evolved to the point that most HMOs and preferred provider organizations (PPOs) pay physicians discounted fee-for-service rates. According to Sandy and Schroeder (2003), the most devastating aspect of managed care is that under this environment primary care

did not result in increases in quality and reduction in health care costs as originally thought.

<div align="center">*Characterization of Family Medicine*</div>

The specialty of family medicine was developed in the 1960s (Martin, Avant, Bowman, Bucholtz, Dickinson, Evans, et al., 2004) to fulfill the generalist's role in medicine, reverse the decline of general practice (AMA, 1966a; AMA, 1966b), and provide personal, frontline medical care to people of all socioeconomic levels in all regions of the United States (Graham, Roberts, Ostergaard, et al., 2002). Family medicine evolved from general practitioners at the primary care level to a specialty that maintains an ongoing relationship with the patient and coordinates care for acute and chronic illnesses, primary and preventive care, and mental health problems (Stange, 1998). The definition of family medicine set forth by the American Academy of Family Physicians (AAFP) (AAFP, 2005) is: "the medical specialty which provides continuing, comprehensive health care for the individual and family. It is a specialty in breadth that integrates the biological, clinical and behavioral sciences. The scope of family medicine encompasses all ages, both sexes, each organ system and every disease entity." Throughout this research study the term family medicine will be used to indicate the medical specialty as defined by AAFP. Primary care will be used to indicate the broader concept of care provided by internal medicine, family medicine, pediatrics, and obstetrics and gynecology.

Family medicine practices represent a substantial component of the health system for delivering primary and preventive care in the United States (Stange, 1998). Of all the

specialties that represent primary care, family medicine is the most congruent with the

distribution of the US population, with 25.7% of family physicians located in non-

metropolitan statistical areas, in contrast to approximately 12% of other office-based

physicians (Lipsky & Sharp, 2006). According to the 2002 National Ambulatory Medical

Care Survey, 24.2% of all outpatient visits were made to general and family medicine

providers (CDC NCHS, 2002). Other specialties under the umbrella of primary care

concentrate on specific age groups or a specific gender, while family medicine is geared

to provide care for a wide range of illnesses and problems for patients of both sexes and

all ages.

The AAFP (2007) reports the following information on family medicine

physicians in Virginia:

- 16.6% describe themselves as working in rural areas and 83.3% in urban areas;

- 77% accept Medicaid and 91.8% accept Medicare;

- 13.4% of physicians are solo practitioners, 9.1% work in 2 person partnerships,
  51.6% work in family medicine group practices, 15.2% work in multispecialty
  groups and 10.2% report other practice arrangements; and

- 19.4% report that they self-own their practice, 29.4% report ownership by the
  medical group, 32.1% report their practice is owned by a hospital or health
  system, 8.1% report ownership by federal, state or local government, and 1.8%
  report their practice is owned by a managed care or an insurance plan.

Current Environment of Family Medicine Practice

Overview of the Environment

Family medicine practices exist in a complex, unstable environment where many diverse external elements interact with and influence these organizations. Practices are influenced by numerous government regulations, professional specifications that govern staff and practice activities, third party payer requirements, and increasing patient and stakeholder expectations. Environmental influences originate from political and regulatory sources, cultural norms and expectations, and resource dependencies to form considerable pressure on family medicine practices to implement changes to care delivery, administration and management, and business functions.

The complexity of the environment can be explained by the numerous expectations placed upon family medicine practices and the multifaceted and fragmented health care system. Family medicine practices are expected to: provide care for a broad range of diseases; coordinate care between disparate health system components; manage complicated business, legal and regulatory requirements; address individual patient requirements for independence, information, and access; ensure the use evidence-based practices; safely use the right medical science and technology; and address a diversity of needs and expectations as a result of different racial, ethnic, religious, cultural backgrounds (Lawrence, 2002). The health care system under which family medicine practices operate in is comprised of numerous reimbursement methods, i.e., self pay, fee-for-service, capitation, and at-risk contracts, with a range of organizations and

government agencies dictating rules and regulations for delivery of care and reimbursement.

Family medicine practices also experience a high degree of "unstable" conditions in the external environment, where environmental elements shift abruptly. Complex and unstable conditions place family medicine practices in a high "uncertainty" environment. Uncertainty is when organization decision makers do not have sufficient information about environmental factors, and they have a difficulty predicting external changes (Daft, 1998). "Uncertainty increases the risk of failure for organizational responses and makes it difficult to compute costs and probabilities associated with decision alternatives" (Daft, 1998, p. 87). In today's world of increased expectations, rapid technology breakthroughs, and shifting markets, family medicine practices are facing a greater level of uncertainty and change.

The issues and challenges contributing to an uncertain and complex environment for family medicine practices are discussed in the following sections. Described are the characteristics of the overall health system that influence family medicine, issues in quality and delivery of care, challenges specific to family medicine and primary care, the United States political and regulatory environment, and the socioeconomic and regulatory situation in Virginia.

Overall Health System

There are many issues in the overall health care system that influence the capability of family medicine to fulfill its mission. These issues range from a large number of Americans without health insurance to a system that is highly decentralized

and fragmented. Lawrence (2002) outlined the major challenges facing the health system in "From Chaos to Care, the Promise of Team-Based Medicine". These challenges include: the changing expectations of patients, expanding pace and scope of discovery in medical science and technology, increasing number of Americans with chronic illnesses, growing complexity of medical care and financing, increasing demand for transparency of services and information, increasing diversity of the population and their needs, and external threats to our health from bioterrorism and environmental hazards (Lawrence, 2002). Other environmental influences on the overall health care system include ever-increasing costs of care, aging of the population, and the increasing role of expensive technology for diagnoses and treatment (Starfield, 1998).

The IOM report "Crossing the Quality Chasm" (2001) identified four major reasons for inadequate quality of care and inefficient delivery of care in the United States. These shortcomings are attributable to the underlying characteristics and challenges of the health care delivery system: poorly organized delivery system, growing complexity of science and technology, increase in chronic conditions, and system-wide challenges in implementing advancements in information technology. The IOM report also describes other issues with the current health system that center around the provision of primary and preventive care services. These issues include a lack of organizations and programs that provide a full range of services for people with chronic health conditions and the lack of mechanisms to coordinate these services (IOM, 2001). The report concludes that "quality problems occur typically not because of a failure of goodwill, knowledge, effort,

or resources devoted to health care, but because of fundamental shortcomings in the ways care is organized" (IOM, 2001, p. 25).

<div align="center">*Quality and Delivery of Care*</div>

Quality of care is one of the most critical concerns in healthcare today. The Agency for Healthcare Research and Quality (AHRQ) promotes that "quality health care means doing the right thing at the right time in the right way for the right person and having the best possible outcome" (AHRQ, 2000). The AAFP defines quality in a family medicine context as "the achievement of optimal physical and mental health through accessible, safe, cost-effective care that is based on best evidence, responsive to the needs and preferences of patients and populations, and respectful of patients' families, personal values, and beliefs" (AAFP, 2006a). These definitions provide a foundation for the concept of "quality of care," which focuses on access, outcomes, satisfaction, timeliness, and clinician adherence to standards of care and evidence-based practices.

Quality of care has become a major national policy issue in primary care, as well as other medical specialties. One reason for the recent focus on quality of care in primary care settings is findings of a significant gap between scientific knowledge and actual practice. There have been many studies over the last twenty years that show patients do not receive the recommended standard of care (McGynn, Asch, Adams, et al., 2003; O'Conner, 2005; Saaddine & Engelgau, 2002). Research has shown that about 30–40% of patients do not receive care according to current scientific evidence, and about 20–25% of care provided is not needed or is potentially harmful (Grol & Grimshaw, 2003). The IOM report on quality (2001) describes many studies on the failure to provide care

consistent with well-established guidelines for common chronic conditions such as hypertension, asthma, and diabetes. This finding was so significant that it was one of the major impetuses behind the IOM's appeal for system-wide changes in the delivery of health care.

The results of other studies show that there are also huge practice variations between primary care practices (Martin et al., 2004) and that primary care clinicians are not consistent in the delivery of secondary preventive services (Chen, Radford, Wang, & Krumholz, 2000). Another issue in primary care is that specialists have been found to be more current in their practices than primary care physicians (Solomon, Bates, Panush, & Katz, 1997; Anderson, Rothman, & Wagner, 2003). These studies point toward a need to focus on the quality and delivery of care at the primary care level.

Challenges Specific to Family Medicine and Primary Care

Family medicine and other primary care specialties currently face many challenges in meeting the expectations placed on these specialties by the health care system. Despite the large number of primary care visits, these specialties are threatened by factors such as poor reimbursement, physician stress, lack of prestige, difficulty in managing chronic illness, and an inability to provide prompt access and reliable continuity of care (Lipsky & Sharp, 2006). Many experts in the field (Bodenheimer 2003; Graham, Bagley, Kilo, et al., 2004) claim that primary care in the United States is facing difficult times due to factors such as large workload, physician dissatisfaction, lack of professional recognition, lack of research advancements, and low growth of primary care disciplines. These issues stem from an increase in necessary care for chronic illnesses,

lack of integration with other components of the health system, increase in pressure to provide services to patients that lack access to care, decrease in reimbursement for services, and a model for care that is focused on episodic care and procedures.

There is increasing pressure on family medicine practices to improve efficiency in the use of resources, improve clinical performance, and increase efforts to collect outcomes information as a result of demands placed upon medical practices by health plans, insurance companies, and government agencies. Also, the health care system continues to emphasize technologically oriented specialty care (Sandy & Schroeder, 2003), taking attention away from needed research and advancements in primary care specialties.

Delivery of Primary Care

Stange (1998) reports that the problems of the current health care system are a result of the system's failure to provide fundamental primary care to all patients. Primary care specialties are an important component of the health care system yet are unable to meet current expectations (Bodenheimer, 2003). According to Scherger (2005a) primary care physicians are expected to provide comprehensive and continuing care to patients and families, including modern preventive care and chronic illness management. They must adhere to the latest clinical guidelines, provide care based on the biopsychosocial model, and complete all the paperwork required by health plans and insurance companies. Results from the Direct Observation of Primary Care Study (DOPC) (Stange, 1998) indicate that family medicine physicians care for a wide variety of medical conditions, develop relationships with patients and families, provide patient education

and tailor messages to individual patients based on health risk, use illness visits to provide opportunities for prevention, identify mental health concerns, and in some cases incorporate teaching for medical students.

Scherger (2005b, p 513) argues that "our current process of care is ineffective and obsolete" because the brief-visit model used by outpatient care providers is an acute care model that no longer fits the tasks required of family medicine physicians. Today, in addition to acute care, family medicine physicians also provide family oriented care for prevention and chronic illness management. In the current model, the physician as the sole caregiver limits the range of skills and experiences provided to the patient, and physicians are faced with limited time and resources. The disparity between time available in the current model and expectations of primary care providers has resulted in substandard quality and major stress and unhappiness among physicians (Scherger, 2005a).

Another issue facing the specialties of primary care is that care delivery processes are overly complex, requiring steps and handoffs that slow down the care process and in some cases decreases quality and patient safety (IOM, 2001). These complex care delivery processes are a major source of the lack of integration of family medicine with other components of the health system. The IOM reports that these processes "waste resources; leave unaccountable gaps in coverage; result in the loss of information; and fail to build on the strengths of all health professionals involved to ensure that care is timely, safe, and appropriate" (IOM, 2001, p. 28).

A growth in chronic diseases has also taxed healthcare organizations and revealed deficiencies in the delivery of care to patients at the primary care level. The prevalence of individuals with chronic diseases is growing at an astonishing rate because of the rapid aging of the population and the greater longevity of individuals with chronic illness (United States Department of Health and Human Services [DHHS], 2000b) and medical complications related to obesity. Chronic conditions, defined as illnesses that last longer than 3 months and are not self-limiting (IOM, 1996), are now the leading cause of illness, disability, and death in this country, and affect almost half of the United States population (IOM, 2001). About 100 million Americans have one or more chronic conditions, and this number is estimated to grow to 134 million by 2020 (The Robert Wood Johnson Foundation, 1996). Unlike acute episodic care, care of the chronically ill is a time consuming, collaborative process involving both patients and providers to jointly develop a care plan with goals, targets, and implementation strategies. Chronic care requires the provision of self-management training, numerous support services, and active, sustained follow-up (Von Korff, Gruman, Schaefer, Curry, & Wagner, 1997).

Professional Challenges in Family Medicine

The discipline of family medicine is also faced with professional challenges that include:

- creating avenues for family medicine physicians' to make important contributions in the areas of clinical care and education;

- developing a broader, more accurate understanding of the specialty among the public and other health professionals;

- addressing the wide scope and variance in practice types within family medicine;

- winning respect for the specialty in academic circles;

- making family medicine a more attractive career option; and

- improving the perception that family medicine is not solidly grounded in science and technology (Task Force 1 Writing Group, 2004).

Physician dissatisfaction with their career, salary, and work environment is a major issue facing family medicine. Keating, Landon, Ayanian, Borbas, and Guadagnoli (2005) found that 24% of physicians were dissatisfied with their work. One reason for this dissatisfaction is that the incomes of primary care physicians are well below those of many specialists, and the primary care–specialty income gap is widening. During 2000 to 2004, the median income for family practice physicians increased 7.5% compared with a 15.8% increase for all non–primary care specialties (Bodenheimer, Berenson, & Rudolf, 2007). The median income for family medicine physicians for 2004 was $156,000, while the median income for invasive cardiologists was $428 000, hematologists and oncologists was $350,000, and diagnostic radiologists was $407,000 for the same time period (Bodenheimer, Berenson, & Rudolf, 2007).

Perhaps related to the low satisfaction levels reported by family medicine providers is low growth in the field. All primary care specialties, including family medicine, have experienced low growth of individuals interested in the field. The number of medical students choosing to train in primary care has declined steadily throughout the past decade (Starfield, 1998).

United States Regulatory and Political Environment

The United States regulatory and political environment has a major influence on the practice of family medicine. In recent years, legislators have focused on the following health care issues: quality of care, health care information technology, security of health information, drug safety, physician performance incentives, physician ownership of health care institutions and service organizations, Medicare beneficiary's access to medications, and funding to increase access to health care for uninsured children (Baucus, Barr, Easton, et al., 2007). Specific regulatory actions that have had or will have a dramatic influence on family medicine practices include the Health Insurance Portability and Accountability Act of 1996 (HIPAA), pay-for-performance, and decreasing levels of reimbursement for services for Medicare beneficiaries. These examples of environmental pressure from regulatory and political sources are outlined in the following paragraphs, which illustrate the extent of burden on family medicine practices and pressure to change administrative and clinical processes and procedures.

Title II of HIPAA, the Administrative Simplification (AS) provisions (DHHS, 2000a), placed severe burden on family medicine physicians, as well as other health providers, to adhere to the requirements surrounding electronic health care transactions, the security and privacy of health data, and national identifiers for providers. DHHS issued the final rule regarding HIPAA enforcement, which became effective March 2006. The enforcement rule set penalties for violating HIPAA rules and established procedures for investigations and hearings for HIPAA violations. As of May 2006, physicians were required to use a single National Provider Identifier (NPI) that replaced all other

identifiers used by health plans, Medicare, Medicaid, and other government programs. The influence of this regulation on physician practices includes the burden of additional costs, staff time, and other resources dedicated to ensure compliance. Medical practices shouldered costs related to implementing systems and procedures to ensure information security and compliance. In addition to the costs of developing and revamping systems and practices, the increase in paperwork and staff time necessary to meet the legal requirements of HIPAA influences the finances and distribution of work responsibilities in family medicine practices. One study in response to the HIPAA privacy rule found that health care providers were uncertain about their legal privacy responsibilities and often responded with an overly guarded approach to disclosing information to ensure compliance with the privacy rule (Wilson, 2006). This finding shows that the HIPAA regulations contribute to uncertainty in the environment by creating situations where physicians are unsure of their specific responsibilities.

Pay-for-performance is another initiative undertaken by private health insurers and CMS that may seriously influence family medicine practices in the future. Pay-for-performance systems link compensation to measures of work quality or established performance goals. Providers under this arrangement are rewarded for quality of health services, which is a fundamental change from fee-for-service payment and other reimbursement methods. Medicare previously implemented various pay-for-performance ("P4P") demonstration efforts in offices, clinics, and hospitals (CMS, 2005).

In December 2006, the President signed the Tax Relief and Health Care Act of 2006 (TRHCA) (CMS, 2007). Section 101 under Title I authorized the establishment of a

physician quality reporting system by CMS, titled the Physician Quality Reporting Initiative (PQRI). PQRI establishes a financial incentive for eligible professionals to participate in a voluntary quality reporting program. Physicians who successfully report a designated set of quality measures may earn a bonus payment of 1.5% (CMS, 2007). The PQRI initiative is focused on preventing chronic disease complications, avoiding preventable hospitalizations, and improving quality of care. Although this program is voluntary, physician reporting of quality data represents a significant trend in reimbursement for care provided to Medicare beneficiaries, as well as beneficiaries in other health plans and programs. Physician reporting of quality data may involve substantial time and effort and additional costs to implement and maintain. It is uncertain how family medicine practices will respond to the small changes in payment offered under the PQRI initiative. Small rural practices may face major challenges in providing needed measurements, and larger practices that lack infrastructure to provide measurements may face reporting challenges (Wilensky, 2007).

Family medicine practices are also negatively influenced by reimbursement practices because the visit-based fee-for-service model does not support, and at times inhibits, the accomplishment of providing and coordinating patient-centered primary and preventive care, and mental health services (AAFP, 2007b). Payment arrangements in the health system do not reimburse for all preventive care and appropriate health maintenance services. For example, there are no established mechanisms for reimbursement for non face-to-face physician services such as electronic communication and consultations that physicians provide for the medical management of their

established patients. Family medicine practices also experience instability and uncertainty when changes in reimbursement rates or billing requirements are imposed by the government such as the expected 10% decrease in physician reimbursements under the Medicare payment formula for 2008 (Reichard, 2007).

<div align="center">*Specific Operating Environment in Virginia*</div>

Virginia Socioeconomic Environment

Socioeconomic indicators, health workforce indicators and political and regulatory actions aid in describing the specific operating environment in Virginia that influences family medicine practices. Virginia appears to be above the national average on multiple socioeconomic indicators; however, lags behind on several population health indicators and health workforce indicators. In regard to the political and regulatory environment, Virginia has not been a leader in developing innovative solutions to address problems in the health sector.

The population served by family medicine practices in Virginia can be partly described by specific socioeconomic indicators such as income, the unemployment rate, and percent of the population below the poverty level. It has been shown in past research that socioeconomic status is related to health status and increased risk for specific diseases (Koster, Bosma, Kempen, Penninx, Beekman, Deeg, et al., 2006; Meier & Ackermann-Liebrich, 2005), health seeking behaviors (Lemstra, Neudorf, & Opondo, 2006), and patient compliance with physician orders (Gardner, Eastman, Mehl, & Merimee, 1985). Several statistics on income are presented to provide a picture of the economic situation in Virginia. The median household income in Virginia is $52,300 –

$57,000, with an unemployment rate of 3.1 to 4.1% (The New York Center for Health Workforce Studies, 2006, p 7-12). Both of these indicators are better than the national average. The percentage of population in Virginia living at or below poverty level is between 9 and 12% (The New York Center for Health Workforce Studies, 2006, p. 7-12).

Health insurance coverage is an important patient characteristic that influences provider behaviors (Davis, Ndiaye, Freed, Kim, & Clark, 2003) and individual health behaviors (Garces, Scarinci, & Harrison, 2006). The percent of people without health insurance in Virginia is 13.6, compared to an overall percentage of 17.9 in the United States (U.S. Census Bureau, 2006). The percent of Virginia's children under age 19 at or below 200% of poverty level with no health insurance coverage is 5.6 (107,000), which is lower than the national rate of 7.2 (U.S. Census Bureau, 2006). Virginia's Medicaid recipients represent 10-12% of the population, and Medicare enrollees are 12-14% of population (The New York Center for Health Workforce Studies, 2006, p. 7-12).

Population health is another environmental influence on the practice of family medicine. In 1999, Virginia was slightly above the national rates of deaths due to cancer and firearms, but below the national rate of deaths due to heart disease (Health Resources and Services Administration [HRSA], 2004).

Health workforce indicators for Virginia show the availability of health professionals, and reflect accessibility to health services for the population. Statistics from the HRSA (2004) indicate that there were more than 257,000 people employed in the health sector in Virginia in 2000, 7.5% of Virginia's total workforce. Virginia ranked 38th among the states in per capita health services employment. Health services

employment in Virginia grew 44% between 1988 and 2000, while the state's population grew by 18%, resulting in a per capita growth of 23% in health services sector employment. Virginia has 55 health professional shortage areas where there are not enough doctors to provide care to local citizens (HRSA, 2006). In 2000, there were nearly 13,500 active patient care physicians in Virginia (HRSA, 2004), with an average physician age of 50 – 51 (The New York Center for Health Workforce Studies, 2006, p. 26). With 191 physicians per 100,000 population, Virginia was slightly below the national ratio of 198 physicians per 100,000. Virginia had 66 active primary care physicians per 100,000 population in 2000, slightly lower than the national rate of 69. Medical schools in Virginia graduated over 400 new physicians in 2000. Virginia ranked 15th among the 46 states with medical schools in number of medical school graduates. On a per capita basis, Virginia graduated 5.8 new physicians per 100,000 population, compared to the national rate of 6.4 and ranked 24th among the 46 states in medical school graduates per capita (HRSA, 2004). There were also 721 physician assistants practicing in Virginia in 2000. This translates to 10.1 physician assistants per 100,000 population, less than the national rate of 14.4 (HRSA, 2004).

Virginia Regulatory Environment

Virginia has not initiated many statewide efforts to address access, quality or cost issues. Several regulatory actions are noteworthy and influence the delivery of care from family medicine practices. The most far reaching effort is that Virginia has consistently provided state resources to establish and maintain departments of family medicine and associated residencies at Virginia Commonwealth University, Eastern Virginia Medical

School, and the University of Virginia. Other state efforts to improve quality of care and access to care are described below.

Legislation was passed in 2006 by the General Assembly and signed by Governor Kaine on April 5, 2006, that initiates self-examination of Virginia's primary healthcare delivery mechanism for the Medicaid program (Virginia General Assembly, 2007b). The legislation created the Medicaid Revitalization Committee consisting of patient advocates, healthcare providers, and other stakeholders. The Committee is examining alternative and innovative approaches to health care delivery for Medicaid recipients. The focus of this initiative is on client-centered planning, individual budgeting, and self-directed quality assurance and improvement. This legislation may change requirements for family medicine practices that provide care to Medicaid beneficiaries, which may result in additional costs, staff time and resources.

The 2007 budget and legislative package included measures to make quality and safety priorities in health care regulation and to strengthen health and health care for women and minorities. Bills passed in Virginia by the house and the senate in February 2007 included efforts to: raise the threshold for covering prenatal care for pregnant women, reduce Virginia's infant mortality rate, increase efforts for disease prevention and emergency preparedness, fight childhood obesity and other chronic health conditions that affect school-age children, and coordinate women's health efforts to prevent, detect, and treat breast cancer, cervical cancer, and other diseases that primarily affect women (Commonwealth of Virginia, 2007). Increasing government payments for necessary health services improves the ability of family medicine practices to treat acute and

chronic illnesses for uninsured and underinsured individuals. Efforts to increase coordination of care and treatment for specific diseases may place pressure on family medicine practices to change care delivery and/or administrative and management procedures.

One example of how Virginia regulation has influenced family medicine practices is the Virginia Health Care Foundation (VHCF), which was established by the Virginia state government and the Joint Commission on Health Care in 1992 (Virginia General Assembly, 2007a). This foundation was designed to help create and expand a health care safety net in Virginia. Over the last 14 years, the VHCF has increased access to primary health care for Virginia's uninsured and medically underserved citizens by providing health insurance options to those in need and increasing the number of primary care providers in medically underserved areas. This influences family medicine practices in two ways: first, by increasing access to family medicine services; and second, by building a larger pool of primary care providers.

Summary of the Situation and Environment in Family Medicine

Although many problems persist in delivering primary and preventive health care, there are many positive features that family medicine practices bring to the health care system in the United States. Family medicine practices have a high level of interpersonal communications, accumulate knowledge of the patient, coordinate care with specialty physicians, and provide first-contact care and continuity of care (Stange, 1998). Considering these critical components of health care delivery, it is essential to understand

the problems and challenges facing family medicine practices, environmental factors influencing these practices, and efforts to redesign how care is organized and delivered.

A review of improvement efforts and specific redesign initiatives is an important first step for assessing the influence of the environment on innovations in family medicine. Three essential categories of redesign efforts can be constructed: strategies at the health system level, strategies in the primary care sector/family medicine level, and strategies at the practice level. The strategies and recommendations presented in this section are from empirical studies, where noted and expert opinions based on leading practices in health care and other industries.

Strategies at the Health System Level

The IOM report (IOM, 2001) calls for fundamental changes to improve quality of care and provides strategic direction for redesigning the health care delivery system in the United States. The IOM recommends a system for all Americans to receive safe, effective, timely, efficient, equitable, and patient-centered health care (IOM, 2001). The report presents a challenge to the health care community to develop a system that is capable of providing primary and preventive care, caring for the chronically ill, and coping with acute and catastrophic events. The IOM (2001) report states that there must be change at all levels of the health system, including "the clinician and patient relationship; the structure, management, and operation of health care organizations; the purchasing and financing of health care; the regulatory and liability environment; and others" (IOM, 2001, p. 33).

Donald Berwick (2004), Founder, President and CEO of the Institute for Healthcare Improvement (IHI), believes that problems faced in delivering health care are a result of design issues, basically caused by a system lacking three properties – the ability to transfer knowledge into practice, patient-centered care, and a systems approach to care. He states that care needs to be knowledge-based, centered on patients, encourage patient self-efficacy and assertiveness, and designed to be systems-minded, instead of fragmented. Berwick (2004) defines systems-minded care as care that provides continuity, coordination between providers, and devoid of delays or obstructions. This integration and coordination of care is essential to bridge the gap between care providers. Shortell (2004) also argues for using a systems approach for addressing the managerial and organizational challenges facing health care delivery. He discusses redesigning care systems to produce meaningful and sustainable improvement in quality by working on the following health care delivery components: effective care delivery teams; mechanisms for coordinating care across patient conditions, services, providers, and settings over time; and the use of performance-based accountability reporting systems. Shortell (2004, p. 14S) states that "much is known about organizational design, communications, coordination, how to organize effective teams, and conflict management, but this knowledge appears to be underused in health care settings."

Strategies at the Primary Care Sector/Family Medicine Level

A redesign of the primary care sector is gaining acceptance in the United States (Bodenheimer, 2003). Redesign efforts in primary care and family medicine concentrate on incorporating new practices and technologies into the care process, bringing together

fragmented pieces of the medical care system, improving communications and information systems, redesigning care processes to be more efficient, incorporating quality improvement concepts, improving transparency of information, and addressing the growing need for performance information (Bodenheimer, 2003; Martin et al., 2004). Recommendations to advance the specialty of family medicine involve increasing physicians' ability to: provide technically appropriate chronic disease management; focus on providing new technologies and evidence-based practices; respond to mental health issues; and enhance clinical preventative service delivery (Martin et al., 2004; Stange, 2006).

Strategies at the Practice Level

Many experts in primary care and family medicine believe a new model of office practice is needed (IOM, 2001; Martin et al., 2004; Scherger, 2005b; Shortell, 2004). An IOM study aimed at identifying exemplary practices in health care (Donaldson & Mohr, 2000) was the foundation for the recommendation that health care delivery organizations implement multiple strategies for redesign. These strategies include: redesign care processes based on best practices; use information technologies to improve access to clinical information and support clinical decision making; incorporate knowledge and skills management; develop effective teams; coordinate care across patient conditions, services, and settings over time; and incorporate performance and outcome measurements for improvement and accountability. Another study conducted by Solberg, Hroscikoski, Sperl-Hillen, Harper, and Crabtree (2006) resulted in a list of attributes of well-run family medicine practices. These attributes were captured through case studies of

individual practices. The main attributes of the practice's approach to patient care and business functionality were: leadership; patient-centeredness; focus on the physician-patient relationship; broad physician sense of ownership and responsibility; highly organized change management; market driven; teamwork and standardization; physician feelings of pride and joy; data-driven processes, transparency, and accountability; and strong change and improvement orientation.

<div align="center">Specific Models and Initiatives</div>

Health care organizations have initiated a wide range of efforts to enhance both the quality and the value of medical services (Budetti, Shortell, Waters, Alexander, Burns, Gillies, et al., 2002). These models include changes in organizational structure, redesign of processes and procedures for delivering care, and tools that assist in gathering and using information. Several multifaceted models have been developed for organizations, such as the "New Model" for family medicine. Other initiatives have been developed to address specific types of health conditions or organizational issues. Initiatives include group visits, team-based care, open access scheduling, decision support systems, electronic health records, disease management, and patient registries. These improvement efforts are designed for various purposes including meeting patients' diverse needs and preferences, enabling patients to become partners in their care, and increasing efficiency and effectiveness of care delivery.

A new model of family medicine was proposed in 2004 to align family medicine with the needs of the population and to meet health system improvement goals proposed by the IOM (2001). Multiple organizations associated with the specialty of family

medicine joined together for the Future of Family Medicine (FFM) project to create a strategy to redesign family medicine. The goal of the FFM project was "to recommend changes to the discipline so that family medicine can better meet the health care needs of patients in a changing environment" (Martin, et al., 2004, p. S4). The FFM project resulted in a long-term strategy to transform the discipline of family medicine based on the findings from numerous qualitative and quantitative research studies.

The FFM report urges family medicine physicians to redesign their practices to serve patients better and to develop effective and efficient mechanisms for delivering care. The new model of family medicine emphasizes team-based, proactive care that is supported by effective office systems, technology, and a culture of improvement. The FFM report also articulates core values, key characteristics, and an identity statement for family medicine to meet the stated goals and objectives. The identify statement for family medicine set forth in the report is "family physicians are committed to fostering health and integrating health care for the whole person by humanizing medicine and providing science-based high-quality care" (Martin, et al., 2004, p. S12).

