UNDERSTANDING THE IMPACT OF MEDICAL HOMES ON THE HEALTH CARE UTILIZATION AND EXPENDITURES OF CHRONICALLY ILL ADULTS

By

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Dedicated to my parents,
Maxine and Walter (who is now with the Lord).

For your unwavering support and confidence in me
long before I found my way and for your examples of faith,
perseverance and understanding of what really matters in life.

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DEFINITION OF TERMS

CHRONIC DISEASE: The irreversible presence, accumulation, or latency of disease states or impairments that involve the total human environment for supportive care and self-care, maintenance of function and prevention of further disability (Curtin and Lubkin, 1995).

CONTINUITY OF CARE: Coordination ensures the provision of a combination of health services and information that meets a patient's needs and specifically means the connections within and across those services and settings - putting them in the right order and appropriately using resources of the community (IOM, 1996).

PATIENT CENTERED MEDICAL HOMES: This study utilizes the American Academy of Pediatrics definition as care that is accessible, family centered, coordinated, comprehensive, continuous, culturally competent, and compassionate (American Academy of Pediatrics, 2002).

PRIMARY CARE: According to the Institute of Medicine (IOM), primary care is the provision of integrated, accessible health care services by clinicians who are accountable for addressing a large majority of personal health care needs, developing a sustained partnership with patients, and practicing in the context of family and community (IOM, 1996, p. 31).

PROVIDER-PATIENT COMMUNICATION: Communication is the method by which information is conveyed between a source and one or more receivers; a process of sharing meanings using common rules (Berry, 2007; Northouse and Northouse, 1998).

SHARED DECISION-MAKING: defined as the active patient involvement during the medical encounter.

USUAL SOURCE OF CARE: The Agency for Health Care Research and Quality (AHRQ) defines this as a particular doctor’s office, clinic, health center, or other place where an individual regularly visits if he or she is ill or requires advice about personal health matters (AHRQ, 2001).

LIST OF ABBREVIATIONS

AAFP	American Academy of Family Physicians
AAP	American Academy of Pediatrics
ACP	American College of Physicians
ADA	American Diabetes Association
AHRQ	Agency for Health care Research and Quality
AMA	American Medical Association
AOA	American Osteopathic Association
CAPI	Computer Assisted Personal Interviewing
CBO	Congressional Budget Office
CDC	Centers for Disease Control and Prevention
CMHI	Centers for Medical Home Improvement
CMS	Centers for Medicare and Medicaid Services
COPD	Chronic Obstructive Pulmonary Disease
CSHCN	Children with Special Health care Needs
DCCT	Diabetes Control and Complications Trial
DM	Diabetes Mellitus
FY	Fiscal Year
GDP	Gross Domestic Product
HMO	Health Maintenance Organization
HTN	Hypertension
ICD-9-CM	International Classification of Diseases 9th Revision Clinical Modification
IOM	Institute of Medicine
KFF	Kaiser Family Foundation
MEDPAC	Medicare Payment Advisory Commission
MEPS	Medical Expenditure Panel Survey
NCHS	National Center for Health Statistics
NCQA	National Committee for Quality Assurance
NHIS	National Health Interview Survey
PCMH	Patient Centered Medical Home
PPC - PCMH	Physician Practice Connection - Patient-Centered Medical Home
SDM	Shared Decision-making
UKPDS	United Kingdom Prospective Diabetes Study
USC	Usual Source of Care
USPSTF	US Preventive Service Task Force

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Growing challenges to health system quality and ongoing financial constraints warrant a paradigm shift in the organization and delivery of the health care system. There are both state and national level debates for the establishment of a Patient-Centered Medical Home (PCMH) as the centerpiece of primary care reform. While most states and the Centers for Medicare and Medicaid Services (CMS) have implemented demonstrations to test this model of care, to date limited empirical evidence is available.

The care provided in a PCMH is characterized as accessible, family centered, coordinated, continuous, culturally competent, and compassionate. This research seeks to estimate the impact of PCMH on two specific aspects of care: utilization and expenditures, as they are observed among adults who are chronically ill.

This is a cross-sectional study design that identifies a sub-population, chronically ill adults (<18 years), participating in the Medical Expenditure Panel Survey (2004-2007) and living with asthma, diabetes, chronic obstructive pulmonary disease, high blood pressure, depression, arthritis, coronary heart disease, and stroke. To ascertain the construct of a PCMH, an exploratory factor analysis was conducted on twenty

theoretically based items that might be considered part of a PCMH. Multiple regression models were conducted to assess the association between the degree of medical homeness and the health care outcomes of interest among 3,125 chronically ill adults.

Principle Component Analysis was used to extract a sixteen-item measure of two final factors. The American Academy of Pediatrics attributes observed in the two factors were quality and safety-focused care; coordinated care; comprehensive care and enhanced access with an overall Cronbach $\alpha = 0.64$. Medical homeness was not significantly associated with total health care expenditures, prescription drugs, physician visits, ER visits and hospital discharges. Individuals in medical homes had significantly longer hospital stays than their non-medical home counterparts.

These findings add to the discussions concerning which features accurately measure a medical home. Further, it contributes to the ongoing debate about health care reform and the role of medical homes, as well as the relatively scarce body of research on measuring medical homes by levels rather than by a dichotomous variable.

CHAPTER 1
INTRODUCTION

Health Care Quality and the Role of a Patient-Centered Medical Home

Notwithstanding significant achievements in medical care, recent studies have revealed that Americans receive approximately half the recommended care for common conditions (both acute and chronic) and vital preventive services (Kerr et al., 2004, McGlynn et al., 2003). Additionally, the health care system delivers an excessive quantity of unnecessary care (Fisher et al., 2003a; Fisher et al., 2003b). Combined, these attributes translate into an expensive system that spends almost 2.5 times more per capita than any other nation in the world (Anderson et al., 2006). Moreover, the National Scorecard on US Health System Performance (2008) asserts that the care delivered falls short of achievable standards. The report observed that there were high variances in quality of care and numerous missed opportunities for improvements in disease prevention, disability, hospitalizations and mortalities. While it is clear that millions of Americans continue to receive high-quality health care, the Institute of Medicine (IOM) suggest that there is significant evidence to suggest that there are widespread and serious quality challenges throughout the system (IOM, 2001a). Further, the IOM's Crossing the Quality Chasm (IOM) asserts that health care harms frequently and consistently falls short on delivering its potential benefits (IOM, 2001a).

Challenges include: rising costs in the face of inadequate and inequitable access; fragmented and uncoordinated care, incentives that are unsuccessful at rewarding good health outcomes; large variations in care; increasing patient dissatisfaction and limited productivity and efficiency gains compared to other industries (Paulus, Davis and Steele, 2008). The IOM recommends significant reorganization of the system to improve

quality of care (IOM, 2001a). The literature supports the presence of a healthy primary care system as a core component of an efficient and high-quality health care system (Starfield, Shi, and Macinko, 2005). However, in the United States the future of the primary care system is considered uncertain (Barr, 2008).

While the IOM's report, Crossing the Quality Chasm, was a clarion call for fundamental reform, such proposals have been in existence for decades. As early as the 1890s, physicians were struggling with efficient and effective ways to meet their professional needs and the health care needs of their patients. It was during this era that the prototypical group practice model, Mayo Clinic in Rochester Minnesota, was founded by Dr. William Mayo (Starr, 1982).

By 1910 Mayo declared that it was necessary to organize medical care as a "cooperative science" with the clinician, specialist, and laboratory professional working beside each other. Further, Mayo denounced individualism in medicine and suggested that it could no longer continue (Stewart, 2004). Despite Mayo's declaration, C. Rufus Romen, who conducted a private group clinic survey in 1932, concluded that the group practice phenomena did not occur as a result of ideological reasons, but in fact was an "*an experiment in social reform*" since the original clinics expanded without an initial design (Starr,1982, p.212; Mancur, 1965).