The new model of practice for family medicine is based on leading practices in organizing the delivery of care, such as those offered by the IOM and other experts in primary care and family medicine. The organizational processes and practices recommended in the new model are proposed to improve family medicine's ability to coordinate and deliver care by enhancing access, provide a defined set of services, and support team-based care delivery (Martin et al., 2004). These recommendations include: establishing a personal medical home for each patient, patient-centered care, team based

care, elimination of barriers to care, whole-person orientation, quality of care, patient safety and cultural competencies, advanced information systems, functional office space, and performance management activities. Each of these redesign efforts are described in following section along with other innovations at the practice level.

Advanced Information Technologies

Multiple initiatives in family medicine and primary care focus on the use of advanced information systems to improve information collection, retrieval, and use. These systems have been promoted to improve care, provide effective practice administration, communicate with patients, network with other practices, and monitor the health of the community.

Electronic Health Record

The Healthcare Information and Management Systems Society (HIMSS) (2003) defined an electronic health record (EHR) to assist in the implementation of EHR's in health systems and physician offices. The HIMSS definition of EHR is "a secure, real-time, point-of-care, patient-centric information resource for clinicians. The EHR aids clinician decision-making by providing access to patient record information where and when they need it and by incorporating evidence-based decision support. The EHR automates and streamlines the clinician's workflow, closing loops in communication and response that results in delays or gaps in care. The EHR also supports the collection of data for uses other than direct clinical care, such as billing, quality management, outcomes reporting, resource planning, and public health disease surveillance and reporting" (HIMSS, 2003). Attributes and system requirements outlined by HIMSS

include: secure, reliable, real-time access to patient health information; captures and stores episodic and longitudinal electronic health record information; functions as the clinicians primary information resource in the provision of care; assists with planning and delivering evidence-based care; and captures information for quality improvement efforts, planning, and performance measurement (HIMSS, 2003).

Clinical Decision Support

Clinical Decision Support (CDS) refers to any system for advising or providing guidance about a particular clinical decision at the point of care (AHRQ, 2006). These systems provide "clinicians or patients with clinical knowledge and patient-related information, intelligently filtered or presented at appropriate times, to enhance patient care" (HIMSS, 2003). Knowledge gained from CDS systems range from simple medical or pharmaceutical facts to best practices for managing patients with specific diseases or presentation of new medical knowledge from clinical research. These systems have been implemented to: increase patient safety, increase the use of specific life-saving medications in appropriate circumstances, inform physicians of the cost of brand name and generic pharmaceuticals, warn clinicians of possible adverse events, alert clinicians of necessary tests or procedures, and many other applications. Several case studies have shown the value of clinical decision support systems including a computerized physician order entry of medications and fluids in a neonatal intensive care unit (Blumenfeld & Kapusnik-Uner, 2003) and an alerts system for provider order entry at Massachusetts General Hospital (Glynn, 2002). Clinical practice guidelines are "systematically

developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances (Field & Lohr, 1990, p. 38)

Personal Medical Home

A personal medical home for each patient ensures access to comprehensive, coordinated care through an ongoing relationship with the doctor. In this initiative, a personal medical home is established with each patient and serves as the focal point through which individuals receive acute, chronic, and preventive medical services. Through an on-going relationship with a family physician, patients can be assured of care that is not only accessible but also accountable, comprehensive, integrated, patient-centered, safe, scientifically valid, and satisfying to both patients and their physicians. (AAFP, 2006b)

Patient-Centered Care

Family medicine practices that exhibit patient-centered approaches to care have a relationship oriented culture that emphasizes the importance of meeting patients' needs. Patient-centered care is when patients have a direct say in the care and support services they receive, care meets patient needs, and physicians value individual choices and desires. Several experts believe that practices exhibiting patient-centered primary care have the following characteristics: access to care, patient engagement in care, information systems, coordination of care, comprehensive team care, patient centered-care surveys, and publicly available information (Davis, Schoenbaum and Audet, 2005). Patient-centered care can be accomplished through the use of technologically enhanced services such as online communication, same-day appointments, and team-based care.

Team Based Care

Team-based care can help the patient become a partner in the care process and provide a structure and the resources to address the patient's questions and needs. Patients can draw upon a range of ideas and experiences by interacting with multiple individuals on a team. Also, team-based care reduces the burden on the physician to address all the patients needs, increasing the possibly that all patients' needs are meet. Team-based care can address the needs of a wider cross section of society more effectively, and may provide care more efficiently than a solo doctor or a small group practice (Lawrence, 2002).

Quality of Care, Patient Safety and Cultural Competencies

Numerous initiatives stress quality of care, patient safety, and care provided within a community context that considers cultural differences. Family medicine practices are encouraged to document quality and safety through ongoing analyses of practice patient care data. Practices are also encouraged to collect patient feedback to ensure that the practice is meeting patients' expectations, satisfying their needs for access to the practice, and responding to the needs of increasingly diverse populations (Task Force 1 Writing Group, 2004).

Elimination of Barriers to Care

Family medicine practices experience pressure from policymakers and stakeholders to increase access to care. Practices are encouraged to play a role in eliminating or reducing barriers to access through administrative tactics such as

implementation of open scheduling, expanded office hours, and developing convenient options for communication between patients and practice staff, such as the use of e-mail and telephone consultation.

Whole-Person Orientation

Whole-person orientation refers to meeting the complete range of needs for a given patient population by providing coordinated care through mechanisms such as developing cooperative alliances with services or organizations that extend beyond the practice setting. Family medicine practices that exhibit whole-person orientation specialize in caring for the physical, mental, and emotional well-being of their patients and their families. They care for patients through all the stages of life and in all major medical areas. They diagnose and treat the full range of patient problems (AAFP, 2007a).

Group Visits

Many experts in the field have recommended group visits as a way to address patients' needs and at the same time reduce the time and financial resources required to treat patients (Bodenheimer, 2003, Lawrence, 2002, Scherger, 2005a). Group visits are designed for multiple patients that are grouped according to their diagnoses, health status, or impeding surgery or procedure (Lawrence, 2002). Since chronic illness management and lifestyle modification dominate primary care, group visits offer an efficient method for meeting with patients that have similar problems. Group dynamics and peer support can help patients deal with tough problems such as weight loss. In group visits, patients meet with their clinicians, receive patient education as a group, and discuss problems and issues that may affect all members of the group. There are multiple organizations that

have been employing this method for quite some time, including Kaiser Permanente, the Mayo Clinic, and the Southern Alabama Medical School (Lawrence, 2002). This care delivery method can enable patients to become more involved with their care, increase patient comfort and acceptance of their situation, and reduce costs.

Open Access Scheduling Systems

Open-access scheduling involves seeing patients on the day they call for an appointment. Practitioners at the Allina Medical Clinic (O'Hare and Corlett, 2004) found that open-access scheduling has increased both quality of care and revenue. Other outcomes included improved continuity of care, more productive patient visits, higher physician compensation and higher net gains for clinics. Implementing open access requires an overhaul of scheduling infrastructure, including decreasing appointment types, simplifying operational processes, using past appointment requests to predict future demand and developing contingency plans for when demand exceeds prediction (O'Hare and Corlett, 2004). Open access scheduling has been successfully implemented in Kaiser Permanente, the Mayo Clinic's Primary Care Pediatric/ Adolescent Medicine team, and HealthPartners Medical Group and Clinics in Bloomington, Minneapolis (Murray and Tantau, 2000). Murray and Tantau (2000), creators of the open-access model, propose strategies for practices to design an open access schedule. These strategies include: working down the practice's backlog of appointments; rolling out the new system by showing patients how it works; offering all patients an appointment on the day they call or schedule an appointment of their choosing; allowing physicians to pre-schedule patients when it is clinically necessary; limiting appointments to three kinds

(personal, team, and unestablished) and one standard length of time; ensuring each physician has a manageable panel size, based on his or her scope of practice, patient mix and time spent in the office; encouraging efficiency and continuity by protecting physicians' schedules from their colleagues' overflow; and developing plans for extreme demand or physician absence.

Disease Management

Disease management programs have been addressed in multiple research articles to improve care for chronic health issues. These programs involve enhanced screening and monitoring, disease-specific patient education, coordination of care among providers and settings, and the use of evidence-based practices (Congressional Budget Office, 2004). Disease management seeks to identify chronic conditions more quickly, treat the disease more effectively, and slow disease progression. In a meta analysis study conducted by Ofman, Badamgarav, Henning, Knight, Gano, Levan, et al. in 2004, disease management appeared to improve patient satisfaction, patient adherence, and disease control. The CDC Task Force on Community Preventive Services (CDC, 2001) strongly recommends disease and case management to improve clinical processes and patient outcomes. The Task Force recommends that disease management programs are based on the demographics of the population and the burden of disease in the population served (CDC, 2001).

Disease or Patient Registries

Numerous articles mention the development and use of a patient registry to capture important information on patients. A patient registry is a database of patient

information that can be analyzed to understand and compare the outcomes and safety of health care. Some registries include patients who have the same disease, others are comprised of patients who have undergone a common surgical procedure or received a newly approved medication (AHRQ, 2007). Studies using patient registries include Benedetti's (2004) study of the Chronic Care Model in clinics, Larson's (2003) assessment of a diabetes care management system, and Patel and Welsh's (2004) work on measuring asthma outcomes using a coordinated care approach in a large medical group. Patient registries have been used effectively in many settings to issue reminders for preventive care and necessary follow-up, and to provide feedback to the provider on patient compliance and service use.

Functional Office Space

Redesigned physician offices are also being put into operation to improve the efficiency of office functions and support patient-centered care in family medicine practices (Task Force 1 Writing Group, 2004). The goal of redesigning physician offices is to accommodate innovative work processes, and to ensure convenience, comfort, and efficiency for patients and clinicians. Functional office space indicates efficient work flows and the ability to accommodate group visits, special needs patients, and the ability to provide extra services such as a patient library or computer work stations for patient education.

Performance Measurement and Monitoring

Performance measurement and monitoring are one of the many quality improvement activities that has been implemented in organizations to improve patient

care. Performance measurement and monitoring can be defined as the review and tracking of performance results on care processes that are based on current scientific evidence to improve quality and effectiveness. A performance measurement system is utilized by health care organizations to track and analyze trends associated with the care and treatment of patients. The measurement system is designed to provide information back to the group practice management, providers, and patients to facilitate the identification of both successes and failures (Engelgau, 2003). Examples of information that is often measured and reviewed by health care organizations include: clinician use of evidence-based guidelines, results of clinical quality improvement projects, outcome data for selected conditions, and financial performance.

Enhanced Practice Finances

Efforts to enhance practice finances include using ancillary care providers, offering additional services such as diagnostic testing and services not covered by insurance companies, and increased attention to financial profitability and reimbursement for services. Physician offices have started to offer non-covered services and products to patients for revenue enhancement. This effort to increase revenue is in response to decreased reimbursement for covered services and the rising costs of providing these services. Examples of non-covered services and products include vitamins and cosmetic procedures and products. No research on the extent and utilization of techniques to enhance practice finances in primary care or family medicine was identified in the literature review.

Chapter Summary

Family medicine practices are a critical component for delivering primary and preventive care in the United States, yet few research studies have addressed organizational issues in this specialty. There is a lack of empirical studies not only on the influences presented by the political, regulatory, and societal environment but also on the level and types of improvement efforts employed by practices to improve care delivery and business functionality. Most of the literature available on this topic is not based on empirical research, but rather prescriptive or descriptive articles based on opinions from family medicine physicians or qualitative research studies. These articles review various methods to change the way care is delivered or improve office efficiency, however the majority of what is written on this topic is not supported by quantitative research methods.

The literature review indicates that family medicine practices exist in a complex and unstable environment. Practices experience pressure from stakeholders, government agencies, professional associations, and payer organizations to substantially revise practice operations and processes by which care is delivered (Budetti, Shortell, Waters, Alexander, Burns, Gillies, et al., 2004; Graham et al, 2004). It is crucial to seriously examine efforts aimed at improving the quality of care and business functionality of family medicine practices. Table 1 provides an overview of innovations in family medicine practices.

Table 1. Summary of Practice Innovations in Family Medicine

Model/Initiative	Description
Clinical Improvement Efforts	
Personal Medical Home for Patients	Efforts to ensure on-going relationship with a specific physician, accessible care, comprehensive, integrated, patient-centered care
Team Based Care	Coordinated use of ancillary care providers
Patient Involvement in Care	Efforts to increase patient self management
Alternative Scheduling Arrangements	Use of open access scheduling, group visits, telephone or e-mail consultations, evening or weekend visits
Patient Centered Care	Providing care that respects patient preferences and beliefs and promoting an excellent care experience. Activities may include patient involvement in care, use of patient satisfaction surveys, provide alternative scheduling arrangements
Advanced Information Systems	Electronic health record that consists of all or some of the following components: problem list, ambulatory visit data, emergency room visits, services by other specialists, inpatient stays, medications, radiology findings, clinical guidelines, medication reminders and/or drug interaction information, laboratory findings
Whole Person Orientation	Care for the physical, mental, and emotional well-being of patients through all the stages of life and in all major medical areas
Quality of Care	Use of evidence-based medicine, use of clinical guidelines, track and measure clinical performance and make changes based on performance data
Cultural Competency	Provide access to translation services
Elimination of Barriers to Care	Offers alternative scheduling options, offers translation services

Table 1. Continued.

Business Improvement Efforts

Functional Office Space	Evaluation of office space for functionality, accommodation of special needs patients, group visits, patient library or computer work stations for patient education
Performance Measurement and Monitoring	Measurement of some or all of the following: clinician use of evidence-based guidelines, results of clinical quality improvement projects, outcome data for selected conditions, and financial performance
Enhanced Practice Finances	Operating efficiencies such as use of ancillary care providers and activities to improve employee morale New revenue streams such as providing diagnostic services or non-covered services Reviews financial performance
Market Assessment	Reviews trends in the community and/or state such as disease patterns, regulatory actions, competition, research availability, demand for services, patient demographics

Numerous researchers recommend further examination of family medicine practices and initiatives to improve business functionality, quality of care, organizational change, and leadership (Solberg, Hroscikoski, Sperl-Hillen, Harper, and Crabtree, 2006; Stange, 1998). There is a critical need for additional knowledge of innovations, quality improvement activities, and the influence of environmental pressures on family medicine practices. This study addresses several areas that have not been addressed in previous empirical studies; what level and type of improvement efforts are being employed in family medicine practices and what environmental dimensions influence practices to engage in improvement efforts.

CHAPTER 3 - THEORETICAL FRAMEWORK

Introduction

The purpose of this chapter is to develop a theoretical framework that posits a logical argument about the causal pathways of organizational and environmental forces on innovations in family medicine. This study concentrates on macro perspectives, examining the structure of wider environments and their effects on organizational structures, strategies, and processes in family medicine practice.

This chapter reviews pertinent organizational theories concerning the effect of the environment on organizational response. The chapter presents an overview of the development of open systems theories, then examines specific perspectives from institutional and resource dependency theory. Both institutional and resource dependency theories were used to guide this study in exploring innovations and the complex set of internal and external pressures faced by family medicine practices. The theories were combined to create a conceptual framework and model that addresses both institutional pressures and dependencies on resources. The blending of perspectives enables the identification of a variety of motivations for strategic decision making in family medicine practices (Luke & Walston, 2003). The chapter concludes by presenting testable study hypotheses that were developed based on the theoretical perspectives and the resulting conceptual framework.

Background on Organization Theory

Organizational theory provides a framework to conceptualize general organizational responses to the environment and to explain organizational behavior in health care (Mick & Wyttenbach, 2003). Organization theory can be defined as "the study of the structure, functioning and performance of organizations and the behavior of groups and individuals within them" (Pugh, 1984, p. 9). Central to organizational theory, and particularly important to this study, is the question of what causes organizations to change and adopt specific operational processes and management practices. A review of the history and background on organizational theory can assist in understanding organizational behavior in family medicine practices.

Theoretical Background on Organizations and Environment

Recognition of the importance of management and the structure of organizations reaches far back into history starting with early organizations of the Muslims, Hebrews, Greeks, and Romans (Shafritz, Ott, and Jang, 2005). The origins of organizational theory can be traced to the eighteenth century with its basic tenets and assumptions rooted in the industrial revolution and the professions of mechanical engineering, structural engineering, and economics. Since that time, organizational theory expanded and matured to reflect changing societal values. Significant advancements in the understanding of organizations resulted from the works of Adam Smith, Frederick Winslow Taylor, Henri Fayol and others (Shafritz, et al., 2005). One of the most important advancements in organizational theory came from Weber's analysis (Weber, 1922) of bureaucratic organizations. His work outlined the core characteristics of fully

developed bureaucratic organizations. A key concept from Weber's work that is particularly important to this study is the idea that building and sustaining organizations depends on the availability of resources, both human and material (Carroll & Hannan, 2000).

In the 1960s, researchers and theorists began to recognize the need to understand organizational behavior better based on the contemporary understanding that organizations serve as the principle mechanisms for achievements that are beyond the reach of individuals (Parsons, 1960). The current body of knowledge about organizational behavior benefited from a growing recognition of the importance of the wider environment on the structure and functioning of organizations. During the 1960s and 1970s, an open systems perspective gained acceptance as the general premise for studying diverse aspects of organizational behavior, which takes into account the influence of various characteristics of the environment. Before that time, organizations were viewed as closed systems operating autonomously within fixed boundaries. The closed-system view of organizations failed to acknowledge the interdependencies and interactions between organizations and their environments (Shafritz, et al., 2005). The organizational environment, as defined by Daft (1998, p. 82), is "all elements that exist outside the boundary of the organization and have the potential to affect all or part of the organization". The examination of organizations as open systems takes into account the external dynamics of competition, stakeholder demands and expectations, and interdependent relationships and interactions with other organizations. It is now considered essential to study organizational actions and structures from the open systems

perspective, i.e., with full consideration of the organization's external environment (Zakus, 1998). The awareness of environmental factors on an organization's strategies and actions (Katz & Kahn, 1966; Thompson, 1967), and the introduction of open systems models (Scott, 2003) are some of the most important intellectual developments shaping organizational research over the last 40 years.

New organizational theories and practical management approaches came out of the awareness of the importance of the environment and the constraints that the environment can impose on an organization (Zakus, 1998). This perspective has influenced our understanding of change management, organizational lifecycles, strategic decision making, performance management, employee training and motivation, customer satisfaction, and leadership styles. This perspective has contributed to the development of multiple theories to explain why the environment is important and how it exerts its influence, including rational systems/contingency theory (Thompson, 1967), institutional theory (Meyer & Rowan, 1977), resource dependency theory (Pfeffer & Salancik, 1978), population ecology (Hannan & Freeman, 1989), and other concepts and models under the umbrella of open systems theories. These organizational theories share the common viewpoint that the environment influences organizational behavior and structure; however, all theories progressed in various directions regarding the impact of the environment and motivation for change within organizations. A number of environment-organization associations are explained through market competition, positions of dependence, and social norms and values.

Organizational Environment

The environment and its influences are difficult to describe, especially for industries that exist in complex and uncertain environments. Pfeffer and Salancik (1978), however, developed a framework to describe the environment through various levels and structural characteristics. On the first level, "the environment consists of the entire system of interconnected individuals and organizations that are related to one another and to a focal organization through the organization's transactions" (Pfeffer & Salancik, 1978, p. 63). The next level of the organization's environment is the set of individuals and organizations with whom the organization directly interacts. The third level is the "the enacted environment" (Pfeffer & Salancik, 1978), the organization's perception and representation of the environment. It is the "enacted" environment, comprised of the most important components as determined through perception and belief, which determines organizational action.

Components of organizational environments are interactive and are extremely complex and multifaceted (Mick, 1990). Open systems theories can show links between the environment and an organization's strategies and actions and have been increasingly applied to health care organizations over the last several decades. These theories illustrate general organizational responses to environmental influences and are appropriate conceptual frameworks to explain organizational behavior in health care (Luke & Walston, 2003). Twaddle (1996) proposed that sociological frameworks, such as open system theories, can explain the "socially embedded nature" of health care organizations

in order to understand and equip innovations better such as those currently undergoing in family medicine physician practices.

Open system theories were reviewed for this study to understand the environment-organization relationship and to search for frameworks that explain the effect of the environment on organizational change efforts. Multiple theories from organization sociology were reviewed to understand organizational response to various aspects of the environment, such as economic, social, ethical, and legal pressures. Institutional theory was examined to understand the environmental pressures to conform to cultural norms and values and externally imposed requirements, such as laws, professional standards, and licensure and accreditation standards. Resource dependency theory was evaluated to understand organizational response resulting from dependence on financial, human, and information resources, as well as the goods and services necessary for organizational survival. Of the theories that grew out of the open systems perspective, institutional theory and resource dependency theory best describe the impact of environmental factors on family medicine practices.

Institutional Theory

Theoretical Perspectives

Institutional theory, an organizational theory deriving from the field of sociology, offers a well-defined perspective on organizational response to the environment, specifically responses to legal requirements, stakeholder expectations, and cultural norms and values. The framework imparted by the theory derives from the work of Zucker (1977) and Meyer and Rowan (1977) who established the theoretical foundation of

institutional theory that emphasizes the effect that an operating environment places upon an organization.

Institutional theory maintains that organizations consider aspects of its environment when making strategic and operational decisions and that organizations need legitimacy from their stakeholders (Daft, 1998). Institutional theorists have traditionally focused on how organizational structures and strategies are put into practice based on the organization's need for legitimacy. Legitimacy occurs when an organization's actions are desirable, proper, and appropriate within the environment's system of norms, values, and beliefs (Daft, 1998). This perspective maintains that organizations consider whether stakeholders find actions acceptable, and whether stakeholders will recognize organizational characteristics, functions, and processes (Wells & Banaszak-Holl, 2000). Institutional theory also emphasizes that organizational success and survival depend upon congruence between organizational responses and expectations from its environment (Daft, 1998). The survival of organizations, therefore, depends on conformity to externally imposed requirements such as laws, professional standards, licensure or accreditation criterion, as well as fulfillment of stakeholder expectations.

Institutional theory is increasingly being used in organizational research to explain strategic decisions and management actions (Ingram & Silverman, 2002). This perspective has been used as a framework to analyze diverse organization types, including profit, not-for-profit and government, and industry sectors such as education, labor, and health care (Scott, 2004). Institutional theory provides the basis for understanding the substantial changes occurring in the health care sector. Alexander and

D'Aunno (1990) advocate that change in the health care sector should be a central

concern of organizational research considering the rapid shifts in the environment and the

unprecedented rate of new organizational forms. Institutional theory offers the potential

for developing new insights into these changes and the increasingly businesslike

characteristics of health care system in the United States (Alexander & D'Aunno, 1990).

Institutional Environment

Institutional environments are comprised of elaborate rules and regulations for

individual organizations to receive support and legitimacy (Meyer & Rowan, 1990). The

rules and regulations of the institutional environment derive from norms and values from

stakeholders, which reflect the views of society as correct ways of organizing and

behaving. The institutional perspective claims that organizations adopt structures and

processes to please stakeholders. Response to the environment is through conformity to

these externally imposed requirements or regulations (Scott & Meyer, 1983). One type of

conformity is isomorphism, which is the process that compels one organization to

resemble others that face the same set of environmental conditions (DiMaggio & Powell,

1983).

Institutional Forces

Organizations receive legitimacy and support through three institutional forces

within the environment: coercive forces, mimetic forces, and normative forces

(DiMaggio & Powell, 1983). All three institutional forces are at work to stabilize social

behavior (Scott, 2004), which ultimately affects the strategies and actions put into

practice by organizations. These forces shape the nature of the industry, market and

competition, as well as the meanings of effective performance and efficient operation (Scott, 2004). The characteristics of institutional forces affecting organizations are explained in the following text.

Coercive, or regulatory, forces stem from governmental organizations, legislation, and court decisions on the structure and activities of organizations (Scott, 2004). Essentially, coercive pressure is placed upon organizations by outside institutions that maintain a position of legal authority or resource control over organizations. The pressure is experienced as being forced since the organization is bound by dependency on other organizations or by laws and regulations. Consequently, organizations are structured and engage in management practices and activities that aid legitimization or acceptance from the external institution (DiMaggio & Powell, 1983; Scott, 1987).

Normative forces result from social consensus and enforcement of standards set by societal norms and values dictating how organizations are structured and how they function (DiMaggio & Powell, 1983; Scott, 1995). Culture and norms shape regulatory mechanisms, from informal sanctions to laws and funding patterns (Wells, 2001). Normative agents, such as professional associations, have enormous power in shaping organizational forms and processes (Scott, 2004). Professionalism is one source of normative pressure on organizations, which can be defined as "the collective struggle of members of an occupation to define the conditions and methods of their work, to control 'the production of producers', and to establish a cognitive base and legitimization for their occupational autonomy" (DiMaggio & Powell, 1983, p. 152).

Mimetic, or cognitive, forces reflect the need of organizations to reduce uncertainty, ensure survival, and gain legitimacy through imitation of other members of the organization's market (DiMaggio & Powell, 1983). Mimetic forces influence an organization's response to uncertainty in the environment, causing the organization to adopt systems and techniques perceived as successful by other organizations (DiMaggio & Powell, 1983; Scott, 1987). Successful organizations are used as models for change in response to complex and uncertain elements in the environment. A detailed description of the characteristics of institutional forces is presented in Table 2.

Table 2. Characteristics of Institutional Forces Affecting Organizations

	Coercive (Regulative)	Normative	Mimetic (Cognitive)
Basis of compliance	Expedience	Social obligation	Taken for granted
Logic	Instrumentality	Appropriateness	Orthodoxy
Indicators	Rules, laws, and sanctions	Certification, accreditation	Prevalence, isomorphism
Basis of legitimacy	Legally sanctioned	Morally governed	Culturally supported, conceptually correct

Adapted from: Scott, W. R. (1995) and York University (2006)

Organizational Response to Institutional Forces

The environment referred to in institutional theory is the cultural and social environment consisting of traditions, trends, norms, values and ideals that exert expectations on organizations. These expectations encourage appropriate, expected and

legitimate organizational structures and behaviors. Institutional theorists argue that organizations are not run according to rational decisions, with efficiency as the objective, but rather through adaptation to prevailing and contemporary principles for organization, management, and administration in order to be perceived as up-to-date, innovative and legitimate (Scott & Meyer, 1994). Institutional theorists also believe that organizational strategies are not entirely driven by internal operations or management problems but also by external pressures such as social and cultural norms. DiMaggio and Powell (1983) propose that variation in structures and processes would be greater if strategic choice was the only determinant of organizational structures and behavior. They found in their research that organizations grow increasingly similar to each other. Hawley (1968) originally labeled this process "homogenization isomorphism" and defined it as pressures in a population to become similar to other units facing similar conditions.

In institutional theory, isomorphism is the adaptation and change in organizations to conform to industry norms (Scott, 1992). Searches for "best practices" in an operating environment and similar service provision are examples of isomorphism. In this phenomenon, the environment puts pressure on organizations, with varying amounts of force, to resemble one another regardless of an increase in efficiency. In cases where efficiency, success, or survival has occurred, institutional theorists believe that organizations have been rewarded for complying with prevailing practice. Previous research on organizations has shown that compliance has resulted in an increase in prestige, stability, legitimacy, social acceptance, organizational commitment, access to

resources and personnel, and professional reputation (DiMaggio, 1988; DiMaggio & Powell, 1983; Meyer & Rowan, 1977).

Despite the emphasis on organizational similarities, deviation and variation in organizational structures and behaviors can be understood within institutional theory. In recent years, theorists began to recognize that organizations are capable of responding in a variety of ways to environmental influences to gain access to resources and markets, obtain legitimacy, and ultimately achieve success and survival. Oliver (1991) and others suggest that variation, despite a similar institutional environment, can be understood as a result of organizational responses to institutional pressures. In this paradigm, divergent strategies and practices exist due to organizations being subjected to varying levels and types of institutional pressure (Lounsbury, 2001).

When discussing institutional pressures on a given organization, it is important to define the environment to understand the sources of pressure (Scott, 1987; Zucker, 1987). Organizations in different environments or populations face different pressures. Acceptable norms in one industry or type of organization may be unacceptable in another. For instance, the motivation to engage in quality improvement efforts between nonprofit, for profit, and government organizations is a good illustration of this point (Scott, 1987; Zucker, 1977, 1987). Societal norms might convey that it is acceptable for profit organizations to engage in improvement efforts to increase revenue, however may disapprove of nonprofit or government organizations engaging in improvement efforts for this reason. Therefore, to assess the importance of institutional theory in a given industry, it is important to define the environment and intensity of pressures faced by organizations

in that industry. It has been recognized that health care organizations are influenced as much by economic, organizational, and market forces as by the long standing institutional values and constraints (Luke & Walston, 2003). Chapter 2, Literature Review, described the environment in health care and its pressures on family medicine practices.

Resource Dependency Theory

Theoretical Perspectives

Resource dependency theory stipulates that organizations continuously seek resources from their environment in order to survive and succeed (Pfeffer & Salancik, 1978). Organizational behavior, in resource dependence theory, is triggered by the need for critical resources an organization must have in order to survive and function. Organizations depend on the environment for resources such as raw materials, capital, equipment, human resources, information and a channel for its products and services. The theory aids in explaining the relationship between an organization's response to its environment and the discretionary control the organization has over needed resources, the degree of need for these resources, and the lack of access to alternatives (Pfeffer & Salancik, 1978). In this perspective, organizations are seen as rational decision makers adopting externally legitimate strategies as a way of gaining the resources they need from their environment. This recognizes and builds on the open systems perspective in that organizations adapt to their environment to acquire needed resources (Zakus, 1998).

Resource dependency deals with specific pressures placed on an organization from the environment. Organizations consciously adapt through a process of scanning the environment for opportunities and threats, and then formulating and implementing

change efforts to manage the organization and the environment (Zakus, 1998). A dependence on external resources has a strong influence on the strategic decisions and actions taken by organizations, including the structure and processes of organizations, actions taken to accomplish organizational goals and objectives, and relationships with external entities.

The literature on resource dependency theory examines two broad categories of resources: factors of production and power (Mintzberg, 1983; Pfeffer, 1981). Factors of production include land, human resources, information, equipment and supplies, and capital. Resource dependency theory stipulates that organizations are dependent upon relationships with other organizations to obtain these resources. Power, another resource sought by organizations, provides the ability to exert some degree of control over the environment (Mintzberg, 1983; Pfeffer, 1981). External power is utilized in an organization's relationship with other organizations in the environment. These entities may be suppliers, consumers, government institutions, or the media. Power relations of this type can include lobbying, public relations, and collective bargaining (Helms, 2004). External power relationships illustrate the attempt of managers in an organization to deal with complexity in the environment. Resources that flow into the organization are inherently affected by power through institutional forces, supply relationships, or consumer relationships.

Pfeffer and Salancik (1978) propose three broad environmental dimensions that influence organizations: concentration, munificence and interconnectedness. These three environmental dimensions represent constructs that have led to the development of

measures commonly used to apply resource dependency theory to organizational behavior. Concentration is the proportion of an industry's output, sales, assets, or employees controlled by the largest organizations in the market. An environment that is highly concentrated in terms of critical resources is indicative of organizations that wield great power, resulting in greater levels of dependence of focal organizations on the dominant organizations. An aspect related to concentration that is often used to measure resource dependency is the level of competition in the market (Alexander & Morrisey, 1989; Banaszak-Holl, Zinn, & Mor, 1996; Zinn, Proenca, & Rosko, 1997). Munificence refers to the availability of critical resources in the environment. The decision to comply with the needs or demands of other organizations will depend on how abundant and stable resources are in a given market environment (Banaszak-Holl, et al., 1996). Interconnectedness is defined as the number and pattern of relationships (linkages or connections) among organizations. Interconnectedness creates management challenges and relationship risk because "the greater the level of system connectedness, the more uncertain and unstable the environment for given organizations" (Pfeffer & Salancik, 1978, p. 69). The environment becomes more uncertain and unstable due to increased dependency on other organizations for resources.

Organizational Response to Resource Dependency

There are two broad adaptive responses that organizations may take to deal with resource dependencies: the organization can either adapt and change itself to deal with environmental requirements, or it can attempt to exert "power" to modify the environment (Pfeffer & Salancik, 1978; Thompson, 1967). Organizations may undertake

various strategies to adapt to requirements of the environment. In some instances, organizations may engage in ownership or structural changes such as a merger or acquisition of organizations providing required services or supplies. In other instances, organizations may attempt to change their internal practices, human resource composition, and relationships with other organizations in order to have more control over needed resources or work more effectively. Organizations may also engage in change efforts to improve their efficiency and effectiveness to gain resources, such as additional revenue or staff availability. Organizational strategies, therefore, become a means for organizations to minimize their dependence on others or increase the dependence of others on them. In this sense, the effective organization is "the organization which satisfies the demands of those in its environment from whom it requires support for its continued existence" (Pfeffer & Salancik, 1978, p. 60).

<center>Application of Theoretical Frameworks in Health Care</center>

Open systems theories are ideal for examining the effect of the environment on organizational response in the health industry since it is highly unique and inexperienced in responding to market forces (Luke & Walston, 2003). Both institutional theory and resource dependency theory impart pertinent frameworks for explaining many of the distinctive strategic responses that occur in health care. Institutional theory is relevant to industry sectors that are undergoing rapid change and consist of fragmented systems and inadequate processes (Scott et al, 2000); clearly, these are characteristics of the health industry in the United States. Wells specifically points out that institutional theory is applicable to health care organizations because of the difficulty in evaluating the

technical effectiveness of these organizations (Wells, 2001). In addition, Alexander and D'Aunno (2003) advocate the use of institutional theory as a theoretical basis for understanding changes occurring in the health care sector. Resource dependency theory has also been frequently used in the health industry to examine organizational structure and behavior that reflect adaptation intended to secure a stable flow of resources (Oliver, 1990).

While no studies could be found that utilized an institutional or resource dependency framework for the redesign of physician practices, numerous studies have applied these perspectives to redesign efforts and strategic responses taken by other types of health care organizations. These studies are explored in the following sections.

Application of Institutional Theory

Institutional theory has been used to study various aspects of the environment-organization relationship in health care organizations. Several studies described in this section have applied institutional theory to understanding innovations in the health industry. For instance, Bolon (1998) used institutional theory, combined with concepts from bureaucracy theory, to study redesign efforts in hospital structures and processes. He argues that as productivity and efficiency become institutionalized, hospitals conforming to established operational standards will gain legitimacy and additional resources from their environment. Floyd (1999) used concepts from institutional theory to study whether legitimacy factors determined strategic directions among Veterans Health Administration's substance abuse programs. He found that legitimacy factors played a role in program closure and change. Hakkinen and Lehto (2005) used concepts from

institutional theory to review health care reform and change in the Finnish health care system. These researchers concluded that while the institutional perspective provided great insight on reform efforts, other theoretical frameworks should also be employed to gain a complete picture of health care reform and change.

Application of Resource Dependency Theory

Empirical research in the health industry has supported the underlying premise of the resource dependency perspective and its application to health care services. Researchers have been able to establish that environmental factors and organizational characteristics are associated with organizational actions and behaviors (Banaszak-Holl, et al., 1996; Garpenby, 1999; McNally, 2006; Roggenkamp, 2000). McNally (2006) used resource dependency theory, combined with survival concepts from ecological theory, to analyze technological innovation and organizational survival in hospitals. McNally found that organizations acquire new technology for a variety of reasons such as generating revenue, meeting the needs of patients, and enhancing their image as a technological leader. Garpenby (1999) used resource dependency to evaluate strategic relationships and efforts to improve medical quality and organizational quality in Sweden. He found that resource dependency is useful in explaining why organizations establish strategic relationships between government, public, and professional organizations. Banaszak-Holl, et al. (1996) used resource dependency theory to investigate organizational and environmental factors associated with innovation in health care service delivery, specifically the provision of specialty care in nursing care facilities. Their findings

indicate that while competition is an incentive to innovate, regulatory stringency constrains the development of innovation in specialty care.

An Integrated Approach

Organizations are capable of responding in a variety of ways to environmental influences. This concept was advanced by Oliver (1991), who recognized the value of linking several theoretical models to explain the environment-organization relationship. This perspective suggests that organizations do not simply respond to institutional demands with passive compliance but employ a range of "strategic" responses that may include submission, compromise, avoidance, defiance, and/or manipulation (Scott, 2004). Luke and Walston (2003) advocate that no one theory can adequately explain organizational behaviors in an industry as complex and unique as health care. Researchers in health care, as well as other fields, are progressively utilizing theoretical frameworks consisting of multiple organizational theories to explain organizational responses to environmental influences.

Two perspectives that have been used as complementary frameworks to understand health care organizational phenomena are institutional and resource dependency theories (Roggenkamp, 2000). There is growing research that suggests greater explanatory power is possible if the perspectives are considered in tandem rather than as mutually exclusive frameworks (Balotsky, 2005). For example, Oliver (1991) combined institutional and resource dependence perspectives to predict how organizations strategically respond to various institutional pressures. Campbell and Alexander (2005) applied resource dependence and institutional theories to explain the

variation in the adoption and implementation of outpatient substance abuse services for women. Balotsky (2005) used both theories to build a framework to better explain hospital strategic response to the constraint on resources resulting from the 1983 Tax Equity and Fiscal Responsibility Act. Lipski (1995) also employed both institutional theory and resource dependency theory to evaluate the impact of physician payment reform and the Medicare fee schedule.

Family medicine practices, similar to other organizations, are heavily influenced by their dependency on resources, as well as by cultural, social, and political processes (Scott, 2004). Considering the numerous environmental influences on family medicine practices, as outlined in Chapter 2, the conceptual model developed for this research includes concepts from institutional theory and resource dependency theory. A framework consisting of perspectives from both theories balances institutional forces with economic variables to better explain organizational responses to pressures from the environment than a traditional single paradigm approach. An integrative perspective proposes that family medicine practices exercise strategic choice within the constraints posed by organizational capabilities and institutional environments (Zinn, et al., 1998).

<div align="center">Theoretical Assumptions</div>

Several assumptions can be drawn from the theoretical perspectives of institutional and resource dependency theories that apply to this research. The following assumptions are used to guide the study hypotheses presented in the next section.

1. Organizations are affected by the surrounding environment. The open systems perspective implies that organizations are not solely managed by individuals, but are dependent on the surrounding environment to supply resources and a market.

2. Organizations are also dependent on legitimacy. In order to be viable organizations need to be recognized as legitimate and valuable to access resources and customers.

3. The environment is assumed to contain scarce and valued resources essential to organizational survival. Scarcity of resources reflects the level of uncertainty organizations face in resource acquisition.

4. Organizations are assumed to work toward two related objectives: acquiring control over resources that minimize their dependence on other organizations and control over resources that maximize the dependence of other organizations on themselves. Attaining either objective affects organizational relationships, thereby affecting an organization's power and dependency on resources.

5. Organizations will act in ways that are consistent with their economic well-being. However, as a result of institutional constraints, many health care organizations have had little experience with economic rationality (Luke & Walston, 2003).

Study Conceptual Framework

The overall conceptual framework for the research project, depicted in Figure 1, illustrates the relationship between a highly uncertain and resource dependent environment and responses of organizations.

Environment   **Influences**   **Organizational Response**
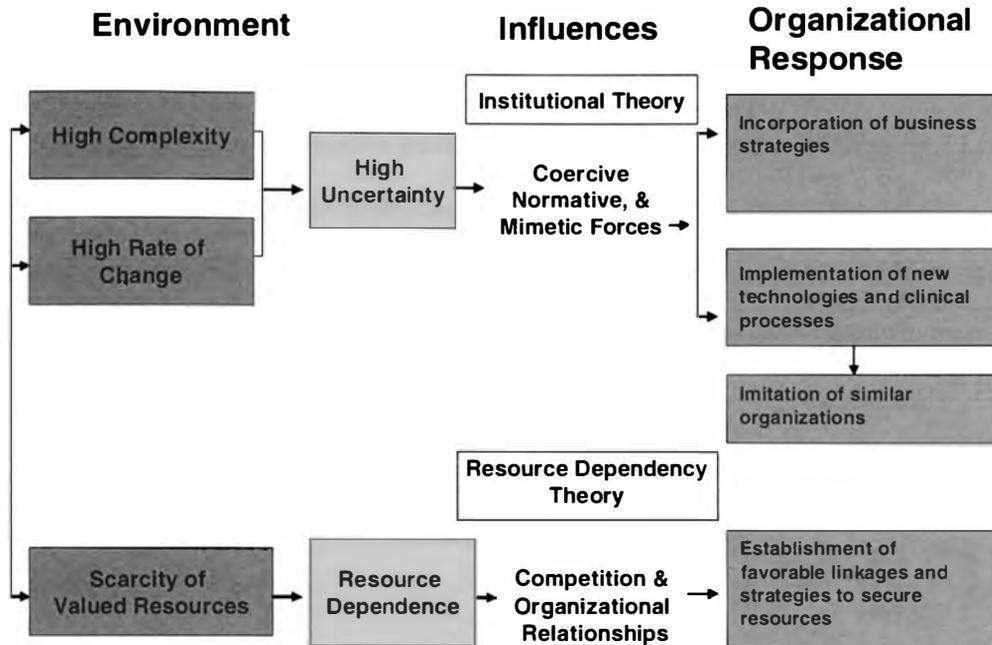
Figure 1. Framework for Environmental Effect on Organizational Response
(Adapted from: Daft, 1998, p. 105)

In this framework, an environment that is extremely complex with a high rate of

change, or instability, results in a highly "uncertain" environment. In an uncertain

environment, organizations are more susceptible to coercive, mimetic, and normative

forces and respond by incorporating changes, implementing new technologies and

process, and imitating successful organizations to meet the demands presented by these

forces. In addition, a lack of resources in an environment causes organizations to compete

for needed resources and have a high dependency on other organizations that have

control over these resources. Organizations will respond to this situation by creating

favorable linkages to other organizations and implementing strategies to obtain necessary resources.

The conceptual framework presented in Figure 1, depicting the relationship between the environment and organizational responses, provides a foundation to build a more specific model representing the responses of family medicine practices to pressures in the environment. Based on the characterization of the environment in Chapter 2, it can be deduced that family medicine practices in Virginia exist in a highly complex and unstable environment (Bodenheimer 2003; Graham, et al., 2004; Lipsky & Sharp, 2006; Showstack, Anderson Rothman, & Hassmiller, 2003; Starfield, 1998) with limited resources.

The complexity of the environment surrounding family medicine practices is represented by intense regulatory requirements, rigorous professional standards, complicated reimbursement systems, powerful and varied special interest groups, a fragmented and decentralized health care system, and deep-rooted cultural norms and expectations. The high rate of change in the environment is evidenced by changing regulatory requirements, reimbursement rates, and expectations of patients; expanding pace and scope of discovery in medical science and information technology; shifting focus care processes to account for more chronic illnesses; and increasing demand for privacy and transparency of services. There have also been fundamental changes in the health care sector over the last several decades involving the transformation of organizational forms, shifts in authority and control patterns, and increased emphasis on cost containment and sound business practices (Alexander & D'Aunno, 1990). These

complex and rapidly changing elements suggest that family medicine practices exist in an uncertain environment rather than a stable environment.

Family medicine practices also exist in an environment with scarce resources – explained by a reduction in the number of family medicine practitioners (Graham, et al., 2005) and a decrease in reimbursement for services (Sandy & Schroeder, 2003) – leading to an immense dependency on external resources. This dependency on resources, combined with an environment that is highly complex and changing at a rapid pace, influences the responses of family medicine practices to secure resources and to ensure the organization's survival (Daft, 1998).

The conceptual model used in this study to examine the effect of the environment on innovations in family medicine is depicted in Figure 2. Figure 2 was designed to tailor the theoretical concepts presented in Figure 1 to the circumstances surrounding family medicine practices. This model reflects the institutional forces and resource dependencies, drawn from both theoretical perspectives, which are hypothesized to influence the implementation of innovations within a family medicine practice environment.

Institutional pressures facing family medicine practices are a result of coercive, normative, and mimetic forces in the environment. Pressures also arise from a dependency on resources that result from competition and the number and types of organizational relationships. This environment, characterized as uncertain and resource dependent, influences family medicine practices through coercive, normative, and mimetic forces, as well as pressures from competition and organizational relationships, to
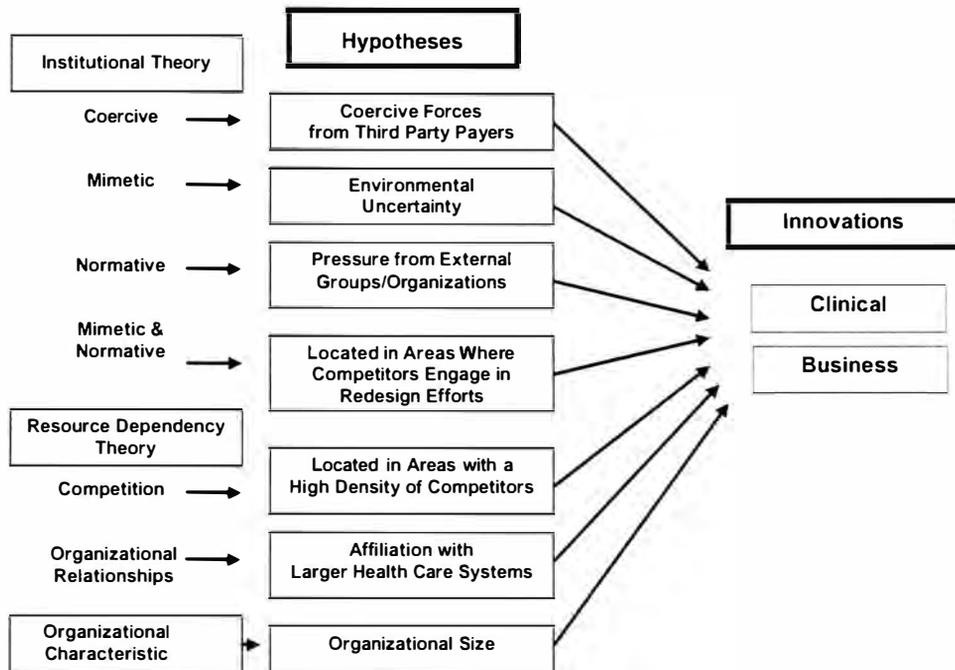
Figure 2. Environmental Effect on Innovations in Family Medicine

redesign and improve quality and business functionality. The graphic in Figure 2

illustrates the hypothesized relationships between the constructs of institutional and

resource dependency theory and organizational size on the outcome variable of interest:

utilization of innovations.

In this model it is hypothesized that the motivation for innovation in family

medicine is to create processes, relationships, and organizational structures conducive to

obtaining necessary resources, generating revenue, producing favorable

clinical/management outcomes, and meeting stakeholder expectations. Organizational

responses to the environment are hypothesized to include the adoption of strategies to improve business functionality and generate revenue, implementation of clinical and management processes to improve quality of care and meet stakeholder expectations, imitation of successful family medicine practices, and development of relationships to improve the flow of resources.

Figure 2 depicts a conceptual model that incorporates the theoretical factors influencing efforts to redesign family medicine practices in Virginia. This conceptual model illustrates the group of hypotheses used to describe the expected relationships among the observable variables and the outcome.

<div align="center">Study Hypotheses</div>

The conceptual framework presented in the previous section provides a model to test the usefulness of the integrated theoretical model as well as predictors presented in the hypotheses. The study hypotheses stated below describe the expected relationships among the observable variables and the outcome.

<div align="center">*Hypotheses Drawn from Institutional Theory*</div>

The following hypotheses have been drawn from constructs in institutional theory to explain relationships between the environment and responses of family medicine practices in Virginia. Institutional theory suggests that the more family medicine practices are dependent on resources in the environment, the more likely these organizations will comply with its demands (DiMaggio &d Powell, 1983). Coercive, mimetic, and normative forces are the constructs used from the institutional perspective

(DiMaggio & Powell, 1983) to draw hypotheses regarding the influence of environmental forces on the innovations of family medicine practices.

Coercive Forces

Organizational pressures that are coercive in nature are likely to come from external sources that control critical resources and are able to exert influence and power through rules and regulations. Coercive forces hypothesized to influence innovations in family medicine practices originate from the government through programs such as Medicare and payer organizations such as managed care organizations (MCOs). A straightforward example of this relationship is the government's (Centers for Medicare and Medicaid Services' [CMS]) ability to demand conformance to strict guidelines from medical practices in exchange for financial resources for services to Medicare patients.

H1: Family medicine practices experiencing greater coercive forces from third party payers (Medicare, MCOs) are more likely to engage in clinical innovations than those experiencing less coercive forces.

H2: Family medicine practices experiencing greater coercive forces from third party payers (Medicare, MCOs) are more likely to engage in business innovations those experiencing less coercive forces.

Previous research on the environment-organization relationship in health care organizations has shown that the concentration of Medicare patients significantly influences an organization's effort to redesign and make innovative changes (Zinn et al 1997; Zinn, Weech, and Brannon, 1998). Zinn, Weech, and Brannon (1998) found that Medicare's share of total hospital discharges in the market and facility Medicare census were predictors of TQM adoption in nursing homes.

H1a: Family medicine practices in areas with higher concentrations of Medicare recipients are more likely to engage in clinical innovations than practices with lower levels Medicare beneficiaries.

H2a: Family medicine practices in areas with higher concentrations of Medicare recipients are more likely to engage in business innovations than practices with lower levels Medicare beneficiaries.

The penetration of managed care organizations has been found to influence the organizational responses of hospitals, nursing care facilities, and medical groups (Banaszak-Holl, Zinn, Mor, 1996; Roggenkamp, 2000; Zinn et al., 1997; Zinn et al., 1999). For example, Roggenkamp (2000) found that medical groups are more likely to develop strategic relationships with hospital organizations in markets with higher concentration of managed care organizations. Banaszak-Holl, et al. (1996) also found that nursing home facilities located in markets with larger MCO memberships are more likely to provide innovative solutions to care delivery problems. It is hypothesized in this study that family medicine practices in areas that have higher penetration of MCOs are more likely to utilize innovative strategies and practices in response to coercive forces from these organizations.

H1b: Family medicine practices in areas with greater managed care   organization penetration are more likely to utilize clinical innovations than   practices with lower levels managed care organizations.

H2b: Family medicine practices in areas with greater managed care   organization penetration are more likely to utilize business innovations than practices with lower levels managed care organizations.

Cognitive/Mimetic Forces

Institutional theorists contend that cognitive, or mimetic, forces are pressures to imitate other more legitimate or successful organizations (DiMaggio & Powell, 1983).

Mimetic forces are stronger under conditions of uncertainty because organizations feel pressure to minimize risks presented by the environment and are more likely to search for successful practices that can be replicated (DiMaggio & Powell, 1983). Therefore, the mimetic mechanism posited to affect innovations in family medicine practices is an uncertain environment. Uncertainty is when organization decision makers do not have sufficient information about environmental factors, and they have a difficulty predicting external changes (Daft, 1998). Environmental uncertainty represents an important contingency for organizational structure and internal behaviors. In today's world of increased competition, rapid technology breakthroughs, and shifting markets, physician offices are facing greater level of uncertainty and change.

Institutional theory suggests that when one physician practice in an area adopts a specific redesign effort, others may adopt the same strategy to remain competitive. Innovation studies reveal a positive relationship between the numbers of competing organizations in an organization's environment that adopt an innovation with the probability others in the same environment will subsequently adopt (Burns & Wholey, 1993). It is hypothesized that family medicine practices that experience greater uncertainty are more likely to imitate innovative strategies and practices of other organizations.

H3: Family medicine practices experiencing greater uncertainty are more likely to imitate clinical innovations in other practices, hospitals, and health service organizations than practices that experience less uncertainty.

H4: Family medicine practices experiencing greater uncertainty are more likely to imitate business innovations in other practices, hospitals, and health service organizations than practices that experience less uncertainty.

Normative Forces

Normative forces result from social consensus and enforcement of standards set by societal norms and values dictating how organizations are structured and how they function (DiMaggio & Powell, 1983; Scott, 1995). From the family medicine practice perspective, normative forces reflect the values set by the profession of family medicine and the values of the community. These forces typically originate from patients and stakeholder groups, professional associations, and inter-organizational relationships. Similar to hospitals, family medicine practices experience normative forces from the environment that consist of increasing expectations from patient and stakeholders and rigorous professional standards that govern staff as well as organizational processes and procedures (Scott & Backman, 1990).

H5: Family medicine practices that experience more pressure from external groups or organizations are more likely to utilize clinical innovations than practices that experience less pressure.

H6: Family medicine practices that experience more pressure from external groups or organizations are more likely to utilize business innovations than practices that experience less pressure.

Environmental pressures caused by increasing expectations of patients are a result of the expanding pace and scope of discovery in medical science and technology, increasing number of Americans with chronic illnesses, a demand for transparency of services and information, and increasing diversity of the population (Lawrence, 2002). This increase in patient expectations is the basis for the study hypothesis that posits that family medicine practices that experience pressure from patients and patient groups are more likely to utilize innovations.

H5a: Family medicine practices that indicate that patients influence their organization are more likely to engage in clinical innovations than practices that do not report patient influence on their organization.

H5b: Family medicine practices that indicate that that patient groups influence their organization are more likely to engage in clinical innovations than practices that do not report patient influence on their organization.

H6a: Family medicine practices that indicate that patients influence their organization are more likely to engage in business innovations than practices that do not report patient influence their organization.

H6b: Family medicine practices that indicate that patient groups influence their organization are more likely to engage in business innovations than practices that do not report patient influence their organization.

Family medicine physicians are experiencing increased pressure to improve quality of care, access, satisfaction, timeliness, and clinician adherence to standards of care and evidence-based practices (AARP, 2006; IOM, 2001) Several studies have shown that patients in primary care settings do not receive the recommended standard of care (Saaddine, 1990; Saaddine and Engelgau, 2002; Radford, Wang, Krumholz, 2000), which has led many researchers and professional groups to advocate for increased emphasis on improving quality of care in primary care settings (Budetti, et al., 2004; Graham, et al., 2004). Other health care professionals have concluded that inadequacies in the overall health care system present opportunities to enhance the effectiveness of primary care delivery and, therefore, the practice of family medicine (Berwick, 2004; Bodenheimer, 2003; Lawrence, 2002; Stange, 1998). It is hypothesized that family medicine practices that experience increased pressure from professional groups and associations are more likely to utilize innovations.

H5c: Family medicine practices that indicate that professional associations influence their organization are more likely to engage in clinical innovations than practices that do not report professional associations influence their organization.

H6c: Family medicine practices that indicate that professional associations influence their organization are more likely to engage in business innovations than practices that do not report professional associations influence their organization.

One hypothesis is believed to be a result of both mimetic and normative forces on innovations of family medicine practices. The organizational actions and behaviors of competing family medicine practices, defined as those practices that reside in the same primary care service area, are hypothesized to influence the utilization of innovations on other family medicine practices. Competition, therefore, presents mimetic forces as a result of uncertainty to secure resources and normative forces as a result of pressure to conform to the standards set by the local professional community.

H7: Family medicine practices in areas where their competitors engage in innovations are more likely to utilize clinical innovations than practices in areas where their competitors do not.

H8: Family medicine practices in areas where their competitors engage in innovations are more likely to utilize business innovations than practices in areas where their competitors do not.

Hypotheses Drawn from Resource Dependency Theory

Resource dependency theory is used in this study to explain the response of family medicine practices related to dependency on resources external to the organization. Resources needed by physician practices include financial, information, human resources, supplies and equipment, and services by other organizations such as physician specialists and laboratories. The resource dependency perspective suggests that family medicine practices that experience scarcity of critical resources, heavy

competition, and dependency on other organizations will try to innovate in order to improve the organization's success and viability (Pfeffer & Salancik, 1978). The theory characterizes three key elements of the environment that influence organizations, which include: munificence, the accessibility or scarcity of critical resources; market competition; and interconnectedness, the number and types of linkages between organizations (Pfeffer & Salancik, 1978). According to resource dependency theory, organizations engage in adaptive strategies to secure resources as environmental uncertainty rises. Uncertainty occurs when there is variability and complexity involved in acquiring resources. In this study, the constructs used to reflect these key elements are competition and organizational relationships.

Competition

The degree of competition in the local market is one environmental factor mitigating compliance with external constituencies. In more competitive environments, organizations share a limited resource pool (Pfeffer & Salancik 1978) and survival depends more on how resources are allocated across competitors. Degree of competition is one environmental factor found to be associated with organizational actions and behaviors in health care (Alexander & Morrisey, 1989; Banaszak-Holl, et al., 1996; Zinn, Proenca, Rosko, 1997). Specifically, Zinn and colleagues (1998) found competition to be an important determinant of organizational response to the environment when researching the adoption of TQM principles in nursing homes. Banaszak-Holl, et al. (1996) also found that competition among nursing facilities is an incentive for individual nursing homes to innovate. It is hypothesized in this study that family medicine practices that

experience heavy competition for resources are more likely to utilize innovative practices.

H9: Family medicine practices in areas with a high density of competitors are more likely to utilize clinical innovations than practices in areas with less competition.

H10: Family medicine practices in areas with a high density of competitors are more likely to utilize business innovations than practices in areas with less competition.

Organizational Relationships

Family medicine practices that are affiliated with larger health care systems, such as university hospitals, managed care organizations (MCOs), and other public or private health systems, have greater exposure to institutional norms and values and are more likely to conform to rules and regulations brought on by the government and other institutions. The work of Ingram and Simmons (1995) has suggested that the interconnectedness of an organizational field is related to the amount of attention organizations pay to the rules, regulations, and norms of other organizations. It is also likely that family medicine practices that are affiliated with other health care organizations have more resources available to support organizational innovations than independent practices. In their research on nursing care facilities, Banaszak-Holl, et al. (1996) found that system membership was associated with a greater likelihood of innovations in care delivery, suggesting greater access to resources and greater flexibility in the allocation of resources. In this study, it is hypothesized that family medicine practices that are affiliated with larger health care systems are more likely to utilize innovations than those that are not affiliated.

H11: Family medicine practices affiliated with larger health care systems are more likely to engage in clinical innovation than practices that are independent.

H12: Family medicine practices affiliated with larger health care systems are more likely to engage in business innovation than practices that are independent.

Organizational Characteristics

Previous researchers have established that larger organizations are more vulnerable to the requirements demanded by external institutions and stakeholder groups because these organizations are more visible to the government, media, and larger populations (Meyer, 1979; Powell, 1991; Roggenkamp, 2000). This visibility may drive organizations to comply with norms and values of external institutions and stakeholder groups and, therefore, engage in improvement efforts. Larger organizations may more frequently utilize innovations since they have greater access to resources (Banaszak-Holl, et al., 1996). Roggenkamp (2000) found that larger medical group practices are more likely to develop strategic relationships with hospital organizations as a result of pressures from the environment. Banaszak-Holl, et al., (1996) also found that organization size was associated with a greater likelihood that specialty care will be provided in nursing homes.

For the most part, family medicine practices are small organizations, organizations with less than 50 employees (European Union [EU], 2003), or micro-businesses, less than 10 employees (EU, 2003). However, practices range from single practitioners to multiple group practices. It is assumed in this study that small and micro-businesses are also vulnerable to the requirements demanded by external institutions and

stakeholder groups. Therefore, size is an organizational characteristic hypothesized to be related to the likeliness of utilizing innovations.

H13: Large family medicine practices are more likely to utilize clinical innovations than smaller practices.

H14: Large family medicine practices are more likely to utilize business innovations than smaller practices.

A summary of the hypotheses is presented in Table 3. The table identifies the hypothesis, relevant predictor or construct, and the proposed association.

Chapter Summary

This chapter presented two organizational theories that constitute an integrated framework for the study. The theories, institutional theory and resource dependency theory, provide a comprehensive framework for generating hypotheses on the response of family medicine practices to environmental pressures. The conceptual framework graphically illustrates the hypothesized relationships between organizational and environmental variables derived from institutional and resource dependency theories with the dependent variable of interest: utilization of innovations. The hypothesized relationship suggests that family medicine practices in Virginia will engage in more redesign efforts when there is increased pressure from institutional forces, i.e., coercive, normative, and mimetic forces, and dependency on resources that result from competition and interdependence.

Table 3. Summary of Study Hypotheses

Construct	Posited Association with Clinical and Business Innovation
Institutional Theory	
Regulative (Coercive) Forces	
H1 & H2 Degree of Coercive Forces from Third Party Payers	+
Cognitive (Mimetic) Forces	
H3 & H4 Degree of Environmental Uncertainty	+
Normative Forces	
H5 & H6 Degree of Pressure from External Groups/ Organizations	+
Combined Mimetic and Normative Forces	
H7 & H8 Located in Areas Where Competitors Utilize Innovations	+
Resource Dependency Theory	
Competition	
H9 & H10 Located in Areas with a High Density of Competitors	+
Interconnectedness	
H11 & H12 Affiliation with Larger Health Care Systems	+
Organizational Characteristics	
H13 & H14 Size of Family Medicine Practices	+

CHAPTER 4 – METHODOLOGY

Introduction

The purpose of this chapter is to describe the methodology used to address the research questions and study hypotheses. The chapter provides detailed information on the research design, data sources and data collection methods, measurement of variables, quantitative methods, and the strengths and limitations of the study. The study was submitted to the Institutional Review Board at Virginia Commonwealth University, Office of Research Subject and Protection for review. This study, VCU IRB#11093, was approved by expedited review according to Code of Federal Regulations (CFR) 46.110, Category 7.

Research Design

Study Design Characteristics

This quantitative study assesses the environmental and organizational factors that are associated with innovation efforts in family medicine practices. The research employs a cross-sectional, non-experimental design to accomplish this task. Cross-sectional analyses measure relationships among exogenous and endogenous variables at a single point in time. The non-experimental design means that no intervention or experimental treatment is incorporated into the study (Cook and Campbell, 1979). The study is retrospective since it links an observation in the present to some attributes that occurred

in the past. The study is based on correlational research that describes the relationship among variables using the physician practice as the unit of analysis. The study design characteristics are presented in Table 4.

Table 4. Study Design Characteristics

Study Design Characteristics		
Dimension	**Design**	**Major Features**
Degree of structure	Structured	Data collection and analyses are specified before data are collected
Type of group comparisons	Between-groups	Groups being compared are different
Time frame	Cross-sectional	Data are collected at one point in time
Control over independent variable	Non-experimental	No manipulation of independent variable
Measurement of independent and dependent variables	Retrospective	Quantitative data: • Primary data collection from family medicine practice survey (self-report) • Secondary data collection from Area Resource File, Virginia Board of Medicine Practitioner Database

Adapted from Polit and Beck, 2004, pg. 165.

The use of an experimental design is not practical for this research topic. First, there are constraints such as insufficient time and financial and human resources to implement an intervention and evaluate the results in physician offices across Virginia (Polit & Beck, 2004). Second, it would be difficult to work with numerous physician offices to implement, study the results of an intervention, and control for extraneous

variables such as physician and practice characteristics that may influence findings. Since there is little or no research on how the environment and organizational characteristics influence efforts to innovate family medicine practices, it is appropriate to utilize a cross-sectional design to document the scope of the issue and describe critical relationships between relevant variables (Polit & Beck, 2004). Advantages to using cross-sectional research are that it is practical, manageable and economical (Polit & Beck, 2004). However, it is risky to infer causal relationships in correlational research because of the lack of control over the independent variable. In this study, research is conducted after variations in the dependent variable, level of innovation, have occurred. Cause-and-effect conclusions are problematic because it is subject to a fallacy labeled post hoc, ero propter hoc, which is the impression that one thing has caused another merely because it occurred before the other (Polit & Beck, 2004). The weaknesses of correlational research are minimized because the study attempts to test causal hypotheses that have been deduced from well established theories on the environment-organization relationship.

Design Validity

The following section discusses whether threats to internal validity are causes of concern in a correlation study that is cross-sectional. Mitigation strategies to reduce threats to validity were built into the study design to reconcile some of the limitations.

The major threat to internal validity is selection. Selection encompasses biases resulting from preexisting differences between groups (Cook & Campbell, 1979). Selection biases occur in this study because family medicine practices are in groups, in part, because they differentially possess traits or characteristics that possibly influence or

are otherwise related to the variables of the research problem (Kerlinger & Lee, 2000).

Biases caused by the selection effect were minimized by collecting information on and

controlling for practice-level characteristics that are related to innovation efforts.

Another threat to the internal validity of the study is ambiguity about the direction

of causal influence (Cook & Campbell, 1979). This is an especially salient threat to

internal validity of correlational studies that are cross-sectional. Threats to internal

validity based on the direction of causal influence are minimized through the use of well

established theories on the environment-organization relationship and testing and

adjusting for endogeneity using 2SLS methods.

Testing biases result when a pretest of an individual influences the results of a

later test. In this study, pretesting of the survey instrument was conducted on practice-

based family medicine practitioners outside the state of Virginia and on practitioners

from other specialties, therefore eliminating an effect from testing. Biases due to

maturation are not a concern in cross-sectional studies considering there is only one

measurement period. The threat of history refers to the occurrence of external events that

take place concurrently with the independent variable that can affect the dependent

variable (Polit &Beck, 2004). It is unlikely that a history effect influenced the study. The

researcher examined political, regulatory and newsworthy events and is not aware of any

historical events that occurred in Virginia during the time data were collected that would

differentially influence practices. Mortality is a threat to internal validity that does not

influence cross-sectional designs since the sample is drawn at the same time other data

for the study is collected, therefore eliminating the threat of participants dropping out.

Statistical regression and instrumentation are other threats that do not influence the internal validity of cross-sectional studies since there is only one measurement period.

Data Sources

This study used primary and secondary data sources to evaluate environmental and organizational influences on innovation efforts of family medicine practices in Virginia. The primary data source was an organizational survey of family medicine practices in Virginia that captured information on practice characteristics, adoption of innovations, and pressures from the environment. Secondary data on the environment and practice characteristics were obtained from multiple data sets from the Virginia Department of Health, HRSA, AMA, and U.S. Census Bureau. Secondary data on environment characteristics are measured at the market level; this study uses PCSA as the definition of market. PCSAs are aggregated ZIP code areas designed to reflect patient travel to primary care providers (Goodman, Mick, Bott, et al., 2003).

Primary Data

Primary data for this study were collected through a large-scale survey to family medicine practices in Virginia. The objective of the survey, provided in Appendix A, was to obtain information on the types and level of innovations employed by family medicine practices, assess practice's perception of environmental influences, and obtain detailed information on practice characteristics. Surveys have been widely used to collect information from physicians and physician practices. Campbell, Gruen, Mountford, et al. (2007) surveyed physicians to collect information about their financial associations with industry and the factors that predict those associations. Keeton, Fenner, Johnson et al.

(2007) mailed a self-administered survey to a national sample of 2,000 randomly selected primary care physicians to determine predictors of career satisfaction, work–life balance, and burnout. Simon, Kaushal, Cleary, et al. (2007) surveyed a random sample of 1,884 physicians in Massachusetts by mail to assess the availability and use of EHR functions, predictors of use, and the relationships between EHR use and physicians' perceptions of medical practice.

The survey for this study was developed based on a comprehensive literature review and refined with the aid of expert advice from family medicine physicians to establish content and face validity. Before deployment, the survey instrument was cognitively tested with a panel of physicians for clarity and readability. This process resulted in several iterations before the questionnaire was completed. The survey, Attachment A, included questions regarding the types of innovations (team-based care, alternative visit arrangements, EHR, etc.) employed by physicians in the office setting. Therefore, the survey captured data on the outcome variable of interest: physicians' self-reported implementation of clinical and business innovations in their office practice.

Survey Development

The survey used to collect information from family medicine practices focused on organizational characteristics, innovations, and perceptions of the environment. The survey consisted of 45 questions, and was designed to take approximately 20 minutes to complete. Multiple strategies were used to create an effective survey that could be administered online and through the mail. These strategies are based on expert opinions and scientifically supported methodologies from Dillman (2000) and others, which

included: pretesting questions, providing an introduction for the survey to encourage cooperation from participants, dividing long surveys into sections, limiting use of open-ended questions, and using incentives to encourage response (Dillman, 2000; Gunn, 2002). The survey was designed with consultation from the Chair, Family Medicine Department at VCU and other physicians in the department. The survey was also tested on several family medicine physicians and nurse practitioners outside the state of Virginia and four physicians from other specialties.

Survey Administration

The survey was administered August 2007 through January 2008 to a sample of 700 family medicine practices in Virginia. A mixed-mode methodology (Dillman, 2000) was used to administer the survey through the mail, internet, and at the Summer VAFP meeting to ensure a high response rate. The objective was to obtain one survey from each family medicine practice in the sample. The researcher initially mailed a survey to a physician in each practice in the sample with the option to complete the hard copy questionnaire or an electronic version. The researcher sent an introductory letter along with the survey containing information about the study purpose, instructions on how to complete the survey, how the data was expected to be utilized in the study, the auspices under which the study was conducted, and other information. The same message and questions were delivered to all participants to ensure constancy of communications and minimize error related to differing interpretation of the survey instrument. A blue and gold pen with the inscription "Advancing Family Medicine" was included in the mailing packet as an incentive to respond to the survey.

A follow up post card was sent seven days after the initial mailing to thank those that responded and remind others to fill out the survey. The researcher waited two weeks, and then sent a reminder letter to practices that had yet to respond. After another four weeks a second survey package was sent to practices that did not respond. After the survey closed and all data were entered into the study database, the researcher determined if responding practices fell within the target population and if duplicate responses were received from family medicine practices. Responses from the medical director or senior partner were used if several responses from one practice were found in the database.

It has long been recognized that physicians are a frequently surveyed population from which it is difficult to obtain a high response rate (Dillman, 2000). Campbell, Gruen, Mountford, et al. (2007) received a raw response rate of 52% and a weighted response rate of 58% to their survey on physician-industry relationships. Keeton, Fenner, Johnson et al. (2007) received a 48% response rate to their national survey of physicians on career satisfaction. Simon, Kaushal, Cleary, et al. (2007) received 71.4% response rate to their survey to physicians in Massachusetts. Strategies to increase physician response to the family medicine survey included: providing an incentive to participate, limiting any burden placed on the physician, ensuring ease of completing and submitting the survey, emphasizing the importance of the study to the specialty of family medicine, and follow up by mail and telephone to non-responders. In addition, information about the research project was delivered to various professional groups and leaders in the field explaining the importance of the study and the study's contribution to the specialty of family medicine. This resulted in endorsement of the survey by VAFP. Participants were

also promised an aggregate level report of the survey findings to use for benchmarking their organization with other family medicine practices in Virginia.

Web-Based Survey Software

The electronic questionnaire was developed using Inquisite Survey System 8.0 (Inquisite, 2007) to collect data from family medicine practices over the internet. Inquisite is an automated web-based survey software system that does not require custom programming. The survey software allowed the survey questions and possible responses to be entered into a database table, provided tables needed to record the data entered through the questionnaire, provided a user interface for the web-based questionnaire, and prevented data entry errors by preventing entry of responses outside the range of response categories. The survey software also allowed the results to be transferred to SPSS to compute advanced statistics after the survey administration period closed.

The Inquisite software operates in a Microsoft environment and has the ASP.Net service enabled, which allows the use of Windows Operating system and the Microsoft Internet Information Services (IIS). Microsoft SQL server was required to store the questions and responses. Inquisite required that web survey respondents have access to Internet Explorer or Firefox for completing the questionnaire. A web/application server was maintained at the VCU School of Allied Health Professions that allowed survey development, submission of e-mail invitations to complete the survey, web survey response, and analysis. A database server hosted the Inquisite administration database and survey results. A file backup/recovery system and an Uninterruptible Power Supply (UPS) were used to protect the data and operating system.

Limitations to Survey Data

There are risks of reporting biases regarding self-reported data that may influence findings from the questionnaire. The following are limitations of most surveys, which are identified as possible influences on the results of data analysis:

- Incomplete or absent responses (non-response) to survey questions,

- Objectivity of individual survey respondents and the possibility of intrinsic bias in their response,

- Variability in interpretation of item wording and responses,

- Respondent concerns about the possible impacts of survey results, and

- Difficulty of respondents in characterizing complex concepts in terms of simple responses.

Validity of survey data could also be affected by many other factors, the most important of which is measurement error and transcription errors (Chambers & Skinner, 2003). The survey methodology attempted to address the majority of the above limitations. Survey questions were worded carefully with assistance from experts in family medicine to increase respondent understanding and improve instrument clarity. The instrument was pilot tested with multiple physicians to improve the instrument format and instructions for completing the survey, and to reduce variations in administration of the survey. The researcher's telephone number and e-mail address were included in the instructions to provide an avenue for additional assistance in completing the survey. Transcription errors were minimized through the use of web-based survey

software and data validation techniques such as double-checking data entries and reviewing for outliers and/or inconsistencies in the data.

Survey Response

The survey resulted in a 56% response rate; 342 unique responses were received from practices that fell within the targeted population. The population and sample were adjusted based on information that was received by telephone or mail that indicated the practice was not family medicine or was not currently operational. The original population of 1,045 family medicine practices identified from the Virginia Board of Medicine practitioner database was reduced to 916, and the sample size was reduced to 612 practices. The major reasons why these practices were removed from the study database were: death or retirement of a solo practitioner, practitioner or practice moved with no forwarding address or one outside the state of Virginia, specialty other than family medicine, and types of organizations not under study such as a center exclusively for urgent care and free clinics.

Secondary Data

The secondary data used in this study are from multiple sources including the Virginia Department of Health and the HRSA. Secondary data were used to gather information on the target population and to measure specific domains of the environment.

Primary Care Service Area

The PCSA national database of primary care resources and utilization, funded by HRSA, was used in the study to represent the market for analysis and to obtain specific data elements. PCSAs are defined through utilization data and represent geographic

approximations of markets for primary care services (Goodman, Mick, Bott, et al., 2003). The PCSA database contains 6,542 areas that were defined using 1999 Medicare claims data, 2000 Census data, and ZIP Code Tabulation Areas (ZCTAs) to reflect Medicare patient travel to primary care providers (PCSA, 2003). The unique features of the database is that it outlines service areas that encompass actual patterns of local primary care use, provides links between each PCSA and primary care resources, and provides population characteristics and Medicare primary care utilization for each service area. Data elements used in the study included: health care resources, such as numbers of physicians by specialty; population descriptors, such as poverty status; Medicare beneficiary population; and primary care shortage areas. Since the PCSA data fields consist of data from the years 1996 through 2000, multiple data fields were updated from the AMA and the U.S. Census Bureau to capture more recent data for analysis.

Virginia Board of Medicine Practitioner Database

The Virginia Board of Medicine Practitioner Information database (VBoM, 2007) was used to collect information on all certified family medicine physicians in the state of Virginia. In this database there are 3,896 physicians that are licensed medical doctors in family medicine. Information on each physician was extracted to develop a population database in Excel on all family medicine practices in Virginia. Data elements gleaned from the Board of Medicine database include the following: physician name; practice name, address, and telephone number; and participation in Medicare and Medicaid.

Area Resource File (ARF)

The ARF, from the Bureau of Health Professions, U.S. Department of Health and Human Services, (HRSA, 2006) was used to obtain detailed information on environmental characteristics in Virginia. The ARF dataset is compiled by the HRSA and contains county-level information aggregated from numerous national sources (HRSA, 2005). The ARF is widely used in health services research as a source of environmental measures (Alexander and Morrissey, 1989, Banasak-Hall et al, 1996; Menachemi, Ford, Chukmaitov, et al., 2006; Zinn et al., 1998). Data used for this study came from the February 2005 AFR release. Variables extracted from the ARF data set were the latest available, reported between 2000 and 2005.

Various environmental indicators were matched, by PCSA, to the primary data collected via the practice survey and the Virginia Board of Medicine data described above. The ARF provided data on population and socioeconomic indicators, and geographic codes and descriptors. Geographic codes gleaned from the ARF include: state name, county name, metropolitan/micropolitan statistical areas, urban/rural continuum codes, federal regions, census county group codes, census contiguous county codes, and health profession shortage areas for primary care. Population statistics and economic activity data included population per square mile and median household income. Data fields in PCSA were revised, when possible, with updated data from the U.S. Census Bureau and the AMA.

Health maintenance organization (HMO) penetration rates for the first quarter of 2005 were also obtained from the ARF. A HMO is defined as "an entity that offers

prepaid, comprehensive health coverage for both hospital and physician services with specific health care providers using a fixed structure or capitated rates" (The Henry J. Kaiser Family Foundation, 2006). The PCSA-level HMO penetration rate was calculated by converting the county level HMO data to PCSA level by taking the number of residents enrolled in a HMO and dividing it by the total number of residents in that PCSA. The 2005 HMO penetration rate for the state of Virginia was 12.9% (The Henry J. Kaiser Family Foundation, 2004).

Study Sample

Target Population

The study population was all family medicine practices in Virginia. The population database was developed from the Virginia Department of Health's practitioner information database of all physicians with clear and active licenses. Office locations were identified based on address information provided for each physician in the practitioner database, which resulted in 916 individual practice locations.

Sampling Method

The study uses a simple random sample (SRS) method to draw a sample from the population. SRS is a sample in which every member of the population has an equal chance of selection (Levy & Lemeshow, 1999). The first step of SRS was to assign a number from 1 to N to each family medicine practice in the population database. The next step was to pick a sample of n of these numbers by the use of a computer random number generator. Once the numbers were chosen, the population elements corresponding to these numbers were taken as the sample (Levy & Lemeshow, 1999).

Estimation of Sample Size

An important step in sample design was determining the necessary sample size

for estimates to be reliable enough to meet the objectives of the study. In estimating a

sample size for SRS the first step involved specifying the level of reliability needed for

the resulting estimates (Levy & Lemeshow, 1999). The level of reliability needed for

estimates was based on the criteria for a 95% confidence that the estimated value differs

from the true value by no more than 5%. A 95% confidence means that in approximately

950 of every 1,000 samples, the true population parameter will lie within 1.96 standard

errors of the estimate (Levy & Lemeshow, 1999). The standard error was set at .25 based

on surveys containing questions that result in dichotomous variables (Barlett, Kotrlik, &

Higgins, 2001).

The equation utilized to estimate the sample size under SRS is:

$$n \geq \frac{z^2 N V_x^2}{z^2 V_x^2 + (N-1)\varepsilon^2}$$
(Eq. 1)

(Levy & Lemeshow, 1999, p.74)

where:

z is the reliability coefficient (z = 1.96 for 95% confidence)
N is the population size
V_x^2 is the relative variance for the variable X
ε is the value set by the investigator.

Estimates were made based on a population size of 916 family medicine practices,

which resulted in a necessary sample size of 284 practices. Since previous surveys to

medical practices resulted in response rates between 48% and 81%, it was determined that 700 practices were required to be randomly selected from the population for survey purposes.

Limitations to Sampling Methodology

Possible limitations of sampling methodology relate to unrepresentative sampling, which result in sampling error and sample bias. The research methodology included attempts to ensure that sample results can be generalized to the larger population of family medicine practices in Virginia. These efforts included using a SRS technique to obtain a sample reflective of the desired population, and calculation of an appropriate sample size based on procedures for sample size estimation for SRS. The researcher also incorporated steps to increase response to the survey and obtain a sufficiently large sample and, therefore, increase the statistical conclusion validity of the study. The methodology incorporated a mixed-mode survey, which provided multiple avenues for responding to the survey, and numerous communications with potential respondents to increase the response rate. A review of practice-level and geographic characteristics of respondents and non-respondents was conducted to determine if a representative sample was obtained.

Data Management

Database Development

A database structure was developed and documented that integrated the various measures from primary and secondary data sources. The study database was developed in

Excel 2007 and later transferred to SPSS version 15.0 (Chicago, Ill.) and Stata/IC 10 for data exploration and analysis.

Database development began with the study population data file, which was matched with respondents to the practice survey. The next step involved extracting essential data fields from secondary sources to include in the study database. The data from secondary sources were assigned a PCSA from county and zip code information. The data from secondary sources were then matched to the study sample by PCSA. For example, an indication of rural or urban was assigned to a case (a specific family medicine practice) based on whether the PCSA was coded as rural or urban. Figure 3 presents the database development process.
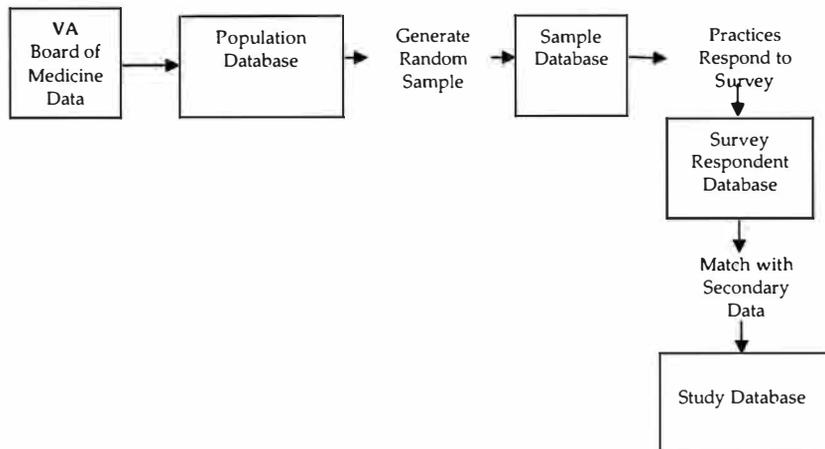
Figure 3. Database Development

Data Security

The last phase of data management involved steps to ensure security and confidentiality of the data. The data on family medicine practices were kept on a secured computer in the researcher's office that is password protected. Backup data files were stored in a locked filing cabinet. Specific mechanisms were used to ensure security for the web-based survey data. The standard Secure Socket Layer protocol (SSL/HTTPS) was used for connecting to the questionnaire from the respondent's computer to ensure the security of the data as the data passed through the network. To incorporate this method, a server security certificate was configured on the server. This certificate was created using the default utilities that are part of the Microsoft IIS server environment.

Variable Identification and Measurement

Discussion of Variables

This study uses a number of environmental and organizational variables. The dependent variables measure reported innovations in family medicine practices. The study utilized numerous measurements for obtaining information on the independent variables representing the environment and perceptions of the environment. Control variables were used to control for extraneous organizational and market effects.

Dependent Variables

The dependent variables are continuous variables derived from indices that were created to measure clinical and business innovations using data obtained from the practice survey. Data elements included responses to survey questions on whether the practice implemented each clinical and business strategy listed in the practice survey.

Clinical Improvement Index

The clinical improvement index was measured based on the number of and extent of innovations undertaken by family medicine practices to improve care delivery processes and clinical practices. Innovations commonly discussed in the literature, outlined in Chapter 2, are used to assess practices' efforts regarding care delivery processes and clinical practices. The data elements needed to measure this construct were derived from responses to survey questions on whether the practice implemented each clinical innovation strategy listed in the practice survey and the extent of implementation of each strategy. The survey asked fourteen questions on whether the practice:

- incorporates evidence-based medicine approaches such as clinical guidelines and patient registries;

- provides multidisciplinary team based care;

- acts as a personal medical home for patients;

- utilizes clinical information systems;

- provides a whole-person orientation to patient care and coordinated care that considers cultural differences; and

- attempts to eliminate barriers to access through alternative visit and scheduling options, access to language translation, and accommodation for disabilities.

A composite measure was created with the practice receiving points for implementation of each clinical innovation. Similar indices have been used in previous health services research (Shortell, Zazzali, Lawton, et al., 2001).

Business Improvement Index

Innovations related to business functionality were measured through a business improvement index. Measurements related to the innovation of business and administrative functions were drawn from the literature review discussed in Chapter 2. The components of this index included whether the practice:

- incorporates performance measurement and monitoring activities;

- conducts patient feedback surveys;

- has functional office space;

- offers non-covered services and products (not covered by insurance); and

- offers programs to improve employee morale.

Credit was assigned for implementation of each of the business index components, with partial score given to practices with partial implementation of business innovations.

Independent Variables

The study included groups of independent variables that measure influences on family medicine practices to improve care delivery and business functionality. These influences were hypothesized to result from: third party payers (MCOs and Medicare), an uncertain environment, societal expectations and norms from external entities, mimetic behaviors, competition, and legal or contractual relationships. One practice characteristic, the size of the practice, is also hypothesized to be related to whether practices engage in innovative strategies. These variables are described in detail in Table 5.

Table 5. Summary of Independent Variables

Hypothesis	Variable	Definition and Measure	Data Type	Data Source
H1: Forces from third party payers	a. Concentration of Medicare recipients	a. Number of Medicare recipients in PCSA	Continuous	4
	b. Practice participation in Medicare	b. Yes/no to whether practice accepts Medicare	Nominal (Binary)	3
	c. HMO penetration	c. % of population enrolled in MCO	Continuous	1
	d. Number of HMOs	d. Number of MCO operating in PCSA	Continuous	1
H2: Environmental uncertainty	a. Rules and Regulations from Medicare and MCOs	a. Perception of rules and regulations	Ordinal	
	b. Changing regulatory requirements	b. Rate of regulatory change	Ordinal	2
	c. Understanding of regulatory requirements	c. Understanding of regulations	Ordinal	2
H3: Societal expectations and norms set by external groups/ organizations	a. Patient concerns and expectations	a. Societal expectation/norms set by patients	Ordinal	2
	b. Professional associations	b. Societal expectation/norms set by professional associations	Ordinal	2
H4: Mimetic/ normative behavior	Regional Innovation	Level of innovation among competitors in PCSA	Continuous	2,4

Table 5. Continued.

H5: Competition	Density of Competitors	Number of primary care and family medicine physicians in PCSA	Continuous	4
H6: Inter-connectedness	Legal or contractual relationships	Yes/no to whether a legal or contractual relationships exist	Nominal (Binary)	2
H7: Practice characteristics	Size of family medicine practice	Number of physicians in practice	Continuous	2

Sources of data: 1) Area Resource File, 2004, data as of 2004, 2) Survey of Family Medicine Practices, 3) Virginia Department of Health, 4) PCSA Database

Control Variables

Control variables were used in the model to control for extraneous effects so that the true relationships between dependent and independent variables could be tested (Polit and Beck, 2004). Statistical control enhances the ability to detect and interpret relationships and is a relatively economical means of controlling numerous extraneous variables. Extraneous variables specific to the research problem were identified through an in-depth literature review and statistical analysis. These extraneous variables were built into the design, permitting the calculation of variance in the dependent variable that may be attributed to these variables.

Characteristics of the practice that may be associated with the outcome variable were included in the model. These control variables were: practice type (single specialty or multispecialty), organization age, and whether the practice is located in a primary care shortage area. Whether a group is multispecialty could exert different effects (Shortell,

Zazzali, Burns et al., 2001). A multispecialty group might signal a need for greater coordination of care across specialties and greater need for team-based care, etc., and hence the existence of more innovation efforts. Practice age could exert either a positive or a negative influence. On the positive side, an older practice might have more experience and have greater ability to deploy resources (Shortell, Schmittdiel, Wang, et al., 2004) for redesign. On the negative side, an older practice may indicate that physician age is also higher and older physicians might be more resistant to changes associated with innovation than younger physicians (Shortell, Zazzali, Burns et al., 2001). Whether a practice is located in a primary care shortage area was also thought to be associated with whether the practice had enough resources to engage in innovations since shortage areas might also indicate lower income levels in the area.

Region is another control variable used in health services research to remove effects of regional differences (Fennell & Alexander, 1987; Longo, Sohn, & Shortell, 1996). There may be numerous differences in the population served, practice styles, or cultural norms and expectations based on the geographic location of the practices. For example, the population in northern Virginia may be comprised of a higher number of individuals from specific ethnic backgrounds that may lead to differences in practice styles and patient expectations. In this study, five regions grouped by county and geographic similarities, as delineated in the Virginia State Planning Grant (SPG), were used to control regional differences. The regions, listed below, are described in detail in Appendix B. Regional differences were also thought to have possible interactions with

other geographical or practice characteristics and were evaluated as part of the statistical analysis.

- Region 1 – Northwestern Virginia
- Region 2 – Northern Virginia
- Region 3 – Southwestern
- Region 4 – Central
- Region 5 – Eastern

To control for differences in the population served by family medicine practices, several other county-level measures from the ARF were included to control for environmental factors that may be related to innovation. These measures included population per square mile and median household income of the county where the practice is located. Whether the practice is located in a densely populated area could also exert an influence on efforts to innovate. Practices located in densely populated areas could have more awareness of other organizations' innovation efforts than practices located in less densely populated areas. This awareness may lead to an increased level of mimetic behavior, resulting in increased efforts to innovation. Median household income is another factor that may exert an influence on practice innovation. Practices in areas with a lower median household income may have fewer resources to devote to innovation efforts.

Measurement Validity and Reliability

This study examined how well the independent variables, environmental and organizational factors, predict the dependent variables, engagement in clinical and business innovation. It does not examine or control for every internal or external factor

that may affect the decision of family medicine practices to engage in innovation. This problem is often referred to as an omitted variable bias and appears in an estimate of a parameter if the regression run does not have the appropriate form and data for other parameters (Davidson & MacKinnon, 1993). For example, the leadership style or management philosophy of the practice may influence the adoption and implementation of new technologies or clinical practices. Efforts were made to capture as much information about practice and environmental influences as possible within the constraints of a self-report data instrument and available secondary databases. Another concern for this study is construct validity, which is whether the study defined, or operationalized, the constructs precisely (Cook & Campbell, 1979). A strong theoretical model was used to develop the study constructs and previous research supports the relationships among constructs in different organizational settings. However, there is a potential threat to construct validity since there is little or no research on innovation in family medicine practices and the influence of environmental and organizational characteristics. Careful attention was given to ensure face validity of the study through family medicine and primary care expert reviews of the theoretical framework, constructs and measurements.

Reliability of measurement is another concern in this study due to the development of a new data collection instrument. An instrument's reliability is the consistency with which it measures the target attribute (Polit & Beck, 2004). The reliability assessment method applied to the dependent variables was the Cronbach's alpha (Polit & Beck, 2004), or the coefficient alpha, which evaluates internal consistency.

An estimation of the proportion of true score variance captured by the items in the

practice survey was compared to the sum of item variances with the variance of the sum

scale. The normal range of values is between .00 and +1.00, and higher values reflect a

higher internal consistency (Polit & Beck, 2004). The Cronbach's alpha equation (Polit &

Beck, 2004, pg. 420) is as follows:

$$r = (k/(k-1)) * [1 - \Sigma (s_i^2)/s_{sum}^2]$$
(Eq. 2)

Where:

r = the estimated reliability
k = the total number of items in the test
s_i^2 = the variances for the k individual items;
s_{sum}^2 = the variance for the sum of all items.

Data Exploration and Cleaning

The data were inspected after the study database was developed to identify

missing values, invalid measures, and outliers. Data validation was performed to discover

and correct data entry errors that were made when the data were transcribed from the

hard copy questionnaire to the Excel database. Cases with extreme or improbable values

were checked for accuracy and corrected if necessary.

Analysis of missing values was performed by reviewing frequency distributions to

determine if a large amount of data were missing from survey questions or data fields

originating from secondary data sources. Missing data were calculated through

expectation maximization (EM) methods under missing value analysis (MVA) in SPSS.

EM forms a missing data correlation matrix by assuming the shape of a distribution for

the partially missing data and basing inferences about missing values on the likelihood

under that distribution. This procedure avoids difficult matrices and overfitting, and produces realistic estimates of variance (Tabachnick & Fidell, 2001).

A review of the data for outliers was performed on all data fields. Since closed survey questions should not result in outliers, any survey data, as well as other data fields, showing outliers were initially checked for accuracy against the original source documents or data file. Univariate outliers for dichotomous independent variables were identified by evaluating the frequency of responses. Variables with a percent spit less than 90/10 were considered to have outliers. Outliers were handled by assigning the outlying case a raw score on the offending variable that is one unit larger than the next most extreme score within the normal distribution (Tabachnick & Fidell, 2001). Multivariate outliers were assessed through the review of the Mahalanobis Distance (Tabachnick & Fidell, 2001) using critical values of chi square 32.909 at .001 significance.

Analytic Methods

Analyses were conducted in SPSS v15 and Stata/IC 10 and significance assessed at the $P < .05$ level.

Univariate Analysis

To analyze the data, standard descriptive statistics were calculated to examine the data for anomalies and to ensure that the assumptions of all analyses were met. These analytic techniques provided the mechanism to summarize sample characteristics, describe key research variables, and document methodological features such as the response rate. Frequency distribution, a systematic arrangement of values from lowest to

highest, was used to count the number of times each value was obtained for nominal and ordinal variables (Polit & Beck, 2004). Measures of central tendency were evaluated to describe findings from continuous variables. The mode, mean, variability, and standard deviation were used for describing the sample characteristics and displaying survey results and other information about the environment.

Multicollinearity was examined using several methods. In cross-sectional research multicollinearity occurs when multiple measures for the same or similar constructs are used as independent variables in a regression equation (Cohen, Cohen, West, et al., 2003), resulting in variables that are highly correlated. A correlation matrix was used to examine the bivariate correlations between the independent variables. The squared correlation, $r^2_{x_i x_j}$ (Cohen, Cohen, West, et al., 2003, pg. 422), between each of the pairs of predictor variables provides an index of bivariate multicollinearity, which was deemed to be present if the correlation coefficient was 0.9 or greater (Tabachnick & Fidell, 2001). Collinearity diagnostics were also calculated in SPSS to identify the offending variable(s) through variance inflation factors (VIF) and tolerances. VIFs of 10 or higher, or equivalently, tolerances of .10 or less (Cohen, Cohen, West, et al., 2003) were considered to be multicollinear. If variables were multicollinear, the variable was transformed or substituted to improve the model.

Factor Analysis

A factor analysis provides a method for summarizing a large set of data with multiple variables and examining interrelationships among data. Factors are formed when variables are correlated with each other and independent of others (Kim & Mueller,

1978). Factor analysis was applied to independent variables to summarize patterns of correlations among observed variables and group interdependent variables into descriptive categories. A review of existing literature on organizational theory indicates that multiple constructs may underlie the concept of practice environment. Principal component factor analysis with varimax rotation was conducted to reduce the set of independent variables and verify the theoretical constructs that comprise the practice environment.

Inferential Statistics

Inferential statistics were used to calculate sample statistics to estimate and make inferences about the population. The study utilized the OLS estimation of coefficients in regression. The ordinary least squares function is as follows:

In (innovation efforts involving clinical improvements [CI] and business improvements [BI] in family medicine practices in Virginia) = f *(coercive forces, mimetic forces, normative forces, competition, interconnectedness, organizational characteristics)* + *control variables,* where:

coercive forces =	concentration of Medicare recipients, HMO penetration, number of HMOs
mimetic forces =	changing regulatory requirements, lack of understanding of regulatory requirements,
normative forces =	stakeholder/patient expectation, standards set by professional associations
mimetic and normative forces =	competitors engage in innovation efforts
competition =	density of competition

interconnectedness =	ownership or contractual relationships with larger health care or hospital systems
organizational characteristics =	practice size
control variables =	other exogenous characteristics in the market and organizational characteristics that may be related to why family medicine practices engage in innovation efforts

Stata/IC 10 statistical software provided the following statistics for interpretation of the model: regression coefficients such as regression coefficient β, standard error of β, and the T-statistics; goodness-of-fit statistics such as R^2; changes in R^2; descriptive statistics such as mean and standard deviation; part and partial correlations; collinearity diagnostics; and the Durbin-Watson statistic for correlation of the residuals and casewise diagnotics.

Ordinary Least Squares

An OLS multiple regression model was used to examine the independent relationship of the environment and practice-level characteristics to the outcome variable. OLS seeks to minimize the sum of squared distances of the data points to the regression line (Cohen, Cohen, West, & Aiken, 2003). There are three important characteristics of OLS regression: the prediction equation includes a linear combination of predictor variables (Tabachnick & Fidell, 2001), residuals are normally distributed, and the predicted scores are in the same units as the observed Y (Cohen, Cohen, West, & Aiken, 2003). The inferences in OLS regression depend on the assumptions of normality, homoscedasticity, and that all regressors are independent of each other.

The ordinary least squares estimator ($\widehat{\beta}_{\text{OLS}}$) is described in matrix notation as:

$$y_i = \beta x_i + \varepsilon_i$$

(Eq. 3)

(McFadden, 1997) and takes the form

$$\widehat{\beta}_{\text{OLS}} = \frac{\sum_i x_i y_i}{\sum_i x_i^2} = \frac{\sum_i x_i(x_i\beta + \varepsilon_i)}{\sum_i x_i^2} = \beta + \frac{\sum_i x_i \varepsilon_i}{\sum_i x_i^2}.$$

(Eq. 4)

(McFadden, 1997)

When x and ε are uncorrelated, the second term goes to zero in the limit and the estimator is unbiased with decreasing variance as the number of sampled units increases and is a consistent estimator.

One problem that often occurs in survey data and cross-section data sets is that variables are measured with error (Davidson & MacKinnon, 1993). This problem is called errors in variables (Davidson & MacKinnon, 1993). The statistical consequence of errors in explanatory variables is severe, since explanatory variables that are measured with error are correlated with the error terms. When x and ε are correlated, the estimator is biased and inconsistent.

Normal regression models assume that all the independent variables are exogenous (Engle, Hendry, & Richard, 1983); OLS can only be utilized if all observations are independent of each other. Endogeneity occurs when the environment

being modeled has a matrix of independent variables X that are correlated to the errors (McFadden, 1997).

The model hypothesizes that engagement in clinical innovation and business innovation is a function of environmental and practice-level organizational variables. However, it is likely that there are confounding effects between these measures and regressors in the model are not independent of each other, resulting in problems associated with errors in variables. For example, the model hypothesizes that societal expectations and norms arising from patients encourages practices to engage in strategies to innovate clinical and business functions. It may well be that successful innovation strategies are looked upon favorably by practices, which then causes societal expectations and norms to be developed around implementation of those successful strategies. The same can be said about legal or contractual relationships with larger health care systems. Perhaps the existence of an innovation such as multidisciplinary team-based care or a whole-person orientation to care encourages organizations to develop legal or contractual relationships with a larger health care system. This two-way causality, or endogeneity, was expected to be a problem in the model.

An instrumental variable is one approach to deal with the problem of endogeneity (Davidson & MacKinnon, 1993). An instrumental variable is one that is correlated with the independent variable but not with the error term. An example in health services research is when Brooks, Irwin, Hunsickerwe, et al. (2006) used an instrumental variable approach to estimate the effect of dialysis center profit-status on patient survival.

The estimator is:

$$\widehat{\beta}_{IV} = \frac{\sum_i z_i y_i}{\sum_i z_i x_i} = \frac{\sum_i z_i (x_i \beta + \varepsilon_i)}{\sum_i z_i x_i} = \beta + \frac{\sum_i z_i \varepsilon_i}{\sum_i z_i x_i}.$$

(Eq. 5)

(McFadden, 1997)

When z and ε are uncorrelated, the final term approaches zero in the limit, providing a consistent estimator. Note that when x is uncorrelated with the error term, x is an instrument for itself (McFadden, 1997). Since endogenous variables are suspected to be present in the causal model for this study, an instrumental variable (IV) estimation technique was applied to minimize issues caused by endogeneity.

IV Estimation

IV estimation can be used in regression analysis to produce a consistent estimator when the explanatory variables (covariates) are correlated with the error terms. In this situation, ordinary linear regression produces biased and inconsistent estimates. There are three main requirements for using an IV approach (McFadden, 1997):

- The instrument must be correlated with the model's predicting (explanatory) variable,

- The instrument cannot be correlated with the error term in the second stage model, and

- The instrument must act on the outcome only through the predicting variable, not directly.

IV estimation was used on regressors that were found to be correlated to errors in the causal model to replace these regressors with estimates that were not correlated to the errors. The replacement regressors were constructed by running regressions of the original regressors on exogenous variables. This technique involves creating consistency by using a T x k matrix of independent variables Z, correlated to the X's but uncorrelated to the errors of the IV estimator. In this case, X is the $T \times K$ matrix of explanatory variables resulting from T observations on K variables and Z is a $T \times K$ matrix of instruments, as shown below in matrix notation.

$$\widehat{\beta}_{IV} = (Z'X)^{-1}Z'Y = (Z'X)^{-1}Z'(X\beta + \varepsilon) = \beta + (Z'X)^{-1}Z'\varepsilon. \text{(Eq. 6)}$$

(McFadden, 1997)

In equation six, the exogenous variables Z are called instrumental variables and the instruments (Z'Z)-1(Z'X) are estimates of the part of X that is not correlated to the e's (McFadden, 1997).

Two Stage Least Squares

In this study, 2SLS estimation was used to create instrumental variables that substitute for the variables with endogeneity problems. This econometric technique is widely used for dealing with problems of endogeneity because it is shown to be insensitive to other estimating problems such as multicollinearity, specification errors, and small samples (Kennedy, 1998). The advantage of using this approach is that it can efficiently combine information from multiple instruments for over-identified regressions in cases where there are fewer covariates than instruments. 2SLS is increasingly being

used in health services research to create instrumental variables that are not correlated to the error terms. McCarthy (1985) used 2SLS procedure to assess the strength of the demand constraint faced by the average primary-care physician firm. Yoo and Frick (2006) used 2SLS models to adjust for potential self-selection of the receipt of influenza vaccination. Fenn, Gray, and Rickman (2007) also used 2SLS to test for effects of tort liability on the use of certain diagnostic procedures in the United Kingdom (UK), where the health care providers' expected cost of litigation is proxied by the risk-sharing arrangements agreed with their insurers.

The first stage of the 2SLS approach involves the regression of each endogenous covariate (predictor variable) on all valid instruments, including the full set of exogenous covariates in the main regression. Since the instruments are exogenous, these approximations of the endogenous covariates will not be correlated with the error term. This process allows a way to analyze the relationship between the outcome variable and the endogenous covariates. A problematic causal variable is an endogenous variable whose disturbance term is posited to be correlated with the disturbance term of another endogenous variable on which it has a direct effect. Problematic causal variables are replaced by substitutes in the first stage of 2SLS.

In the second stage, the regression of interest is estimated using typical OLS procedures, except each endogenous covariate is replaced with its approximation estimated in the first stage. The slope estimator obtained using this method is consistent (McFadden, 1997).

The stages of the procedures are (Kennedy, 1998, p.65):

1. Estimate the reduced form by regressing the endogenous variable used as a regressor on all the exogenous variables in a system of simultaneous equations and then calculate the estimated values of the endogenous variable, then

2. Use the estimated values and the included exogenous variables as regressors in an OLS regression. The new variable will be uncorrelated with the disturbance term of the endogenous variable.

Stage 1: $\widehat{X} = Z(Z'Z)^{-1}Z'X$ (Eq. 7)

Stage 2: $\widehat{B}_{IV} = (\widehat{X}'\widehat{X})^{-1}\widehat{X}'Y$ (Eq. 8)

(McFadden, 1997)

In the first stage, OLS regressions were performed on the suspected endogenous variables: legal and contractual relationships and societal expectations and norms. Additional variables are used in the first stage that were thought to be related to these variables, but unrelated to the dependent variables, clinical and business innovation.

This study uses the following measures in the first stage, in addition to other exogenous variables, to estimate legal and contractual relationships and societal expectations and norms by patients.

Legal or Contractual Relationship = f (urban designation, multispecialty practice, age of practice). Rodggenkamp (2000) found that inter-organizational relationships were more likely to occur in medical practices that were multispecialty. Shortell, Schmittdiel, and Wang (2005) found that medical groups that have been in existence longer are more likely to exhibit stability, which could explain that older

practices are more likely to have legal or contractual relationships with larger health systems. It is also believed that practices located in urban areas are more likely to have legal or contractual relationships with larger health care systems since there is a higher concentration of large health care systems and health system components in urban areas.

Perception of Expectations and Norms from Patients = f (population per square mile, urban designation, population age). Although there are many published research studies on patient expectations for specific medical treatments, there is little information on physician's perception of patient expectations or on the factors that influence patient expectations. There are several factors that are thought to influence overall patient expectations. It is likely that areas with denser populations and in urban areas have more health care options available, and patients will have increased expectations for practices to provide up-to-date services and technology such as alternative scheduling options. It is also believed that younger age groups have higher expectations for innovative services and use of advanced technologies to support their care.

Determination of Endogeneity and Instrument Specification

A test for endogeneity must be conducted before an IV approach is used since OLS yields more efficient estimates; the use of an IV approach in the absence of endogeneity can result in inefficient parameter estimates (Davidson & MacKinnon, 1993). The Durbin-Wu-Hausman tests, or DWH tests, can be conducted (Davidson & MacKinnon, 1993; Kennedy, 1998) after the instruments are entered into the 2SLS model to evaluate the consistency of least squares estimates when some explanatory variables

may be endogenous. DWH tests, however, are invalid in the presence of weak instruments (Hahn, Ham, & Moon, 2008).

In order to produce consistent and unbiased estimates using 2SLS, the proposed instrumental variables must meet several criteria. An instrument is valid for an endogenous regressor if it satisfies two conditions: relevance and exogeneity. Relevance is tested using the first-stage F-statistic, which tests the hypothesis that the coefficients on the instruments are jointly zero. The F-statistic should be at least 10 for a single endogenous regressor (Stock & Watson, 2006). This suggests that the instrumental variables as a group explain a significant portion of the variation in the proposed endogenous regressor. Exogeneity of the proposed instruments is tested using an overidentifying restrictions test (Davidson and McKinnon, 1993) that examines the residuals from the 2SLS regression on the instruments, and exogenous control variables, and tests whether the coefficients on the instruments are all zero. The null hypothesis is that the instruments are valid instruments, i.e., uncorrelated with the error term, and that the excluded instruments are correctly excluded from the estimated equation. A rejection of null hypothesis casts doubt on the validity of the instruments (Schaffer & Stillman, 2006).

The instrument specification tests and the DWH test are commonly used in economics research and are being applied more frequently in health services research. Bazzoli et al. (2000) used 2SLS specification tests in their analysis of the effects of capitation on physician-hospital integration. Cawly (2000) also used specification tests to

develop valid instruments with the goal of measuring the effect of body weight on
employment disability.

Chapter Summary

This chapter has set forth the research design, presented the data collection
methods, described the derivation of the sample for the study, and described the OLS and
2SLS statistical methods that will be used to analyze the data. Chapter five will present
the study results including descriptive statistics, correlations, instrumental variable
specification tests, and regression models.

CHAPTER 5 – RESULTS

The results of analysis are presented in this chapter. First, descriptive statistics are presented and discussed, along with a comparison of the geographic characteristics of the sample against the population of family medicine practices in Virginia. Other descriptive statistics presented in this chapter include practice innovations, perceptions of the influence of external organizations, organizational characteristics, and elements of the organizational environment. The second part of this chapter focuses on multivariate models. This section describes the process of instrumental variable estimation, problems that arose in model-building for 2SLS, and models using OLS. A summary of findings from each model, as well as comparisons between OLS models are presented and discussed.

Sample – Response Non-Response Analysis

The population of family medicine practices in Virginia was derived from information contained in the Virginia Department of Health Practitioner Profile Database. It was necessary to develop a list of practices from practitioner information since no complete list of family medicine practices in Virginia could be identified from other sources including the Department of Health, VAFP, AMA, or Medical Group Management Association (MGMA). The lack of information about family medicine

practices in Virginia limits the sample-to-population comparison to only geographic

characteristics and government insurance programs. The Virginia family medicine

practice survey resulted in a 56% response rate, with 342 unique office locations

participating in the study. Table 6 provides a comparison of family medicine practices in

the sample (n=342) to family medicine practices in the population (N=916). The Pearson

Chi-Square statistics indicate that no significant difference exists between the sample and

the population.

Table 6. Comparison of Sample to Population Characteristics

Variable	Sample (n=342*) $f(\%)$	Population (N=916) $f(\%)$	Pearson Chi-Square (Asym Sign.)
Geographic Characteristics			
Rural	282 (82.9%)	773 (84.4%)	.386 (.584)
Urban	58 (17.1%)	143 (15.6%)	
Virginia Region:			
Northwestern	53 (15.6%)	153 (16.7%)	2.084 (.720)
Northern	68(20.0%)	202 (22.1%)	
Southwestern	62 (18.2%)	169 (18.4%)	
Central	76 (22.4%)	174 (19.0%)	
Eastern	81 (23.8%)	218 (23.8%)	
Government Insurance**			
Accepts Medicare	315 (92.6%)	820 (89.5%)	2.602 (.107)
Accepts Medicaid	249 (73.7%)	665 (72.6%)	.032 (.858)

* Two cases without geographic information
**Practice has Medicare/Medicaid participating provider(s) that either accept new patients or continue to care for existing Medicare and/or Medicaid patients

Descriptive Statistics of Study Variables

Descriptive statistics provide information on the organizational characteristics of sample practices, the organizational environment, practices' perception of external influences, and the types and level of clinical and business innovations used by family medicine practices in Virginia. The data presented in this section are adjusted for missing values and represent the sample dataset of 342 family medicine practices in Virginia.

Analysis of missing values was performed by reviewing frequency distributions to determine if a large amount of data were missing from survey questions or data fields originating from secondary data sources. Missing value analysis revealed that the majority of variables had less than 5% of missing data. An analysis to determine differences in "skipped" survey questions was not necessary since the amount of missing data was small (Tabachnick & Fidell, 2001). Only two variables had higher than 5% of missing data, both of which were questions asking the respondent to calculate the full time equivalent (FTE) employment quantity for care providers. These questions also had a high rate of miscalculation. Due to the amount of missing data and respondent miscalculation these variables were deleted from the study database. Missing data for the remaining variables were calculated through expectation maximization methods under missing value analysis in SPSS. EM forms a missing data correlation matrix by assuming the shape of a distribution for the partially missing data and basing inferences about missing values on the likelihood under that distribution. This procedure avoids difficult matrices and overfitting, and produces realistic estimates of variance (Tabachnick & Fidell, 2001).

Organizational Characteristics

The organizational characteristics of family medicine practices in the sample are listed in Table 7.

Table 7. Descriptive Statistics of Organizational Characteristics

Organizational Characteristics		f (%) or M (SD)
Specialty	Single Specialty	246 (71.9%)
	Multispecialty - primary only	48 (14.0%)
	Multispecialty - primary and specialty	48 (14.0%)
	Total	342 (100%)
Type	Private practice	280 (81.8%)
	Non-profit federally/state funded	22 (6.5%)
	Non-profit privately funded	19 (5.6%)
	Academic	12 (3.5%)
	Urgent care (plus primary care)	9 (2.9%)
	Total	342 (100%)
Ownership	Not owned by outside entity	190 (55.6%)
	Hospital	54 (15.8%)
	Health plan	53 (15.5%)
	Other	45 (13.2%)
	Total	342 (100%)
Location	Not Primary Care Shortage Area	263 (76.9%)
	Primary Care Shortage Area	79 (23.1%)
	Total	342 (100%)
Number of Physicians	1 Physician	90 (26.4%)
	2-9 Physicians	218 (63.9%)
	10-49 Physicians	34 (10.0%)
	Total	342 (100%)
Years in existence at current location		16.3 (12.8)

Organizational characteristics include the specialty, type, ownership, number of

physicians in the practice, whether the practice is located in a primary care shortage area,

and the number of years the practice has been operating at its current location.

Organizational Environment

The organizational environment includes social and economic indicators and

levels of health care resources in the market. Table 8, below, presents information on the

organizational environment in the primary care service area.

Table 8. Descriptive Statistics of the Organizational Environment

Environment of Primary Care Service Area	Mean	Std. Deviation
Primary Care Providers Per 1000 Population	.280	.142
Family Medicine Providers Per 1000 Population	.112	.053
Number of Primary Care Physician Assistants	3.010	3.444
Number of Medicare Beneficiary Population	9,183.760	7,431.358
Percent of Population Below Poverty Level	9.558	5.472
Per Capita Income ($)	23,244.590	7,357.481
Median Income ($)	48,734.770	16,613.676
Population Density Per Square Mile	1,108.900	1,734.654
HMO Penetration (market share)	.203	.127
Number of HMOs	7.850	4.165

Another aspect of the market captured through the Virginia family medicine

practice survey is the practice's perception of rules and regulations placed upon them by

various entities and influences from external organizations. Table 9 presents information

on the perception of influences from external organizations.

Table 9. Descriptive Statistics of Reported Influence of External Organizations

Survey Question	Response 1	2	3	4	5
Medicare rules and regulations are changing fast	30%	46%	18%	5%	1%
MCO rules and regulations are changing fast	29%	45%	19%	5%	2%
Changed practice as a result of expectations from patients	24%	54%	17%	4%	2%
MCO rules and regulations make it impossible to practice	24%	50%	13%	10%	4%
Medicare rules and regulations make it impossible to practice	16%	45%	19%	16%	4%
Physician knowledge of Medicare rules and regulations	6%	34%	21%	29%	11%
Physician knowledge of MCO rules and regulations	6%	31%	21%	29%	13%
Changed practice as a result of interactions with professional associations	6%	26%	39%	17%	12%
Changed practice as a result of expectations from patient groups	4%	20%	42%	20%	14%
MCO rules and regulations have made it easier to practice	2%	13%	19%	38%	28%
Medicare rules and regulations have made it easier to practice	1%	14%	29%	31%	25%

1=strongly agree   5=strongly disagree
2=somewhat agree
3=neither agree nor disagree
4=somewhat disagree

Clinical and Business Innovations

Descriptive statistics presented in this section answer the first research question in the study: what efforts have been taken by family medicine practices in Virginia to improve delivery of health care services and business functionality? First, an explanation is provided on the assignment of innovation variables to either the clinical or the business innovation index. Second, a summary is presented on the innovative efforts used by family medicine practices in Virginia to improve delivery of health care services and business functionality. The innovative strategies and practices reviewed in this study appear in recent family medicine and primary care literature, as described in Chapter 2.

Activities assigned to the clinical innovation index are those commonly identified as medical treatment and/or patient care activities. The Health Insurance Portability and Accountability Act of 1996 (HIPAA) is one example of a major federal legislation that identifies these types of treatment activities (HIPAA, 2007). The medical treatment activities assigned to the clinical innovation index include those that represent the provision, coordination, or management of health care and related services.

Activities assigned to the business innovation index are those commonly identified as management and/or business functions. The HIPAA designates these types of management and business activities under the term "health care operations" (HIPAA, 2007). The management and business activities assigned to the business innovation index include: conducting quality assessment and improvement activities, including outcomes evaluation; evaluating provider performance; business planning and development, such as

planning-related activities and market assessment; enhanced service offerings not covered by insurance companies; and customer service activities.

Findings from the family medicine practice survey indicate that practices employ some clinical innovations at a much higher rate than others. Innovations with a high degree of utilization include: team based care, clinical guidelines, continuity of care processes, alternative scheduling techniques, and provision for linguistic services to non-English speaking patients. Innovations with a lower degree of utilization include: patient registries, programs for self management, EHR, and community linkages for care.

Team-based care was one innovation used frequently with more than 60% of practices utilizing nurses and almost 50% utilizing medical assistants to aid in the delivery of care. Alternative scheduling was another frequently used innovation with more than 96% of practices offering alternative scheduling options. Almost 90% report utilizing rapid access techniques for patients to obtain care on short notice, approximately 40% report utilizing scheduled evenings or weekend visits to provide care, and 40% of practices provide telephone consultation. The majority of practices (77%) report using clinical guidelines and training physicians in the use of guidelines (67%). In addition, the majority of practices (87%) report that they have specific processes to ensure continuity of care. Most practices (71%) with non-English speaking patients offer some form of linguistic services to patients to facilitate communication.

Findings from the survey also specify that almost 75% of practices provide care to all ages groups and both sexes. Survey results also show:

- 96% of practices provide preventive care, acute care and chronic illness care;

- 35% provide rehabilitation and mental health services; and

- 8% provide prenatal and obstetrics care.

Patient registries are not utilized often by practices; more than 66% of practices report not using registries for any diseases. More than 55% of practices also reported that they do not offer programs for self-management to patients. Diabetes and asthma are the top two conditions for use of patient registries and self-management programs. Few practices have programs and registries for depression, coronary artery disease, and congestive heart failure. Also, approximately 70% of family medicine practices report no formal or informal community linkages for care. Less than 40% of practices report having an EHR, however the majority of those that report utilizing an EHR have 7 or more EHR components. All practices utilizing an EHR report that they have access to problem lists, ambulatory visits, and medications through the EHR. Components of an EHR not frequently possessed by practices include: inpatient stays, emergency room visits, and problem specific clinical guidelines. These findings were drawn from information presented in Table 10 that report the percentage of practices using specific clinical innovations. Other findings are drawn from the number of innovation components utilized by practices, reported in Appendix C.

There is also varied use of business innovations among practices. Almost all practices (93%) report reviewing the financial performance of the practice. The majority (70%) of practices report that they actively search for best practices. More than 60% of practices evaluate their office space to determine whether their facility meets patient needs and expectations.

Table 10. Descriptive Statistics of Clinical Practice Innovations

Clinical Practice Innovation	Response Frequency	
	Yes	No
Q1. Existence of team based care		
Nurses	62.5%	37.5%
Medical assistants	49.3%	50.7%
Nurse practitioners	44.0%	56.0%
Patient education	22.9%	77.1%
Physician assistants	19.6%	80.4%
None	13.5%	86.5%
Mental health specialists	8.5%	91.5%
Q2. Existence of patient registry		
None	66.6%	33.4%
Diabetes	28.2%	71.8%
Asthma	21.1%	78.9%
Congestive heart failure	18.5%	81.5%
Coronary artery disease	18.5%	81.5%
Depression	16.7%	83.3%
Other	10.6%	89.4%
Q3. Programs for patient self management		
None	44.9%	55.1%
Diabetes	41.6 %	58.4 %
Asthma	16.1%	83.9%
Depression	10.6%	89.4%
Coronary artery disease	10.0%	90.0%
Congestive heart failure	8.2%	91.8%
Other	7.9%	92.1%
Q4. Alternative scheduling arrangements		
Rapid Access	87.4%	12.6%
Scheduled evenings or weekend	39.6%	60.4%
Telephone consultations	39.0%	61.0%
On-call evenings or weekend	33.7%	66.3%
E-mail consultation	12.3%	87.7%

Table 10. Continued.

Group visits	9.7%	90.3%
None	3.8%	96.2%
Q5. Use of clinical guidelines	76.5%	23.5%
Q6. Physicians trained in the use of clinical guidelines (of those responding YES to Q5)	78.4%	21.6%
Q9. Existence of electronic medical record	39.0%	61.0%
Q10. EMR components (of those responding YES to Q9)		
Problem list	100.0%	0.0%
Ambulatory visits	100.0%	0.0%
Medications	100.0%	0.0%
Lab findings	95.5%	4.5%
Radiology findings	88.7%	11.3%
Services provided by specialists	81.9%	18.1%
Medication ordering reminders and/or drug interaction information	80.5%	19.5%
Inpatient stays	68.4%	31.6%
Emergency room visits	61.6%	38.4%
Problem specific clinical guidelines	47.4%	52.6%
Q11. Continuity of care	86.8%	13.2%
Q12. Patient Types		
Age Group - Adults	100.0%	0.0%
Age Group - Children	92.7%	7.3%
Age Group - Infants	76.2%	23.8%
Sex - Female	99.4%	0.6%
Sex - Males	99.1%	0.9%
All	73.3%	24.3%
Q13. Type of Care		
Preventive	99.1%	0.9%
Acute	98.2%	1.8%
Chronic illness care	97.4%	2.6%
Mental health	81.2%	18.8%
Rehabilitative	38.4%	61.6%

Table 10. Continued.

Prenatal care	12.3%	87.7%
Obstetrics	10.3%	89.7%
Q14. Community linkages for care	30.8%	69.2%
Q17. Non-English speaking patients	76.2%	23.8%
Q18. Provisions for linguistic services (of those responding YES to Q17)	71.3%	28.7%

Almost 70% of practices report assessing the market on at least one community and/or state trend:

- 40% review community/regional disease patterns,

- 35% review regulatory actions, and

- 35% review resource availability.

Also, 50% of practices report administering patient satisfaction surveys; the majority of those practices (70%) make improvements to the office based on feedback obtained from patients. More than 50% offer programs or services that focus on improving employee morale or teamwork. Approximately 65% offer diagnostic tests in their office; 45% offer hearing tests and 41% offer pulmonary function tests. Stress tests are offered to patients by less than 10% of practices.

Other business innovations are utilized less frequently by practices. Almost 75% of practices do not offer services or products to patients that are not covered by insurance programs. Approximately 60% of practices do not utilize performance measurement for clinical activities. A separate review of each performance measurement activity reveals that less than 25% of practices review data on: the results of clinical quality improvement

projects, clinical use of evidence-based practices, or outcomes data. Also, the majority of

practices (70%) do not provide written feedback reports or data to physicians and practice

teams. Table 11 presents the frequency of practice utilization of business innovations.

Table 11. Descriptive Statistics of Business Practice Innovations

Business Practice Innovation	Response Frequency	
	Yes	No
Q7. Administer patient satisfaction surveys	46.0%	54.0%
Q8. Initiate change based on results of patient satisfaction surveys (of those responding YES to Q7)	69.6%	30.1%
Q15. Evaluation of office space	61.0%	36.7%
Q16. Office Space Accommodates		
Special needs patients	66.6%	33.4%
Group visits	34.3%	65.7%
None	24.6%	75.4%
Patient library or patient computer	9.7%	90.3%
Q19. Performance measurement		
None	58.1%	41.9%
Data on the results of clinical quality improvement projects	23.5%	76.5%
Data on clinical use of evidence-based medicine	22.9 %	77.1 %
Outcomes for selected conditions	22.9%	77.1%
Q20. Provision of reports or feedback to physicians or practice teams	29.0%	71.0%
Q21. Review financial performance	93.0%	7.0%
Q22. Offer services not covered by insurance	25.8%	74.2%
Q23 Offer Diagnostic testing		
Hearing tests	44.6%	55.4%
Pulmonary function	41.3%	58.7%
Bone mineral density testing	19.4%	80.6%
Colposcopy	15.0%	85.0%
Stress tests	9.7%	90.3%

Table 11. Continued.

Q24. Programs that focus on improving employee morale and/or teamwork	53.1%	46.2%
Q25. Market assessment		
Community/regional disease patterns	37.2%	62.8%
Regulatory actions	34.9%	65.1%
Resource availability	34.6%	65.4%
Demand for services	32.6%	67.4%
Patient demographics	32.0%	68.0%
None	31.1%	68.9%
Competition	24.3%	75.7%
Q37. Practice actively searches for best practices	70.1%	29.9%

Internal Consistency Reliability

Internal consistency reliability is the correlation between the individual items contained in the measure; the higher the correlation between the items, the higher the internal consistency reliability. The formula for calculating the internal consistency reliability is called Cronbach's Alpha. The initial reliability analysis with the sample of family medicine practices reveals a Cronbach's Alpha of .893 for the clinical innovation index and .799 for the business innovation index. The alpha coefficients indicate internal consistency since coefficients are above the cut-off criteria of .70 (Polit & Beck, 2004) for scale reliability. Another test was conducted to determine the consistency of respondent answers through the use of questions that were asked in opposite directions. Two questions asking about the influence of Medicare rules and regulations showed 89.2% parity in answers and 10.8% disparate answers. Questions on the influence of managed care rules and regulations showed an 87.4% parity and 12.6% disparate

answers. The high degree of parity in responses between questions worded from opposing viewpoints demonstrates that respondents answered questions in a consistent manner.

Data Preparation

In preparation for multivariate analysis, further evaluation of variables and cases was conducted. Seven cases were removed from the database due to lack of zip code information and corresponding socio-economic data; leaving 335 cases for multivariate analysis.

A review of the data for outliers was performed on all data fields. All continuous variables were checked for outliers by identifying cases with very large standardized scores, those with z-scores in excess of 3.29 - a p value < .001 on a two-tailed test (Tabachnick & Fidell, 2001). Variables with outlying cases included: family medicine physicians per 1,000 population, practice size based on number of physicians, practice age, population below poverty level, median household income, and median age of population. Outliers were handled by assigning the outlying case a raw score on the offending variable that is one unit larger than the next most extreme score within the normal distribution (Tabachnick & Fidell, 2001).

Multivariate outliers were assessed through the review of the Mahalanobis Distance (Tabachnick & Fidell, 2001) using critical values of chi square 32.909 at .001 significance. One case was found to be a multivariate outlier; however, it was left in the study database since it was part of the population under study.

Dichotomous variables with a percent spit less than 90/10 were considered outliers. The only dichotomous variables critical to the study that had outliers were survey questions that identified the office setting as academic; non-profit, federal or state funded; non-profit, privately funded; or urgent care. Since the majority of responders reported their office settings to be a private practice, all other office settings were combined to form one dichotomous variable that identified the office setting as a private practice or other. The variable indicating whether the practice accepts Medicare and whether the respondent was a physician were also found to be outliers. Comparison of group means resulted in no difference between groups for both variables. Since both of these variables had less than a 90/10 split, indicating dichotomous outliers, the variables were removed and not utilized for further analysis.

Variable Measurement and Transformation

Testing and Transformation of Independent Variables

The assumption of normally distributed independent variables was tested using skewness and kurtosis statistics. Skewness and kurtosis reflect a normal distribution when values are zero (Tabachnick & Fidell, 2001). As is evident from the skewness and kurtosis scores, the variables in Table 12 did not have a normal distribution. Logarithm or square root transformations were applied to the following independent variables: regional innovation, practice size, age of practice, family medicine physician competition, primary care physician competition, and population density. Transformation of these variables improved the distribution. Transformation of the Medicare beneficiary population variable did not improve the distribution and was not applied.

Table 12. Transformation of Independent Variables

Variable	Skewness and Kurtosis	How Handled	Skewness and kurtosis after transformation
Regional Innovation	Sk=-.512 Kur=-.803	Square root transformation	Sk= .088 Kur=-.842
Practice Size	Sk=2.4 Kur=6.2	Logarithm transformation	Sk=.493 Kur=-.432
Age of Practice	Sk=.94 Kur=.87	Square root transformation	Sk=.220 Kur=-.80
Family Medicine Physician Competition	Sk=1.16 Kur=1.87	Square root transformation	Sk=.51 Kur=.31
Primary Care Physician Competition	Sk=1.57 Kur=4.97	Square root transformation	Sk= .371 Kur=1.385
Population Density	Sk=2.5 Kur=7.1	Logarithm transformation	Sk=.233 Kur=-.960
Medicare Beneficiary Population	Sk=.94 Kur=-.192	Transformation does not improve the distribution	

Factor Analysis

Factor analysis (FA) was performed for data reduction and to verify constructs

that measure the environment of family medicine practices. Principal component analysis

with Varimax rotation was performed to simplify factors by maximizing the variance of

the loadings within factors and across variables. The data used for this analysis met the

assumptions for FA: at least two variables, subjects to variables ratio is more than five,

more than 100 observations, total variance of a variable reflects the sum of explained and

error variance, and variables are continuous or interval data. The variable representing

legal and contractual relationships was not entered into the FA because it is nominal data.

The Kaiser criterion was utilized, which maintains that only factors with eigenvalues

greater than 1 should be retained for analysis.

Results of the FA show the emergence of 5 factors, accounting for 60.1% of overall variance. This meets the qualification of an effective factor analysis, which usually accounts for 60-70% of variability (Tabachnick & Fidell, 2001). A gap in loadings across factors specified variables that loaded onto a factor and those that did not. All factors have loadings of .55 and above, which represents a good to excellent factor loading. The FA resulted in a clean factor structure and a theoretically meaningful factor pattern that demonstrates face and construct validity as indicated by prior research using institutional and resource dependency theories. The results of the FA show evidence that the scale exhibits factorial convergent and discriminant validity. That is, those items that do correlate with a factor correlate more highly with that factor than with any other. Table 13 contains the variables loading on each factor.

Table 13. Factor Loading Scores on Independent Variables (Varimax rotation)

	Factor I	Factor II	Factor III	Factor IV	Factor V
Independent Variable	HMO/ Beneficiary Penetration	Uncertainty - Rules & Regulations	Uncertainty - Knowledge	External Pressure	Competition
Number of HMOs	.934*	.038	-.005	.045	-.030
HMO Penetration	.920*	-.004	.001	.039	.012
Medicare beneficiaries	.555*	.023	-.017	.066	.299
Influence of Medicare	.006	.805*	-.030	.034	-.048
Influence of Managed Care	-.089	.833*	-.079	-.081	-.029
Changes in Medicare	.079	.692*	.184	.090	-.138

Table 13. Continued.

Changes in Managed Care	.055	.595*	.183	.090	-.014
Understanding Medicare	.038	.102	.877*	-.088	-.052
Understanding Managed Care	-.131	.115	.880*	-.056	-.004
Changed - professional organizations	-.021	.225	-.146	.699*	.035
Changed - groups representing patients	.026	.071	-.146	.793*	-.009
Changed -patient expectations	-.085	-.081	.064	.636*	-.070
Family medicine physicians	-.175	-.048	-.041	-.127	.856*
Primary care physicians	.289	-.076	-.084	-.028	.858*
Practice Size	.126	-.157	.087	.217	.290
Regional innovation	-.261	-.008	.129	.219	.025

*Factors with a loading of .55 or more.

Factor scores are estimates of the values that would be produced if the underlying theoretical constructs could be measured directly. The regression approach was utilized to estimate factor scores in SPSS, which calculates standardized component/factor score coefficients. This approach results in the highest correlations between factors and factor scores (Tabachnick & Fidell, 2001). Factor scores for the 5 factors were used in the

multivariate models to reduce a large number of independent variables to a small number of factors. The variables that represent organizational size and regional innovation did not load onto any factors and were utilized in the regression equation in the original format.

Development of Dependent Variables

Six dependent variables, three clinical innovation indices and three business innovation indices, were created and tested using regression models and post-estimation techniques to determine those with the best model fit. Variables that make up these indices are listed in Table 10 for the clinical innovation index and Table 11 for the business innovation index. FA was attempted in the process of developing the dependent variables; however, FA could not be applied because much of the data is in binary form. The following table provides a description of the development of each dependent variable used in this testing phase. Data were reviewed on the number of components implemented for each innovation listed in Appendix C and D to establish a natural cutoff point to determine whether practices have a fully or partially implemented innovation. No outliers were found in any of the dependent variables. Table 14 describes the development of each dependent variable.

These dependent variables were evaluated for linearity, normality, and homoskedasticity. Dependent variables were checked for normality by reviewing histograms and skewness and kurtosis statistics. Most dependent variables displayed moderate positive skewness. The Shapiro-Wilk W test (Shapiro and Wilk, 1965)

Table 14. Development of Dependent Variables

Name	Description
Complete Business Index	The sum of the total count of all components that comprise each business innovation. One point was given for each business innovation component.
Complete Clinical Index	The sum of the total count of all components that comprise each clinical innovation. One point was given for each clinical innovation component.
Number of Fully Implemented Business Innovations	Practices were given one point for each business innovation that was fully implemented.
Number of Fully Implemented Clinical Innovations	Practices were given one point for each clinical innovation that was fully implemented.
Level of Business Innovation Implementation	Practices were given zero points for no implementation, 1 point for partial implementation, and 2 points for full implementation of business innovations. The scores were summed across all innovations.
Level of Clinical Innovation Implementation.	Practices were given zero points for no implementation, 1 point for partial implementation, and 2 points for full implementation of clinical innovations. The scores were summed across all innovations.

was also used to test for normality in Stata/IC 10. The null hypothesis of the test is that the sample is taken from a normal distribution; thus, $P < 0.05$ for W rejects this supposition of normality. All dependent variables except one resulted in a significant W test, which indicates a non-normal distribution. Since the dependent variables represent counts that were collected during a specific time interval, the Poisson and negative binomial distributions for count data were evaluated for possible use. Poisson and negative binomial distributions exhibit extreme positive skewness, comprise data that have many zeros, and are typically used for variables capturing rare events. The dependent variables representing clinical and business innovation exhibited only

moderate positive skewness and had no or very few zeros, and therefore did not fit

distributions for count data. This was confirmed through evaluation of the variance of the

dependent variables that displayed less variation than expected from a Poisson

distribution, which requires equidispersion (standard deviation is equal to the mean). The

dependent variables demonstrated under dispersion, which is opposite than expected from

a negative binomial distribution that typically exhibits over-dispersion (standard

deviation is greater than the mean).

The non-normal dependent variables were then transformed using square root

and/or logarithm methods to obtain a more normal distribution. After transformation, the

dependent variables were again evaluated for normality using the Shapiro-Wilk W test

and skewness/kurtosis tests. The transformation process resulted in three additional

dependent variables with normal distributions.

The dependent variables were used in regression models and subjected to post-

estimation techniques to determine one dependent variable for clinical innovation and

one dependent variable for business innovation that displayed the best fit. Residual

analysis was conducted using histograms, scatterplots, and other tests for violations of

assumptions of OLS. This information, combined with goodness-of-fit statistics, was

used to determine the dependent variables that met the assumptions of OLS and had the

best fit for the regression model. Full regression models were also examined to determine

the dependent variables that accounted for the most variance. The dependent variables

chosen for analysis were the total number of fully implemented business innovations and

the level of clinical innovation implementation. Results of the Shapiro-Wilk W test for

normal data confirmed that there was not a significant departure from a normal

distribution for the variables representing the business innovation (Prob>z = 0.19774) or

clinical innovation (Prob>z = 0.18724). The Breusch-Pagan/Cook-Weisberg test for

heteroskedasticity resulted in a failure to reject the null hypothesis of constant variance

for the business innovation variable (Prob > chi2 = 0.668) and the clinical innovation

variable (Prob > chi2 = 0.709). The following table shows descriptive statistics for each

dependent variable. Table 15 provides a summary of the statistics for the dependent

variables.

Table 15. Summary Statistics for Dependent Variables

Variable	M(SD)	Min	Max	Skewness	Kurtosis
Number of fully implemented business innovations (LG8TotFull)*	1.108 (.086)	.903	1.278	0.386	0.000
Clinical Innovation Implementation (sqrtNumTotInnC) •	2.759 (.586)	1.414	4.123	0.366	0.454

* – transformed by the logarithm

• – transformed by the square root

Bivariate Analysis

Pearson's correlation coefficient was used to assess the degree of association

between independent variables, and between dependent variables and independent

variables. This analysis provided insight into the relationships between variables and

whether multicollinearity existed. The VIF and tolerance were also used to test for multicollinearity.

Correlation Analysis of Independent Variables

Only two independent variables were reviewed for multicollinearity against all independent variables since all other independent variables were transformed through the use of factor scores. The use of factor scores resulting from principal components analysis negates the investigation of multicollinearity analysis because there is no need to invert a matrix. There are no independent variables that exhibit an association of .90 or higher, which would indicate a serious problem (Tabachnick & Fidell, 2001). Region and regional innovation display correlations above .55, which may indicate possible multicollinearity. Table 16 presents the item-to-item correlations for independent variables.

The VIF and tolerance were also analyzed to determine whether multicollinearity existed between variables. The VIF shows how much the variance of the coefficient estimate is being inflated by multicollinearity and the tolerance indicates how much of the variance in X_i is independent of other independent variables. The variables listed in Table 17 that exhibit multicollinearity based on a VIF greater than 10 and tolerance less than .10 (Cohen, Cohen, West, et al., 2003) are: Region 3, Region 2, Region 1, Region 5, and regional innovation.

Further analysis on the control variable for region revealed that no differences in the outcome existed across regions. Region was also not a significant predictor for the outcome in the full regression model. Another regression model was run that did not

Table 16. Bivariate Correlations - Independent Variables

Independent Variables		Organizational Size	Regional Innovation
Factor I	-HMO/ Beneficiary Penetration	.1156	-.2772
Factor II	-Uncertainty - Rules & Regulation	-.1501	-.0293
Factor III	-Uncertainty -Knowledge	.0964	.0577
Factor IV	-External Pressure	.2238	.1806
Factor V	-Competition	.3024	-.0258
Legal and Contractual Relationships		.3546	.0244
Regional Innovation		.0204	—
Control Variables			
Population Density		.1377	.0159
Age of Practice		.2067	-.0365
Primary Care Shortage Area		-.0585	-.1080
Median Income		.1088	.0528
Region	Northwestern	-.0573	.1872
	Northern	.0280	.3075
	Southwestern	.0340	.5644*
	Central	-.0101	-.8945*
	Eastern	.0011	-.1005
Practice Type	Single Specialty	-.2887	.0199
	Multispecialty Primary Care Only	.1288	-.0196
	Multispecialty Primary & Specialty Care	.2436	-.0063

* = variables with correlations above .55

Table 17. VIF and Tolerance

Variable	Variance Inflation Factor (VIF)	Tolerance
Region 3*	271.40	0.003685
Regional Innovation*	190.14	0.005259
Region 2*	101.88	0.009816
Region 1*	97.12	0.010296
Region 5*	55.89	0.017893
Factor 1	4.84	0.206725
Median Income	4.20	0.238039
Population Density	3.56	0.280562
Organizational Size	2.98	0.335903
Factor 6	2.71	0.369163
Practice Type 1	1.90	0.525175
Practice Type 2	1.79	0.559182
Factor 5	1.73	0.578511
Primary Care Shortage Area	1.70	0.588694
Age of Practice	1.14	0.878671
Factor 4	1.06	0.945194
Factor 3	1.03	0.974286
Factor 2	1.02	0.978069

* = variables with VIF greater than 10, and tolerance less than .10

include region as a control variable and was compared to the full model using the

likelihood-ratio test. This test was not significant, indicating that there are no differences

between the two models. Since region is not a significant predictor of the outcome and

there were no differences between the full model and the model that excluded region as a

control, region was removed from the model due to potential problems with

multicollinearity.

Correlation of Dependent Variables to Independent Variables

Correlation analysis was also performed on the dependent variables and the

independent variables to examine possible relationships. Table 18 presents the item-to-

item correlations between dependent variables and independent variables.

Table 18. Bivariate Correlations - Independent Variables to Dependent Variables

Independent Variables	Business Innovation	Clinical Innovation
Factor I -HMO/ Beneficiary Penetration	-.061	.048
Factor II -Uncertainty - Rules & Regulation	.003	-.070
Factor III -Uncertainty -Knowledge	-.059	-.050
Factor IV -External Pressure	.393	.309
Factor V -Competition	.026	-.054
Organizational Size	.429	.282
Legal and Contractual Relationships	.330	.226
Regional Innovation	.140	.120

Multivariate Analysis

Analyses discussed thus far described the process of checking for violations of assumptions necessary for regression analysis, and the transformation of variables and adjustments to the model to meet these assumptions. The next steps undertaken to build a multivariate model for 2SLS analysis were instrument development and 2SLS specification tests through the first-stage model. Problems developed during the process of instrumental variable estimation, which prevented the use of 2SLS for regression analysis. An OLS model is presented. A detailed discussion of the limitations of using an OLS model with potentially endogenous regressors is provided in Chapter 6. All multivariate statistics were conducted in Stata/IC 10.

Development of Instrumental Variables

Instruments for the proposed endogenous variables were chosen based on a theoretical correlation between the instrument and the proposed endogenous variable and the lack of correlation of the instrument with the standard error. No previous studies were identified that created valid and relevant instrumental variables for the proposed endogenous variables in this model, which are family medicine practices' legal and contractual relationships and patient and stakeholder expectations. The predictor variable representing legal and contractual relationships was thought to be correlated possibly with urban designation, multispecialty practice, and age of practice. The predictor variable representing patient and stakeholder expectations was thought to be correlated possibly with population per square mile, age of the population, and urban designation. The proposed endogenous variable representing patient and stakeholder expectations was

changed during development of the Virginia family medicine survey to "practice made improvements based on outside influences." Other variables thought to be related to the variable "practice made improvements based on outside influences" were used in later stages of instrumental variable estimation.

<div align="center">*2SLS Specification Tests*</div>

Specification tests for instrument relevance and validity were conducted in the first stage of 2SLS, along with tests for endogeneity. The results of these tests are explained in the following paragraphs.

First-Stage Model

In the first-stage model each endogenous explanatory variable was regressed on all instruments to test for instrument relevance. The use of all exogenous variables in the first stage is necessary, even when multiple endogenous regressors are present, because the theory of 2SLS considers these variables part of a system (Baum, 2006). This first-stage regression was used in an attempt to develop viable instruments by evaluating the individual and joint significance of proposed instruments. The first row in Table 19 reports the statistical test of the joint significance of the instrumental variables in the model.

The first-stage F-statistics testing the hypothesis that the coefficients on the instruments are jointly equal to zero were non-significant and much less than the acceptable value of 10 recommended by Stock and Watson (1996). A small F-statistic means that instruments are weak and they explain little of the variation of the endogenous explanatory variable, resulting in a biased estimator in 2SLS (Woodridge, 2002).

Table 19. Two-Stage Least-Squares Specification Tests

	Business Innovation Index	Clinical Innovation Index
Joint significance of instruments in first stage:		
Legal/Contractual	.400	.400
Outside Influences	.437	.437
Overidentifying restrictions test	.726	.141
Durbin-Wu-Hausman chi-sq test	.020	.672

All values are P values

The first-stage t-values are used to reveal variables that are the strongest instruments. The t-statistics on each proposed instruments in the first-stage resulted in all non-significant values, indicating all of the proposed instruments are poor predictors of the endogenous explanatory variables. Results of the t-values in the first-stage are shown in Tables 20 and 21 using the business innovation dependent variable. Results of the clinical innovation dependent variable produced similar results.

Table 20. Results of First Stage Reduced Form Estimation for the Predictor Variable: Legal and Contractual Relationships

Instruments	Coefficient	Standard Error	t	p-value
Age of Practice	-.043	.023	-1.88	.061
Multispecialty	-.731	.649	-1.13	.261
Population Density	-.004	.086	-.05	.957
Rural Area	.044	.116	.38	.703
Median Age M	.025	.400	.62	.537
Median Age F	-.014	.038	-.37	.713

Table 21. Results of First Stage Reduced Form Estimation for the Predictor Variable: Practice made Improvements Based on Outside Influences

Instruments	Coefficient	Standard Error	t	p-value
Age of Practice	-.039	.035	-1.11	.269
Multispecialty	-.731	.649	-1.13	.261
Population Density	.076	.131	.58	.564
Rural Area	.053	.178	.30	.766
Median Age M	.007	.061	.11	.913
Median Age F	-.029	.057	-.51	.766

Overidentifying Restrictions Test

The overidentifying restrictions test determines instrument validity; whether the instruments for the proposed endogenous regressors are uncorrelated with the error term (Baum, 2006). The Hansen-Sargan test for overidentifying restrictions was computed in Stata. This model resulted in a non-significant test score indicating that the regressor is appropriately uncorrelated with the error term.

Endogeneity Test

The Durbin-Wu-Hausman test was conducted to test for endogeneity. The model with business innovation as the dependent variable resulted in a significant test score for endogeneity, while the model with the clinical innovation as the dependent variable resulted in a non-significant test score. The Durbin-Wu-Hausman test, however, is not accurate in the presence of weak instruments (Hahn & Hausman, 2003) and in this model cannot be used for analysis.

Additional Variables for Instrument Development

Since each instrument tested was not correlated with the endogenous explanatory variable, other variables thought to have a correlation were identified, extracted from secondary data sources, and added to the model. It was thought that the altered variable "practice made improvements based on outside influences" and the "legal and contractual relationship" variable were related to characteristics of the practice such as age, size, and whether the practice was located in a primary care shortage area. Correlation analysis revealed that these variables were related to the potentially endogenous regressors; however, they were also strongly related to the outcome variable. A correlation between the instrument and the outcome variable is accepted in instrumental variable estimation as long as the relationship is through the potentially endogenous variable and not a direct relationship between the instrument and the outcome variable. Since the relationship between practice variables and innovation was expected to be direct, these variables could not be utilized in 2SLS analysis. At this point, other variables thought to be related to the potentially endogenous regressors were used, including: number of hospital beds per 1,000 residents, per capita income, percent of the population graduated from high school, and the uninsurance rate. A new first-stage model was run for each dependent variable and the t-values and F-statistics were evaluated. The model with new instrumental variables did not result in an improved F-statistic, and the individual t-values for the new instruments were not significant, indicating the variables also result in weak instruments.

Problems with the Second Stage Model

The second-stage of 2SLS specifies the relationship between the instrumental variables and the outcome. Results of the second-stage of 2SLS are presented in Appendix E and F. In this stage the regression of interest is estimated as usual, except each endogenous explanatory variable is replaced with its approximation estimated in the first stage. Since approximations of the endogenous explanatory variables are based on very weak instruments, this would result in biased estimates. When weak instruments are used the sampling distributions are non-normal, and IV point estimates, hypothesis tests, and confidence intervals are unreliable (Stock, Wright, & Yogo, 2002). The weak instruments, therefore, cannot be used to analyze the relationship between the outcome variable and the endogenous explanatory variables. According to Wooldridge (2002), it may be better to use OLS if a proposed instrument has some correlation with the standard error, which causes the IV estimator to be inconsistent. In this study, the use of weak instruments in 2SLS would cause the estimator to be biased, so OLS is considered a better model.

Ordinary Least Squares Analysis, Full Model

The second research question in this study addresses whether environmental factors and organizational characteristics are related to the use of innovation among Virginia family medicine practices. To answer this question, the clinical and business innovation indices were regressed on all predictor variables. Multiple regression was used to determine how well the combination of predictor variables explains the variance in the level of innovation. The relationship between individual predictor variables and

innovation was also evaluated. It was expected that higher levels of clinical and business innovation would be associated with higher:

- HMO penetration, numbers of HMOs, Medicare beneficiary penetration;

- difficulty of operating under Medicare/managed care rules and regulations;

- changes as a result of patient and stakeholder expectations, and interactions with professional associations;

- competition defined as the numbers of family medicine physicians and primary care physicians in the PCSA;

- regional innovation;

- level of legal and contractual relationships in practices; and

- numbers of physicians in practices.

It was also expected that higher levels of innovation would be associated with lower levels of physician knowledge of Medicare and managed care rules and regulations.

Table 22 presents the results of the full regression model on clinical innovation.

Clinical Innovation = B_0 + B_1 HMO/Medicare Beneficiaries + B_2 difficulty under Medical/MC rules and regulations + B_3 knowledge of Medicare/MC rules and regulations + B_4 changes based on patient and stakeholder expectations + B_5 regional innovation + B_6 competition + B_7 legal and contractual relationships + B_8 organizational size + ε

The regression of clinical innovation on the eight predictor variables accounted for 19% of the variance (Adj R-squared = 0.19) and was significant at the .000 level. Of the eight predictor variables, four contribute significantly to the variance in clinical innovation. These variables are: practice made improvements based on outside

Table 22. OLS Regression, Clinical Innovation

Variable	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	P-value
Coercive Forces					
HMO and Medicare Beneficiaries	.046	.049	.079	0.93	.351
Mimetic Forces					
Difficulty under Medicare/ MC rules and regulations	-.006	.029	-.011	-0.22	.828
Mimetic Forces					
Knowledge of Medicare/ MC rules and regulations	-.054	.029	-.093	-1.85	.066
Normative Forces					
Improvements based on outside influences	.129	.030	.219	4.22	.000
Mimetic/Normative Forces					
Regional innovation	.323	.207	.090	1.56	.119
Competition					
Family medicine/primary care physicians	-.108	.038	-.185	-2.86	.004
Interconnectedness					
Legal and contractual relationships	.129	.047	.155	2.76	.006
Organizational Characteristic					
Organizational size	.369	.097	.236	3.79	.000

influences, family medicine/primary care physicians in the market, legal and contractual relationships, and organizational size. The degree of HMO/Medicare beneficiary penetration, difficulty of rules and regulations set by Medicare and managed care

organizations, and knowledge of rules and regulations set by Medicare and managed care organizations were not significantly related to clinical innovation. There was a negative relationship between competition and clinical innovation ($p = .004$), indicating that practices in areas with higher levels of family medicine and primary care physicians reported lower levels of clinical innovation. Organizational size ($p = .000$) was positively related to higher levels of clinical innovation and exhibits the largest influence on clinical innovation. Even though the coefficients for patient and stakeholder expectations ($p = .000$) and legal and contractual relationships ($p = .006$) suggest a positive relationship with clinical innovation, these coefficients may be biased if endogeneity exists. It is difficult to know the direction and degree of bias in a multiple regression analysis with potential endogeneity problems.

Business Innovation = B_0+ B_1 HMO/Medicare Beneficiaries + B_2 difficulty under Medical/MC rules and regulations + B_3 knowledge of Medicare/MC rules and regulations + B_4 changes based on patient and stakeholder expectations + B_5 regional innovation + B_6 competition + B_7 legal and contractual relationships + B_8 organizational size + ε

Table 23 presents the results of the full regression model for business innovation. The regression of business innovation on the eight predictor variables accounted for 35% of the variance (Adj R-squared = 0.35) and was significant at the .000 level. Of the eight predictor variables, five contribute significantly to the variance in business innovation. These variables are: knowledge of Medicare and managed care rules and regulations, practice made improvements based on outside influences, regional innovation, legal and contractual relationships, and organizational size. The degree of HMO/Medicare beneficiary penetration, difficulty of rules and regulations set by Medicare and managed

Table 23. OLS Regression, Business Innovation

Variable	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	P-value
Coercive Forces					
HMO and Medicare Beneficiaries	.008	.006	.098	1.29	.198
Mimetic Forces					
Difficulty under Medicare/ MC rules and regulations	.007	.004	.082	1.81	.071
Mimetic Forces					
Knowledge of Medicare/ MC rules and regulations	-.010	.004	-.119	-2.64	.009
Normative Forces					
Improvements based on outside influences	.025	.004	.287	6.15	.000
Mimetic/Normative Forces					
Regional innovation	.060	.027	.114	2.20	.028
Competition					
Family medicine/ primary care physicians	-.008	.005	-.090	-1.55	.123
Interconnectedness					
Legal and contractual relationships	.024	.006	.201	3.96	.000
Organizational Characteristic					
Organizational size	.074	.013	.320	5.71	.000

care organizations, and competition defined by the number of family medicine and primary care physicians in the market were not significantly related to business innovation. There was a negative relationship between knowledge of Medicare and

managed care organizations' rules and regulations and business innovation ($p = .009$),

indicating that practices that reported more knowledge of the rules and regulations set by

Medicare and managed care also exhibited higher levels of business innovation. Regional

innovation ($p = .028$) and organizational size ($p = .000$) were positively related to higher

levels of business innovation. The coefficients for practice made improvements based on

outside influences ($p = .000$) and legal and contractual relationships ($p = .000$) are

expected to be biased since endogeneity is suspected in these variables. Again, it is

difficult to know whether bias exists in the model, and, if it does, the direction and degree

of bias in these coefficients. It is expected, however, if endogeneity exists, that this

problem would produce stronger positive coefficients in both models and would falsely

suggest that these variables have more influence on clinical and business innovation than

what actually takes place.

Significance of each independent variable is detected by the coefficients. The

Beta coefficient, or standardized coefficient, reflects the weight associated with

standardized scores on the variables. This is a measure of the relationship between an

independent and a dependent variable with the influence of the other independent

variables held constant. According to the Beta coefficient, organizational size has the

largest influence on business innovation.

Regression Analysis Excluding Potentially Endogenous Variables

Another version of the models without the potentially endogenous variables was

evaluated to determine if changes occurred in the outcomes of predictor variables. If the

predictor variables change between the full model and the reduced model, this would

indicate that the estimation problems caused by potentially endogenous variables affect

other variables in the model. Table 24 presents the results of the OLS model for clinical

innovations excluding the potentially endogenous regressors.

Table 24. Second OLS Regression, Clinical Innovation

Variable	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	P-value
Coercive Forces					
HMO and Medicare Beneficiaries	.034	.051	.058823	0.67	.502
Mimetic Forces					
Difficulty under Medicare/ MC rules and regulations	-.007	.030	-.012	-0.23	.820
Mimetic Forces					
Knowledge of Medicare/ MC rules and regulations	-.051	. .030	-.087	-1.69	.093
Mimetic/Normative Forces					
Regional innovation	.450	.212	.126	2.12	.034
Competition					
Family medicine/primary care physicians	-.112	.039	-.191	-2.89	.004
Organizational Characteristic					
Organizational size	.545	.094	.349	5.80	.000

Table 25 presents the results of the OLS model for business innovations excluding

the potentially endogenous regressors. The results of the first OLS model on business

innovation that included the potentially endogenous regressors were compared to the

results of the second OLS model, which excluded the potentially endogenous regressors.

Table 25. Second OLS Regression, Business Innovation

| Variable | Unstandardized Coefficients | | Standardized Coefficients | | |
	B	Std. Error	Beta	t	P-value
Coercive Forces					
HMO and Medicare Beneficiaries	.006	.007	.072	0.88	.380
Mimetic Forces					
Difficulty under Medicare/ MC rules and regulations	.007	.004	.081	1.67	.096
Mimetic Forces					
Knowledge of Medicare/ MC rules and regulations	-.010	.004	-.112	-2.32	.021
Mimetic/Normative Forces					
Regional innovation	.085	.029	.161	2.90	.004
Competition					
Family medicine/ primary care physicians	-.008	.005	-.098	-1.59	.114
Organizational Characteristic					
Organizational size	.107	.013	.467	8.30	.000

In the second model on business innovation the adjusted R-squared drops to .23,

indicating that this model accounts for 23% of the variance.

Comparison of the full models against the models excluding the potentially

endogenous variables demonstrates that results on the exogenous variables are robust and

not particularly affected by estimation problems that may exist due to endogeneity. The

predictor variables in the second model for clinical innovation account for 13% of the

variance. The standard errors in the second model are not dramatically different from the

standard errors in the full model. The significance and direction of relationship of exogenous variables is the same in both models for business and clinical innovation. One variable in the second clinical innovation model, which represents regional innovation, changed to a significant predictor of clinical innovation. This suggests that the regional innovation variable in the clinical innovation model is affected by one or both potentially endogenous variables that were deleted.

Comparison of 2SLS Results to OLS Results

Results of the OLS regression models were compared against the results of the 2SLS models to identify major changes. The two potentially endogenous explanatory variables were replaced in the second stage with weak instruments and resulted in changes to both the direction of the relationship and significance of the outside influences variable and changes in the significance of the legal and contractual relationships variable. The comparison demonstrated that the results on the exogenous variables are in the same direction and the same significance, except for one variable, which changed direction of the relationship but not the significance. Results from the comparison of the endogenous explanatory variables are consistent with what one would expect from weak instruments; the coefficients and associated P-values are the product of the instruments and are not related to original endogenous explanatory variables. Since the majority of results on the exogenous variables are consistent in the 2SLS and the OLS, this provides additional support that the OLS results on the exogenous variables are robust and not particularly affected by problems with endogeneity.

Summary of Findings

This chapter presents the analysis and results of the first two research questions of the study. The main research questions this dissertation attempted to answer are (a) what efforts have been taken by family medicine practices in Virginia to improve delivery of health care services and business functionality?, and (b) are environmental factors and organizational characteristics related to the utilization of innovations in family medicine practices in Virginia? The first research question was addressed through the use of descriptive statistics. The second research question was addressed through multivariate statistics, followed by hypothesis testing and interpretation.

Findings from Descriptive Statistics

The first question represents exploratory research to understand family medicine practices in Virginia better and the innovative methods these practices use to deliver care and operate a business. The research involved collecting a large amount of data on family medicine practices though a large-scale survey and extracting supplementary data from five administrative data sets. These data were combined to present information on organizational characteristics, organizational environment and practices' perception of external influences. This process was intended to provide a comprehensive description of family medicine practices in Virginia. The large-scale survey used to collect information resulted in a 56% response rate, and 342 unique responses from family medicine practices. Practices that responded to the survey and ultimately represented the sample for this study did not differ significantly from the population. This indicates that it is highly likely the results represent family medicine practices in Virginia.

The clinical and business innovations used by practices are explained in detail in descriptive statistics section of this chapter, which addresses the first research question. As expected, some innovations are used more frequently than others. Clinical innovations with a high utilization include: team based care, clinical guidelines, continuity of care processes, alternative scheduling techniques, and provision for linguistic services to non-English speaking patients. Clinical innovations with a low utilization include: patient registries, programs for self management, EHR, and community linkages for care. Business innovations that are utilized frequently include: financial performance reviews, programs for employee morale and teamwork, assessments for best practices used by other organizations, and reviews of office space to meet patient needs. Business innovations with low utilization are: performance measurement for clinical activities, performance feedback to physicians, provision of non-covered services that could provide additional patient service and practice revenue, and assessment of the market for specific business indicators such as demand for services and patient demographics.

Findings from Multivariate Analysis

The second research question is addressed through multivariate analysis. Unfortunately, the statistical techniques proposed in Chapter 4 were not possible due to the lack of relevant and exogenous instruments for the 2SLS regression model. The use of 2SLS with endogenous or non-relevant (weak) instruments would lead to biased estimates. For this reason, OLS was considered a better model for the study, although interpretation of the coefficients and significance for variables with potential endogeneity is hindered.

In the proposed methodology two predictor variables were theorized to be endogenous; therefore, an instrumental variable approach was planned to address this limitation. The proposed endogenous variable representing patient and stakeholder expectations was changed during development of the Virginia family medicine survey. The variable "patient and stakeholder influences" was changed to "practice made improvements based on outside influences". The variable was originally proposed to be endogenous based on two-way causality that suggests that patient expectations could lead to increased practice innovations or that practice innovations could lead to higher patient expectations. Considering changes to the variable, it is no longer thought that two-way causality exists and there is less chance of endogeneity. It is possible that endogeneity exists since this is a cross-sectional study with survey data collected at one point in time; respondent answers to one set of questions may have influenced their answers to other questions. For this reason, the patient and stakeholder expectation variable is still treated as potentially endogenous and the results should be interpreted with caution.

The OLS model was used to regress the dependent variables for clinical and business innovation on all predictor variables. The full set of predictor variables explains 35% of variance in the business innovation and 19% of the variance in the clinical innovation model. Regional innovation and organizational size were significant predictor variables with positive relationships in the business innovation model. Knowledge of Medicare and managed care rules and regulations was positively related to business innovation. Organizational size was also a significant predictor with a positive relationship for clinical innovation, while number of family medicine and primary care

physicians in the market was negatively related to clinical innovation. The two potentially endogenous variables, legal and contractual relationships and practice made improvements based on outside influences, were also significant predictors of business and clinical innovation in the full model. Due to possible issues resulting from endogeneity, the results of these variables cannot be supported.

The full OLS models were compared to models that excluded the potentially endogenous variables. The second models resulted in similar findings for significant predictors, suggesting that the results are robust and these variables are not affected by the potentially endogenous variables.

Hypothesis Testing and Interpretation

This section provides an overview of the relationship between the study's conceptual model, theory-driven hypotheses, and results. The uniting of two organizational theories, institutional theory and resource dependency theory, was applied to the second research question because it was judged a suitable combination to derive theoretical constructs and testable hypotheses. The combined use of these theories was thought to encompass the majority of influences on the use of innovations in family medicine practices in Virginia.

The conceptual model hypothesized relationships between multiple organizational and environmental independent variables and the degree of innovation in family medicine practices. Tables 26 and 27 present the results of hypothesis testing for clinical and business innovation.

Table 26. Results of Hypothesis Testing, Clinical Innovation

Theoretical Construct and Hypothesis	Exp. Sign	Results
Coercive Forces		
H1: HMO and Medicare Beneficiaries	+	ns
Mimetic Forces		
H3a: Difficulty under Medicare/ MC rules and regulations	+	ns
Mimetic Forces		
H3b: Knowledge of Medicare/ MC rules and regulations	−	ns
Normative Forces		
H5: Improvements based on outside influences	+	+*
Mimetic/Normative Forces		
H7: Regional innovation	+	ns
Competition		
H9: Family medicine/ primary care physicians	+	−
Interconnectedness		
H11: Legal and contractual relationships	+	+*
Organizational Characteristic		
H13: Organizational size	+	+

* = Interpretation is limited due to potential endogeneity.

Table 27. Results of Hypothesis Testing, Business Innovation

Theoretical Construct and Hypothesis	Exp. Sign	Results
Coercive Forces		
H2: HMO and Medicare Beneficiaries	+	ns
Mimetic Forces		
H4a: Difficulty under Medicare/ MC rules and regulations	+	ns
Mimetic Forces		
H4b: Knowledge of Medicare/ MC rules and regulations	−	+
Normative Forces		
H6: Improvements based on outside influences	+	+*
Mimetic/Normative Forces		
H8: Regional innovation	+	+
Competition		
H10: Family medicine/ primary care physicians	+	ns
Interconnectedness		
H12: Legal and contractual relationships	+	+*
Organizational Characteristic		
H14: Organizational size	+	+

* = Interpretation is limited due to potential endogeneity.

Institutional Theory

Coercive Forces

Hypotheses 1 and 2 concern coercive forces from third party payers. HMO penetration, numbers of HMOs, and numbers of Medicare beneficiaries in the market measured this construct. It was predicted that coercive forces from Medicare and HMOs would encourage practices to improve the delivery of care and business operations through innovations. This hypothesis was not supported by the research. The construct was positively associated with clinical and business innovation, however was not significant.

Cognitive/Mimetic Forces

Cognitive/mimetic forces on organizations are pressures to imitate other more legitimate or successful organizations. These forces are stronger under conditions of environmental uncertainty and are quantified in this study by two measures: difficulty of operating under Medicare/managed care rules and regulations, and low physician knowledge of Medicare/HMO rules and regulations. Hypotheses 3a and 4a propose the level of difficulty of operating under Medicare/HMO is positively associated with clinical and business innovation. These hypotheses were not supported by the research study. Hypotheses 3b and 4b, which hypothesized that physician knowledge of Medicare/HMO rules and regulations is negatively associated with business innovation, was also not supported by the research. The research finds a significant but positive relationship, suggesting that a higher level of physician knowledge of rules and regulations is linked to higher levels of business innovation. The results show a non-significant association

between physician knowledge of Medicare/managed care rules and regulations and clinical innovation.

Normative Forces

Hypotheses 5 and 6 suggest that practices experiencing more pressure from external groups or organizations are more likely to utilize clinical and business innovations than practices that experience less pressure. This construct was measured by survey questions asking if practices made changes to their organization based on: patient expectations, demands from groups representing patients, or from interactions with professional associations. While the variables for normative forces were significant predictors of clinical and business innovation, this research cannot confirm the result since endogeneity is expected in this variable.

Mimetic/Normative Forces

Hypotheses 7 and 8 concern both mimetic and normative forces on clinical and business innovations. The organizational actions and behaviors of family medicine practices are hypothesized to influence the level of innovation in other family medicine practices. This construct was measured by the level of regional innovation. The research supported this hypothesis for business innovation, but not for clinical innovation.

Resource Dependency Theory

Competition

Hypotheses 9 and 10 propose that family medicine practices in areas with a high density of competitors are more likely to utilize clinical innovations than practices in areas with less competition. This construct was measured by the number of family

medicine physicians per 1,000 population and the number of primary care physicians per 1,000 population in the PCSA. The research does not support the association between competition and clinical and business innovation. Competition had a significant negative association with clinical innovation, and a non-significant relationship with business innovation.

Organizational Relationships

Hypotheses 11 and 12 suggest that practices that have legal and contractual relationships with other organizations are more likely to utilize innovative strategies and practices. This construct was measured by whether the practice was owned or had legal and contractual relationships with other health care organizations. While the variable for organizational relationships was a significant predictor of clinical and business innovation, this research cannot confirm the result since endogeneity is expected in this variable.

Organizational Characteristics

Hypotheses 13 and 14 concern the influence of organizational size of family medicine practices on innovation. Organizational size, for this study, was based on the number of physicians in a practice. The research supports this hypothesis for both clinical and business innovations.

Chapter Summary

This chapter presented the study results, including sample-to-population comparison, descriptive statistics, data cleaning and preparation, bivariate analysis, and multiple regression analysis. A summary of findings and results of hypothesis testing was

also presented. Problems arose in the process of developing instrumental variables, which prevented the use of 2SLS. These problems and the limitations of the OLS method are discussed in detail in the next chapter. The findings presented in this chapter lead to the conclusions and implications discussed in Chapter 6.

CHAPTER 6 - CONCLUSIONS AND IMPLICATIONS

This chapter reviews conclusions that can be drawn from the study and implications for theory, methods, and policy within the context of health services research and family medicine. The chapter also provides a synopsis of study limitations and implications for future research.

Summary of Key Results

This study sought to understand the innovative methods used by family medicine practices in Virginia to deliver care and operate a business. Innovation in this study refers to the implementation of new or altered products, services, processes, systems, and organizational structures. The findings present information on the level and type of clinical and business innovations used by family medicine practices in Virginia. Clinical innovations with a high degree of utilization include: team based care, clinical guidelines, continuity of care processes, alternative scheduling techniques, and provisions for linguistic services to non-English speaking patients. Business innovations that are utilized frequently include: financial performance reviews, programs for employee morale and teamwork, assessments for best practices used by other organizations, and reviews of office space to meet patient needs. Various explanations may account for why these innovations are frequently utilized. Potential explanations include:

- advantages resulting from innovations are easily understood,

- ease of implementation,

- increase in quality of care,

- increase in office efficiency, and/or

- increase in reimbursement.

Clinical innovations with a low degree of utilization include: patient registries, programs for self management, EHR, and community linkages for care. Business innovations with low utilization are: performance measurement, performance feedback to physicians, provision of non-covered services that could provide additional patient service and practice revenue, and assessment of the market for specific business indicators such as demand for services and patient demographics. Several themes emerge from these results. First, many practices do not have an EHR and do not utilize functions typically included in an EHR such as patient registries and performance measurement. Possible reasons for low use of EHRs are high implementation costs, high learning curve for employees, and significant disruption of office functions during conversion from a paper record system. Second, practices do not evaluate performance and, therefore, do not provide performance feedback to physicians. The low use of performance measurement could be due to the lack of available data and difficulty collecting data. There could also be a high resistance from physicians or other staff members regarding performance evaluation. Third, other innovations may not be utilized because physicians lack the business acumen for integrating these activities or services into their practice model.

The study also sought to understand the organizational and environmental influences on clinical and business innovations. Results indicate that organizational size is the largest predictor of both clinical and business innovations. Organizational size was used as a proxy for the level of resources available to practices since data on practice resources are not easily obtained through survey methodologies. This result, then, indicates that level of resources is associated with innovations used in family medicine practices. Legal and contractual relationships and whether the practice made improvements as a result of outside influences are also significantly associated with the level of clinical and business innovation. However, these variables are potentially endogenous, and therefore the results cannot be used to draw conclusions and implications. Regional innovation is significantly associated with business innovations, suggesting that practices may be copying successful business strategies of other practices in their area. The study found that coercive forces from third party payers and difficulty of practicing under Medicare and MCO rules and regulations are not associated with clinical and business innovation.

Several results were significant but in the opposite direction than proposed. The number of family medicine and primary care physicians in the market was negatively related to the level of clinical innovation. The reason for this finding is unknown. Some possible explanations to consider are a high level of conformity to specific practice patterns or a tacit agreement among practitioners to specific standards of care or processes for delivering care. The study also found that a higher level of physician

knowledge regarding rules and regulations set by Medicare and managed care organizations is associated with higher levels of business innovation. One possible explanation for this finding is that practices that are more likely to scan the regulatory environment are also more likely to be business innovators. Other possible explanations are: practices with more knowledge of the rules and regulations set by third party payers are empowered to make improvements to their business operations, or practices looking to implement business innovations become more knowledgeable of the rules and regulations they need to meet in order to make changes.

Theoretical Implications

A secondary goal of the study was to gain knowledge on whether current organizational theories are sufficient to understand and explain the organizational behaviors of family medicine practices. Specifically, this research tested a conceptual model that combined constructs from institutional theory and resource dependency theory on innovations in family medicine. In general, the results of the statistical models indicate that the combined set of predictor variables are significantly related to both clinical and business innovation. A closer look at the coefficients and significance of individual predictor variables suggest that not many constructs are related with the level of innovation as predicted by institutional and resource dependency theories.

Institutional Theory

The theoretical constructs under institutional theory are coercive, cognitive/mimetic, and normative forces that place pressure on organizations to change or

make improvements. Coercive forces on family medicine practices were measured by the number of HMOs, HMO penetration and the number of Medicare beneficiaries in an area. Using these measurements, the study did not support the hypothesis that coercive forces influence practices to utilize business or clinical innovations. Neither did the study support the hypothesis that cognitive/mimetic forces influence practices to utilize business or clinical innovations, based on practices' assessment of the difficulty of operating under Medicare and MCO rules and regulations. Although the study produced significant findings on the relationship between normative forces and clinical and business innovations, the results are potentially biased and not incontrovertible. A combined construct representing mimetic and normative forces, measured by the level of innovation in the region, was significantly related to business innovation, but not to clinical innovation. Overall, this study does not support the use of institutional theory to explain the environment-organization relationship in family medicine practices.

Resource Dependency Theory

In this study, organizational relationships and competition represent the theoretical constructs under resource dependency theory. Although organizational relationships, measured by the legal and contractual relationships held by a practice, was positively related to clinical and business innovation, the findings cannot be supported due to possible problems with endogeneity. The study hypothesis that a positive relationship exists between the level of competition and the level of innovation was not supported. Instead, the study found an opposite relationship between competition,

measured by the number of family medicine and primary care physicians in the market, and clinical innovation. The results of the study do not substantiate the use of resource dependency theory to examine the relationship between the organizational environment and innovations in family medicine practices.

Organizational Characteristics

Another hypothesis posed in this study was that organizational size is positively related to clinical and business innovation. As discussed earlier, results of this study indicate that organizational size is a strong predictor of innovation. This leads to the understanding that larger organizations have more capacity to implement innovative clinical and business practices. Larger organizations may have access to more financial resources and human resources, as well as space and existing technologies to support the acquisition and implementation of innovations. On the contrary, small organizations have difficulty justifying their investment in innovations. Yap (1990) claimed that the increase in organizational size leads to economies of scale that enhance the feasibility of adopting innovations. Large family medicine practices by nature have more financial resources resulting from a larger number of patients. Small practices are also less likely to have an in-house expert or project champion to initiate and implement an innovation, as well as having fewer resources to allocate. These are some explanations for why small family medicine physician practices are not as likely as large practices to adopt innovations.

Integrated Theoretical Framework

The results demonstrate that the majority of hypotheses are not supported. In total, only 4 of 16 hypotheses are clearly supported by the analysis. The research shows that three hypotheses are supported with a significant positive relationship. Another hypothesis, expected to have a negative relationship, is supported since it is not rejected based on the lack of a significant relationship between variables. If endogeneity was not a problem, four additional hypotheses might be supported since a significant positive relationship was found. Seven hypotheses are rejected because there was not a significant positive relationship between variables. Another hypothesis expected to have a negative relationship is not supported based on a positive significant relationship. In summation, only 8 out of 16 hypotheses are supported even if the additional four hypotheses burdened with endogeneity were substantiated and included in the results. This indicates that the study does not substantiate the relationship between environmental influences and innovations in family medicine as proposed in the integrated theoretical framework.

One interesting finding as a result of the study is that the constructs taken from institutional and resource dependency theories have more explanatory power for practice utilization of business innovation than clinical innovation. The statistical models account for 35% of variance for business innovation and 19% of variance for clinical innovation. This suggests that these organizational theories are better at explaining the business functions of family medicine practices than the clinical functions. The amount of variance also suggests there are many other factors that have an effect on family medicine

practices' utilization of innovations. These influences could be internal or external to the organization and may include such things as practice finances, long standing institutional values and constraints, management philosophy, and other factors not captured through the survey or administrative data sets.

Discussion of Unsupported Hypotheses

The use of institutional and resource dependency theories on organizational change efforts in family medicine practices is not supported by the results of this study. Several explanations should be considered in understanding the failure of these theories in this context.

Measurement of Constructs

There are many potential explanations for why some hypotheses are not supported in this study. The first reason is perhaps the measures are not appropriate indicators for the constructs posed in institutional or resource dependency theory. For instance, coercive forces were measured by the number of HMOs, HMO penetration and Medicare beneficiary penetration. The number of organizations and the level of beneficiary penetration may not measure the level of coercive forces formed by these organizations. Another perspective on why these measures may be poor indicators of coercive force is that HMOs and Medicare may not place pressure on physician practices to improve quality of care or organizational effectiveness. Another hypothesis not supported is the difficulty of physician practices operating under Medicare and MCO rules and regulations. This hypothesis was measured based on responses to a survey question

asking respondents to indicate agreement with a statement that read "it is impossible to practice under Medicare (managed care organizations) rules and regulations". The questions were purposely written in an extreme format since it was expected that almost all practices would indicate some level of difficulty. However, it is likely that the word "impossible" in the statement prevented practices that experienced difficulty to indicate agreement, therefore resulting in an incorrect measurement.

Availability of Measurements/Data

One difficulty in designing this study was the lack of established measurement at the practice level on constructs posed by the integrated theoretical framework. The majority of measurements for theoretical constructs used in this research were developed specifically for this study or were taken from previous studies on hospitals, not research on physician practices. The use of these measurements in this context is exploratory and may not be the appropriate indicators to represent theoretical constructs. The lack of existing measurements results from the lack of previous studies addressing the organizational environment of physician practices. Another difficulty in creating appropriate measurements was the lack of existing data on physician practices. This deficit of data is a result of few administrative data sets on family medicine practices.

Appropriateness of Theories

It is possible that not all constructs in the integrated theoretical framework apply to family medicine practices. An example from the study is the hypothesis that competition is positively related to the level of innovation, which was not supported by

the study results. This finding draws attention to the use of competition as a construct in family medicine. Organizational research frequently uses competition to explain organizational behaviors. Competition is usually defined as rivalry between organizations or individuals over a scarce resource, suggesting that family medicine practices compete over a limited supply of patients. This, however, is not the case in family medicine, where there is typically a limited supply of providers and a sufficient or over supply of patients. The concept of competition as used in resource dependency theory may not be appropriate to explain the behaviors of family medicine practices.

Another possible reason for so many unsupported hypotheses in this research is an inappropriate application of institutional and resource dependency theories to organizations that fall outside the theories' domain. Existing theories on the environment-organization relationship have been predominantly applied to medium and large-sized organizations. Medium and large-sized organizations exhibit characteristics of bureaucratic organizations as defined by Max Weber in the early twentieth century (Shafritz, Ott, Jang, 2005). Characteristics of bureaucratic organizations include bylaws, formal policies and procedures, hierarchical office authority, trained office management, and management of the office by a comprehensive set of rules (Weber, 1922).

Physician practices are typically small organizations. In the study sample, 26% of practices are solo practitioners and 64% comprise of two to nine physicians; therefore, at least 90% of practices are considered small organizations. While small physician practices are organizations that supply goods and services, they are not fully developed

bureaucratic organizations as described by Weber. Most small physician practices are rudimentary organizations that probably don't qualify as bureaucracies because they lack organizational structures with formal rules, clear hierarchies, and formal management guidelines. Also, physicians, as organizational leaders, do not typically receive management or business training, another requirement of developed bureaucracies described by Weber. Another cultural characteristic of physician practices that should be taken into account is that physicians operate independently even in a two person partnership or small group practice. Physicians have been trained to think and act independently, thereby evading typical structures and systems observed in bureaucratic organizations. Taking these characteristics into account, small physician practices may not fall within the realm of institutional and resource dependency theories. It is possible that a certain level of bureaucratization must occur before the environment-organization relationship, as posed by institutional and resource dependency theories, can take effect.

Small organizations may have different motivations and organizational requirements than large organizations, which could lead to different responses to the environment. Small organizations may not require formal organizational structures, clear divisions of work and lines of authority, comprehensive management rules, and written policies and procedures. This translates to the idea that innovations evaluated in this study may not benefit small physician practices as they would large organizations that require more formal structures and processes. For example, innovations such as formal clinical guidelines, programs for employee morale and teamwork, and patient registries

may not be as useful or easy to implement in extremely small physician practices. The cost-benefit ratio of innovations should also be considered as one possible reason large practices have more innovations than smaller practices. In small physician practices, the number of patients and/or practitioners that benefit from the innovation is very small, while the cost of acquiring and implementing most innovations remains fairly constant across organizations.

There is very little mention in organizational theory literature on how institutional and resource dependency theories apply to small organizations. Results of the study reveal that organizational size is the strongest predictor of clinical and business innovation. This may indicate that organizational size is a limiting factor in the utility of the integrated theoretical framework that was used to generate hypotheses about what environmental factors would affect clinical and business innovation. There is also a dearth of research that has applied these theories to physician practice organizations. These findings indicate that additional research needs to be conducted that utilizes institutional and resource dependency theories for small organizations, particularly medical practices. Follow on studies should consider other measures that may represent better the constructs posed in these theories.

It is also important that other organizational theories, whether existing or new, be considered to explain the effect of the environment on organizational change efforts in family medicine. It is possible that organizational theories that fall within the realm of open-systems theories are more suited for understanding and explaining organizational

change efforts in medium or large sized organizations that have strong associations with other organizations. Since family medicine practices are typically small, autonomous, and professionally dominated organizations, perhaps other theories are better suited for explaining organizational behaviors of these organizations. Theories most likely to explain organizational change efforts in family medicine practices are change theory and social network theory. Other possible theories to consider are from social psychology and medical sociology on ethical behavior, behaviors of providers, management of uncertainty in practice, and medical professionalism.

Methods Implications

In many instances, researchers have a problem with a structural equation that has an explanatory variable that theory predicts is endogenous. Researchers (Castiñeira & Nunes, 1999) have noted the major problem with instrumental-variable techniques is obtaining a suitable set of instrumental variables that are sufficiently uncorrelated with the stochastic disturbance term and sufficiently correlated with the endogenous explanatory variable. Econometric researchers (Stock, Wright, & Yogo, 2002) have concluded that many applications of instrumental-variable regression have instruments that are weakly correlated with the included endogenous variables. It is now understood that the use of weak instruments leads to an inaccurate test for endogeneity and biased regression estimates.

This research represents one of few, or possibly the only, attempts to create instrumental variables for characteristics of family medicine practices. An analysis of the

methodologies used in this study indicates that it can be difficult to find an instrument that is both relevant and exogenous. The methodology to address the problem of endogeneity included the identification of variables for potential instruments based on a theoretical correlation to the potentially endogenous regressor and a lack of correlation with the standard error. One difficulty was that many variables thought to have a high correlation with the potentially endogenous regressors were directly related to the outcome variable. A direct relationship with the outcome variable creates invalid instruments. Another problem was the lack of available data on physician practices, which limited potential instrumental variables to socio-economic data from the U.S. Census Bureau and health care resource data from AHA and ARF, all of which resulted in weak instruments. The lack of data available on physician practices makes an instrumental-variable approach to address the problem of endogeneity extremely difficult.

The difficulty in finding relevant and valid instruments appears to be prevalent in economic and non-economic research. This leads to the conclusion that much theoretical work remains on what to do about weak instruments and endogenous regressors. Instrumental-variable techniques were developed in the field of econometrics, and most methodological research on these approaches continues to remain in this field. Since instrumental-variable techniques are increasingly being applied in health services research, there needs to be more attention on the use of these techniques in health care for cross-sectional and observational studies.

This study was also one of few studies to utilize PCSAs to define a market for primary care services. PCSAs are aggregated ZIP code areas designed to reflect patient travel to primary care providers. This classification system represents a conceptually unified and standardized approach to defining primary care services in the U.S. The use of PCSAs to define a market for primary care may be useful to researchers, policy makers, and practitioners interested in the provision of, or access to, primary care services. PCSAs could be used in other research on primary care organizations as a method to define areas for economic activity based on the supply and demand of primary care services. PCSAs could be used to identify areas that experience shortages of health care services and health professionals. The size of PCSAs makes them useful for identifying smaller areas where a shortage may exist that cannot be identified using counties as the unit of analysis.

Another methodological implication resulting from this study is the feasibility of physician participation in research on family medicine. While it is generally difficult to obtain completed questionnaires from physicians, the high response rate to the family medicine survey may indicate that family medicine physicians are concerned about their field and are willing to participate in research that may advance family medicine. It should be noted, however, that an immense level of effort was extended in this study to obtain a high response rate. A mixed-mode methodology was used to administer the survey through the mail, internet, and at a family medicine conference. Numerous

attempts were also made to remind physicians to complete the survey, which aided in obtaining a high response rate.

<div align="center">Practice and Policy Implications</div>

The AHRQ, IOM, and other organizations with a stake in ensuring quality and effective health care in the U.S. are interested in innovations in the delivery of care. This study represents one of the first large scale, comprehensive attempts to look at innovations in family medicine practices. Detailed information on the level and types of innovations utilized at the physician practice level provides practices and policy-making organizations a starting point for evaluating individual innovations more closely. Additional research on innovations used by practices and whether these processes and strategies result in improved outcomes should be addressed by funding institutions. This information may lead to improved decision making ability regarding improvement of health services and business functions.

Very few quantitative research studies in the U.S. have focused on organizational changes and strategies to improve quality of care, access, and business functionality in primary care. There has also been negligible attention to the organizational environment of primary care organizations. One possible explanation for the deficit of research on primary care organizations is the lack of existing data on medical practices in administrative data sets. It is also extremely difficult to collect data from physicians. The lack of quality of care research could be explained by the difficulty in collecting outcomes data on prevention efforts and on many treatments, such as those for chronic

health conditions. The lack of research on business functions is probably due to the physician practice culture that downplays the financial aspects of providing care. There is increasing interest on research at the primary care organization level as seen through the work of several notable scholars. One example is Simon, Rundall, and Shortell's (2005, 2007) work on the adoption of EHR in medical groups and decision support systems in physican organizations. However, the general lack of research on primary care organizations signifies the need for more funding dedicated to this critical component of the health care system.

The work completed for this research reveals that studying the organizational environment of family medicine practices is not easy; as demonstrated by the lack of consistent support of hypotheses for the proposed theoretical framework. This is a challenging area to conduct research, considering there has been little quantitative research on family medicine practices and these practices differ from other types of health care organizations. First, as discussed earlier, the majority of practices are extremely small organizations and may react differently to environmental pressures. Second, the diversity of practice characteristics is immense. Wide-ranging practice characteristics include: service and product offerings, organizational relationships, levels and types of staff, organizational structure and processes, ownership types, and culture and management philosophy. Little is known about these characteristics and it is difficult to account for possible differences. Third, since the organizational environment of family

medicine practices has received little attention, it is difficult to identify appropriate constructs and measurements.

The finding that organizational size is the largest predictor of innovation in family medicine practices has important implications for policy. Small physician practices may not have the resources or relationships necessary to acquire, develop and implement innovations. Policy-making and funding organizations may need to take this into account when developing policies that affect family medicine practices.

<div align="center">Contributions to Health Services Research and Family Medicine</div>

This study contributes to the fields of health services research and family medicine in several ways. First, the research led to the identification of all family medicine office locations in Virginia; a database formerly not available for research purposes or practical application. The list of all family medicine practices could be used to identify practices to participate in follow up research on this topic or for other research or improvement efforts in family medicine. The study also led to additional knowledge on organizational characteristics of family medicine practices such as ownership, size, organizational type, and practice specialties. Second, the study presents in detail the level and types of innovations used by family medicine practices to improve delivery of care and business operations. In future research the 2007 results could serve as a baseline to track the diffusion and growth of these innovations. Information on the level and types of innovations used by family medicine practices in Virginia could also be used to investigate further the constraints or impediments that prevent practices from

implementing these innovations. The results could also be used in family medicine to identify innovations for tracking outcomes and improvements in quality of care.

Information on the level and types of innovations could also assist practices in understanding their position as compared to other practices in Virginia in offering services to patients, providing advanced tools and methods for providers, improving employee and staff morale, understanding the market and practice performance, and other aspects of operating a practice. Practices participating in the study will be provided with a summary report of the descriptive statistics on clinical and business innovations. Information will also be disseminated at several regional and state meetings of family medicine physicians.

This research represents one of the first investigations on environmental factors and organizational characteristics that influence the use of innovative strategies and procedures in family medicine practices. The majority of literature published on this topic is prescriptive or descriptive in nature. The significance of this study is that it represents empirical research that expands the knowledge base on family medicine practices in Virginia and the innovations used by practices to improve quality of care, access, and business operations. One important finding as a result of this study is that institutional pressures and resource dependencies are more strongly related to business innovations than clinical innovations. This leads to the understanding that other factors are influencing practices' utilization of innovative strategies and procedures to deliver care and provide services to patients. This study also contributes to the knowledge in health

services research that organizational size, and possibly organizational relationships and outside entities, is associated with organizational change efforts in family medicine.

Limitations

There are several limitations to the study that must be considered. The use of cross-sectional analysis is a considerable limitation in that it does not allow for inferences of causation. The study will not allow definitive conclusions on the influence of environmental factors and organizational characteristics on the level of innovations in family medicine. The use of a survey instrument may produce threats to internal validity resulting from possible intrinsic bias in responses received from individual survey respondents. Another design limitation is that the results of this study can only be generalized to practices in Virginia, not to all family medicine practices in the U.S. These weaknesses are inherent in the design and could be not addressed through statistical techniques.

Another major limitation of the study is that problems caused by potentially endogenous explanatory variables could not be resolved. The two variables thought to be endogenous, legal and contractual relationships and practice made improvements as a result of outside influences, were both significant predictors of clinical and business innovation. Unfortunately, the tests for endogeneity are not accurate in the presence of weak instruments and endogeneity cannot be confirmed or rejected in this study. If endogeneity exists, the coefficients of these variables could be inflated resulting in the appearance of a stronger association than what is actually present.

Results of the study are presented based on OLS models with a cautionary note on interpretation of results on the two potentially endogenous variables. One OLS model is presented that included the potentially endogenous regressors, and another is presented that excluded these variables. The model excluding the potentially endogenous variables has advantages in that exclusion of the variables lessen simultaneity bias in the estimation of other variables that could result by including the potentially endogenous variables. However, this model suffers because variables are excluded that theory indicates should be present. The version of the model including the potentially endogenous variables addresses this problem but opens the door to estimation bias due to simultaneity. Presenting both models permits the assessment of changes on key hypothesized variables. There were no significant changes on exogenous variables in the model, which signifies that the results are robust and not particularly affected by the estimation problems.

Areas of Future Research

Further research needs to be done to advance knowledge of family medicine practices. The finding that constructs used in this study to represent institutional pressures and resource dependencies are not strongly related to clinical and business innovations can be viewed as a starting point in understanding improvements at the practice level. Future research may investigate other factors that play a role in organizational change efforts to improve clinical efficiencies and quality of care in family medicine practices. Given the exploratory nature of the study, further studies of the determinants of the adoption of innovations may want to investigate additional organizational variables, such

as management philosophy, organizational type, organizational structure, information systems structure, etc., to yield more valuable and enriched information on the use of innovations in family medicine. Follow on research should also address whether innovations result in improvement to the delivery of care and business operations. Data collection on outcomes and quality of care could be conducted through standardized patient satisfaction surveys, process indicators for interim outcomes, and data that result from pay-for- performance initiatives.

Low utilization of specific innovations should also be addressed in follow up research. Studies could address why certain clinical innovations are not highly utilized by practices, such as EHR, linkages for community services, use of patient registries, and programs for patient self-management. Additional studies could address certain business innovations with low utilization, including: performance measurement, performance feedback, provision of non-covered services, and use of specific market assessment activities. Follow on research should also address the constraints and challenges practices face in implementing improvements to their medical care and business operations.

Survey methodologies can only capture certain levels and types of information. A deeper understanding of the influences on the utilization of specific innovations could be gained through qualitative research techniques such case studies using focus groups, key informant interviews, and document reviews to collect data on specific family medicine practices.

Conclusion

Family medicine practices represent an important component of our health care delivery system in providing primary and preventive care services, as well as being an agent for coordination of care with other components of the health care system. Through this study much knowledge is gained on family medicine practices and the innovations and redesign strategies used by these practices. An increased understanding of innovations and the operation of family medicine practices can assist with improving services to patients, practice efficiency, profitability, employee and staff morale, and physician satisfaction. This information can help policy-making institutions, professional associations, research organizations, and practices understand better where to focus efforts to improve delivery of care.

Although the use of institutional and resource dependency theories to explain influences on innovations in family medicine was not substantiated, the finding leads to the conclusion that much work remains on the environment-organization relationship at this level of the health care system. The question on what influences family medicine practices to make improvements to the delivery of care and business operations is critical to the larger problem of how to improve access and quality of care at the primary care level.

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APPENDIX A. VCU FAMILY MEDICINE PRACTICE SURVEY

START HERE: Indicate name of physician practice: _____

Team-Based Care

1. Does your practice use any of the following ancillary care providers?
   Check all that apply.
   - ☐ Nurses (LPN/RN)
   - ☐ Nurse practitioners
   - ☐ Physician assistants
   - ☐ Patient education
   - ☐ Mental health specialist
   - ☐ Medical assistant
   - ☐ None of the above

Patient Registries

2. Does your practice maintain a registry or list of patients with the following
   conditions? Check all that apply.
   - ☐ Asthma
   - ☐ Congestive heart failure
   - ☐ Depression
   - ☐ Diabetes
   - ☐ Coronary artery disease
   - ☐ Other:_____
   - ☐ None of the above

Patient Self Management

3. Does your practice offer programs or services to increase patient self-management
   skills for the following conditions? (beyond physician counseling during usual office
   visits) Check all that apply.
   - ☐ Asthma
   - ☐ Congestive heart failure
   - ☐ Depression
   - ☐ Diabetes
   - ☐ Coronary artery disease
   - ☐ Other:_____
   - ☐ None of the above

Alternative Scheduling Arrangements

4. Indicate whether your practice provides the following patient care options. Check all that apply.
    - ☐ Scheduled evening or weekend visits
    - ☐ On-call evening or weekend visits
    - ☐ Group visits (more than one patient receiving patient education, guidance, etc. at the same time and place)
    - ☐ Telephone consultations
    - ☐ E-mail consultation
    - ☐ Rapid access (same day appointments for urgent and non-urgent conditions)

Clinical Guidelines

5. Does your practice use nationally recognized evidence-based guidelines to care for patients? Check one.
    - ☐ Yes, we utilize guidelines for numerous diseases
    - ☐ Yes, we utilize guidelines for one to three diseases
    - ☐ No, we rely on our professional training
    - ☐ No, the available guidelines don't suit our patient population

    If No on question 5, then move to question 7.

6. Are the physicians in your practice trained (continuing education, in-house, formal education) on the use of these guidelines? Check one.
    - ☐ Yes, on numerous guidelines
    - ☐ Yes, on some of the guidelines
    - ☐ No, not at this time
    - ☐ Don't know

Patient Satisfaction Surveys

7. Does your practice administer patient satisfaction surveys? Check one.
    - ☐ Yes, we have administered a patient satisfaction survey within the last year
    - ☐ Yes, we have administered a patient satisfaction survey within the last two years
    - ☐ Not yet, but we intend to do so in the future
    - ☐ No, we don't plan to administer a patient satisfaction survey

    If No to 7, then move to question 9.

8. Does your practice initiate change based on the results of patient satisfaction surveys?

Check one.

☐ Yes, after each survey
☐ Yes, after some surveys
☐ Not yet
☐ Don't know

Information Systems

9. Does your practice use an electronic medical record for patients?

☐ Yes
☐ No   If No to question 9, then move to question 11.

10. Which of the following pieces of information are included on your individual patient's electronic medical record? Check all that apply.

☐ A patient problem list (inventory of all patient problems/conditions)
☐ Ambulatory visit data (encounters)
☐ Emergency room visits
☐ Services provided by other specialists
☐ Inpatient stays
☐ Medications
☐ Radiology findings
☐ Problem specific clinical guidelines
☐ Medication ordering reminders and/or drug interaction information
☐ Laboratory findings

Continuity of Care

11. Does your practice have specific processes to ensure continuity of care (in-person, phone, and/or email) so that most of the time patients receive care from their personal physician? Check one.

☐ We utilize formal processes for continuity of care
☐ We utilize informal processes for continuity of care
☐ Not currently, but we plan to develop processes in the future
☐ Not at this time

Comprehensive Care

12. Does your practice provide care to the following patients? Check all that apply.
   - ☐ Adults
   - ☐ Children
   - ☐ Infants
   - ☐ Males
   - ☐ Females
   - ☐ All of these

13. Does your practice provide the following types of care? Check all that apply.
   - ☐ Preventive care
   - ☐ Acute care
   - ☐ Rehabilitative care
   - ☐ Chronic illness care
   - ☐ Mental health care
   - ☐ Prenatal care
   - ☐ Obstetrics
   - ☐ Gynecology

Community Linkages

14. What types of relationships does your practice have with community service organizations
    (e.g., senior centers, support groups, health department) for your chronically ill patients? Check one.
   - ☐ Written agreements
   - ☐ Informal agreements
   - ☐ We don't have formal relationships with community service organizations

Office Space

15. Has your practice evaluated your office space to consider whether the facility(s) are functional to meet patient needs and expectations? Check one.
   - ☐ Yes, evaluation by outside organization
   - ☐ Yes, evaluation by internal staff
   - ☐ No, but we plan to review our office space in the future
   - ☐ No, a review is not needed for our facility
   - ☐ No, we have not reviewed our office space

16. Does your office space accommodate the following? Check all that apply.

- [ ] Group visits (more than one patient receiving patient education, etc. at the same time and place)
- [ ] Patient library and/or computer work stations for patient education
- [ ] Special needs patients (e.g. physical disability, psychological disorder)
- [ ] None of these at this time

Translation Services

17. Do you have non-English speaking patients?
   - [ ] Yes
   - [ ] No   If 17 is No then move to question 19.

18. Does your practice have provisions for linguistic services (staff member, translation service, etc.) for the non-English speaking population in your service area? Check one.
   - [ ] We utilize internal staff for translation
   - [ ] We utilize an outside translation service
   - [ ] We utilize both internal staff and a translation service
   - [ ] We don't have enough non-English speaking patients to justify this service
   - [ ] We don't offer translation service at this time

Performance Measurement and Monitoring

19.   Does your practice measure and monitor the following kinds of patient care data? Check all that apply.
   - [ ] Clinician use of evidence-based guidelines
   - [ ] Results of clinical quality improvement projects
   - [ ] Outcome data for selected conditions
   - [ ] None of these at this time

20. Does your group provide written feedback reports or data to physicians and practice teams regarding their clinical performance? Check one.
   - [ ] Yes, at least once per month
   - [ ] Yes, at least once per year
   - [ ] We plan to in the future
   - [ ] No, it is not practical for our practice

21.   Does someone in your practice review the practice's financial performance? Check one.
   - [ ] Yes, at least once per month

☐ Yes, at least once per year
☐ We plan to in the future
☐ No, it is not practical for our practice

Patient and Employee Services

22. Does your practice offer services or products to patients that are not covered by insurance plans or health programs (vitamins, cosmetic, etc.)?
    ☐ Yes
    ☐ No

23. Does your practice offer any of the following diagnostic testing? Check all that apply.
    ☐ Bone mineral density testing
    ☐ Colposcopy
    ☐ Pulmonary function
    ☐ Stress tests
    ☐ Hearing tests
    ☐ None at this time

24. Do you have any programs or services that focus on improving employee morale and/or teamwork?
    ☐ Yes
    ☐ No

Market Assessment

25. Which of the following trends in the community and/or state does your practice review? Check all that apply.
    ☐ Community/regional disease patterns
    ☐ Regulatory actions
    ☐ Competition (family medicine or other primary care services)
    ☐ Resource availability (staffing, medical supplies/equipment, specialist care)
    ☐ Demand for services
    ☐ Patient demographics (geographic location, age, sex, ethnic background)
    ☐ None at this time

External Organizations

Indicate your agreement with the following statements

26. The Medicare rules and regulations have made it almost impossible to practice in this environment.
  - ☐ Strongly agree
  - ☐ Somewhat agree
  - ☐ Neither agree nor disagree
  - ☐ Somewhat disagree
  - ☐ Strongly disagree

27. Some aspects of the Medicare rules and regulations have actually made it easier to practice.
  - ☐ Strongly agree
  - ☐ Somewhat agree
  - ☐ Neither agree nor disagree
  - ☐ Somewhat disagree
  - ☐ Strongly disagree

28. The rules and requirements set forth by Medicare are changing so fast it is difficult to keep up with them.
  - ☐ Strongly agree
  - ☐ Somewhat agree
  - ☐ Neither agree nor disagree
  - ☐ Somewhat disagree
  - ☐ Strongly disagree

29. The physicians in our practice have deep knowledge of the rules and requirements from Medicare.
  - ☐ Strongly agree
  - ☐ Somewhat agree
  - ☐ Neither agree nor disagree
  - ☐ Somewhat disagree
  - ☐ Strongly disagree

30. Managed care organizations' rules and regulations have made it almost impossible to practice in this environment.
  - ☐ Strongly agree
  - ☐ Somewhat agree
  - ☐ Neither agree nor disagree
  - ☐ Somewhat disagree
  - ☐ Strongly disagree

31. Some aspects of managed care organizations' rules and regulations have actually

made it easier to practice.
- ☐ Strongly agree
- ☐ Somewhat agree
- ☐ Neither agree nor disagree
- ☐ Somewhat disagree
- ☐ Strongly disagree

32. The rules and requirements set forth by managed care organizations are changing so fast it is difficult to keep up with them.
- ☐ Strongly agree
- ☐ Somewhat agree
- ☐ Neither agree nor disagree
- ☐ Somewhat disagree
- ☐ Strongly disagree

33. The physicians in our practice have deep knowledge of the rules and requirements from managed care organizations.
- ☐ Strongly agree
- ☐ Somewhat agree
- ☐ Neither agree nor disagree
- ☐ Somewhat disagree
- ☐ Strongly disagree

34. We have changed our practice as a result of interactions with professional associations (American Medical Association, Virginia Academy of Family Physicians, etc.).
- ☐ Strongly agree
- ☐ Somewhat agree
- ☐ Neither agree nor disagree
- ☐ Somewhat disagree
- ☐ Strongly disagree

35. We have changed our practice as a result of expectations or demands from groups that represent patient concerns (e.g. AARP, American Cancer Society).
- ☐ Strongly agree
- ☐ Somewhat agree
- ☐ Neither agree nor disagree
- ☐ Somewhat disagree
- ☐ Strongly disagree

36. We have changed our practice as a result of expectations or demands from patients.
  - ☐ Strongly agree
  - ☐ Somewhat agree
  - ☐ Neither agree nor disagree
  - ☐ Somewhat disagree
  - ☐ Strongly disagree

37. Our practice actively looks for information on best practices from other offices, hospitals, or organizations.
  - ☐ Strongly agree
  - ☐ Somewhat agree
  - ☐ Neither agree nor disagree
  - ☐ Somewhat disagree
  - ☐ Strongly disagree

Organizational Characteristics

38. What is your practice type?

Check one.
  - ☐ Single specialty
  - ☐ Multispecialty with primary care only
  - ☐ Multispecialty with primary care and specialty care

Check one.
  - ☐ Private practice
  - ☐ Non-profit clinic federally or state funded
  - ☐ Non-profit clinic privately funded
  - ☐ Academic/teaching clinic
  - ☐ Urgent Care Center

39. At the present time, what is the total number of physicians in your medical practice? (regardless of
full-time or part-time status)

_____Number

40. How many full-time equivalent (FTE) physicians and physician extenders work in your office?
(For example, two full time physicians and one 90% physician would total 2.9 FTE.)

_____ Physician FTE

_____ Physician Extender FTE

41. Is your practice owned (full or partial) by an outside entity? Check one
☐ Yes, full or partial ownership by a health plan
☐ Yes, full or partial ownership by a hospital
☐ Yes, by other
☐ No

42. Does your practice have contractual relationships with another practice, university, hospital, or health care system? (excluding managed care organizations and insurance companies)
☐ We have written agreement(s) to provide services for a stipulated fee
☐ We have other types of written agreement(s) with health care organization(s)
☐ We have no contractual relationships with other health care organizations

43. How long has the practice been in existence in its current location?

_____Number of years

44. Position of respondent (e.g. Staff Physician, Medical Director, Office Administrator):

_____

45. Address of physician practice:

_____

_____

APPENDIX B. VIRGINIA STATE PLANNING GRANT REGIONS

SPG Region 1 Northwestern Virginia		SPG Region 2 Northern Virginia	SPG Region 3 Southwestern Virginia		SPG Region 4 Central Virginia	SPG Region 5 Eastern Virginia
Counties	**Cities**	**Counties**	**Counties**	**Cities**	**Counties**	**Counties**
Albemarle	Buena Vista	Arlington	Alleghany	Bedford	Amelia	Accomack
Augusta	Charlottesville	Fairfax	Amherst	Bristol	Brunswick	Essex
Bath	Fredericksburg	Loudoun	Appomattox	Clifton	Buckingham	Gloucester
Caroline	Harrisonburg	Prince	Bedford	Forge	Charlotte	Isle of Wight
Clarke	Lexington	William	Bland	Covington	Chesterfield	James
Culpeper	Staunton		Botetourt	Danville	Charles	King and Queen
Fauquier	Waynesboro	**Cities**	Buchanan	Galax	Cumberland	King William
Fluvanna	Winchester	Alexandria	Campbell	Lynchburg	Dinwiddie	Lancaster
Frederick		Fairfax	Carroll	Martinsville	Goochland	Mathews
Greene		Falls Church	Craig	Norton	Greensville	Middlesex
Highland		Manassas	Dickenson	Radford	Halifax	Northampton
King George		Manassas	Floyd	Roanoke	Hanover	Northumberland
Louisa		Park	Franklin	Salem	Henrico	Richmond
Madison			Giles		Lunenburg	Southampton
Nelson			Grayson		Mecklenburg	Westmoreland
Orange			Henry		New Kent	York
Page			Lee		Nottoway	
Rappahannock			Montgomery		Powhatan	**Cities**
Rockbridge			Patrick		Prince Edward	Chesapeake
Rockingham			Pittsylvania		Prince George	Franklin
Shenandoah			Pulaski		Surry	Hampton
Spotsylvania			Roanoke		Sussex	Newport News
Stafford			Russell			Norfolk
Warren			Scott		**Cities**	Poquoson
			Smyth		Colonial Heights	Portsmouth
			Tazewell		Emporia	Suffolk
			Washington		Hopewell	Virginia Beach
			Wise		Petersburg	
			Wythe		Richmond	

Reference: Virginia SPG Planning Regions (2005).

APPENDIX C. NUMBER OF IMPLEMENTED CLINICAL

INNOVATIONS

Practice Innovation	Response Frequency
n = 342	$f(\%)$
Q1. Existence of team based care	
6 out of 6	7 (2%)
5 out of 6	16 (4.7%)
4 out of 6	37 (10.8%)
3 out of 6	59 (17.3%)
2 out of 6	74 (21.6%)
1 out of 6	96 (28.1%)
0 out of 6	46 (13.5%)
Q2. Existence of patient registry	
6 out of 6	14 (4.1%)
5 out of 6	41 (12%)
4 out of 6	9 (2.6%)
3 out of 6	2 (.6%)
2 out of 6	12 (3.5%)
1 out of 6	38 (11.1%)
0 out of 6	227 (66.4%)
Q3. Programs for patient self management	
6 out of 6	4 (1.2%)
5 out of 6	13 (3.8%)
4 out of 6	9 (2.6%)
3 out of 6	18 (5.3%)
2 out of 6	35 (10.2%)
1 out of 6	78 (22.8%)
0 out of 6	188 (55%)
Q4. Alternative scheduling arrangements	
6 out of 6	2 (.6%)
5 out of 6	12 (3.5%)
4 out of 6	42 (12.3%)
3 out of 6	68 (19.9%)

2 out of 6	111 (32.5%)
1 out of 6	94 (27.5%)
0 out of 6	13 (3.8%)
Q5. Use of clinical guidelines	258 (77%)
Q6. Physicians trained in the use of clinical guidelines	223 (66.6%)
Q10. EMR components	
10 out of 10	48 (14%)
9 out of 10	23 (6.7%)
8 out of 10	20 (5.8%)
7 out of 10	18 (5.3%)
6 out of 10	7 (2%)
5 out of 10	6 (1.8%)
4 out of 10	8 (2.3%)
3 out of 10	7 (2%)
2 out of 10	1 (.3%)
1 out of 10	0 (0%)
0 out of 10	209 (61.1%)
Q11. Continuity of care	297 (86.8%)
Q13. Type of Care	
Preventive, acute, and chronic illness care	327 (95.6%)
Rehabilitative care and mental health care	118 (34.5%)
Prenatal care and obstetrics/gynecology Services	27 (7.9%)
Q14. Community linkages for care	105 (30.8%)
Q18. Offices with non-English speaking patients (261, 76.2%) that provide linguistic services	186 (71.3%)

APPENDIX D. NUMBER OF IMPLEMENTED BUSINESS PRACTICE
INNOVATIONS

Practice Innovation n = 342	Response Frequency $f\,(\%)$
Q7. Administer patient satisfaction surveys	155 (46.9%)
Q8. Initiate change based on results of patient satisfaction surveys	142 (41.5%)
Q15. Evaluation of office space	209 (61.0%)
Q16. Office Space Accommodates	
3 out of 3	19 (5.6%)
2 out of 3	83 (24.3%)
1 out of 3	154 (45%)
0 out of 3	85 (24.9%)
Q19. Performance measurement	
3 out of 3	33 (9.6%)
2 out of 3	34 (9.9%)
1 out of 3	78 (22.8 %)
0 out of 3	197 (57.6%)
Q20. Provision of reports or feedback to physicians or practice teams	99 (29.0%)
Q21. Review financial performance	318 (93.0%)
Q22. Offer services not covered by insurance	88 (25.8%)
Q23 Offer Diagnostic testing -	
5 out of 5	9 (2.6%)
4 out of 5	8 (2.3%)
3 out of 5	32 (9.4%)
2 out of 5	98 (28.7%)
1 out of 5	75 (21.9%)
0 out of 5	120 (35.1%)
Q24. Programs that focus on improving employee morale and/or teamwork	182 (53.1%)
Q25. Market assessment	
6 out of 6	26 (7.6%)
5 out of 6	22 (6.4%)

4 out of 6	30 (8.8%)
3 out of 6	38 (11.1%)
2 out of 6	63 (18.4%)
1 out of 6	51 (14.9%)
0 out of 6	106 (31%)
Q37. Practice actively searchers for best practices	240 (70.1%)

APPENDIX E. TWO STAGE LEAST SQUARES, CLINICAL INNOVATION

Variable	Coefficients			
	B	Std. Error	z	P-value
Coercive Forces				
HMO and Medicare Beneficiaries	.015	.059	0.26	.798
Mimetic Forces				
Difficulty under Medicare/ MC rules and regulations	-.006	.038	-0.15	.878
Mimetic Forces				
Knowledge of Medicare/ MC rules and regulations	-.056	.035	-1.60	.110
Mimetic/Normative Forces				
Regional innovation	.466	.364	1.28	.200
Normative Forces				
Outside influences	-.041	.272	-0.15	.881
Competition				
Family medicine/primary care physicians	-.096	.041	-2.30	.021
Interconnectedness				
Organizational Relationships	.002	.280	0.01	.995
Organizational Characteristic				
Organizational size	.554	.257	2.15	.031

APPENDIX F. TWO STAGE LEAST SQUARES, BUSINESS INNOVATION

Variable	Coefficients			
	B	Std. Error	z	P-value
Coercive Forces				
HMO and Medicare Beneficiaries	.001	.010	0.16	.872
Mimetic Forces				
Difficulty under Medicare/ MC rules and regulations	.011	.006	1.76	.078
Mimetic Forces				
Knowledge of Medicare/ MC rules and regulations	-.013	.006	-2.17	.030
Mimetic/Normative Forces				
Regional innovation	.119	.063	1.89	.058
Normative Forces				
Outside influences	-.043	.047	-0.92	.358
Competition				
Family medicine/primary care physicians	-.015	.007	-2.16	.031
Interconnectedness				
Organizational Relationships	.045	.049	0.93	.350
Organizational Characteristic				
Organizational size	.109	.044	2.44	.015

VITA