During the last century Dr. Paul Ellwood proposed the health maintenance model as the solution to the health care crises following the passage of Medicare and Medicaid legislation (Kongstvedt, 2007; Ellwood et al., 1971). Dr. Ellwood suggested prepaid group practices were thriving examples of how to reverse perverse system incentives. He anticipated that the health maintenance strategy would provide services that could

be purchased annually at pre-agreed rates before illness, with provider risk sharing and comprehensive services that would keep consumers healthy by offering preventive services. In his proposal, Ellwood highlighted the need for a *coordinated*, *comprehensive* approach with market mechanisms (e.g. competition and *informed consumer* demands) that would provide a check and balance system to deal with to *redundant services*, inflation, and *inequity* (Brown, 1998; Ellwood et al., 1971).

In recent years, a number of key stakeholders have suggested the establishment of Patient-Centered Medical Homes (PCMH) as the centerpiece of a primary care based health care reform (Backer, 2007). While hardly new, over the past decade this approach to organizing the delivery of primary care health care has gained significant momentum and prominence. The concept was first introduced by the American Academy of Pediatrics (AAP) approximately forty years ago (1967) to improve health outcomes for children with special health needs (CSHCN).

The ideals of the PCMH model are reminiscent of early managed care, in that they emphasize some of the same principles (e.g. a comprehensive coordinated approach). However, the models diverge as the PCMH model advocates: a personal provider as strategic manager whereby patients can obtain care when and where they need it; enhanced access; patient-centered care; payment reform that proposes reimbursement for coordination; and other services.

A PCMH as defined by the AAP is more than just a place; it refers to a partnership approach that engages the health provider and individual patients and their families (where appropriate). The care provided is accessible, family centered, coordinated, comprehensive, continuous, culturally competent, and compassionate (AAP, 2002).

Patient-centered care establishes collaborations that ensure a decision-making process that respects patients' wants, needs, and preferences. Patients should be provided with the education and support that they require for decision-making and thus be engaged to participate actively in their own care (AAP, 2002). The IOM suggests patient-centered care as one of the six cornerstones of health care quality. As such, patient-centeredness incorporates "qualities of compassion, empathy, and responsiveness to the needs, values, and expressed preferences of the individual patient" (IOM, 2001a). The original definition has evolved from its description of a place and single source of all medical information to a collaborative approach to primary care among providers, patients, and families (Sia et al., 2004).

The IOM, AAP, American Academy of Family Physician, (AAFP) and the American Osteopathic Association (AOA) have endorsed the principles of PCMH. Additionally, the National Committee for Quality Assurance (NCQA) has developed parallel standards known as the Physician Practice Connection: Patient-centered Medical Homes (Commonwealth Fund, 2008b). The goals of Healthy People 2010 call for each child (including CSHCN) to have a medical home.

Additionally, Medicare, one of the nation's largest payers, has endorsed medical homes. In 2006, the Medicare Payment Advisory Commission (MedPac), in its Reforming the Delivery System report, stated that if left unchanged Medicare will become financially unsustainable and recommended fundamental changes in the organization and delivery of care. This report advocated for Congress to expeditiously pursue three initiatives: medical home demonstration; bundling payments for all care provided by hospitals; and creation of multi-specialty group practices.

There are seven core features of PCMH: personal physician; physician-directed medical practice; whole person orientation; coordinated care; quality and safety; enhanced access; and a reformed payment process. It is not known, however, whether medical homes that achieve some of these ideals in varying degrees and combinations will successfully achieve the intended improvements to care.

The study described here seeks to understand the impact of medical homes on medical care expenditures and utilization among people living with chronic conditions. Improved understanding will inform policymakers as they grapple with the ultimate value of medical homes, and the interventions that might take advantage of this value.

Statement of the Problem

An estimated 133 million Americans have at least one chronic disease (Bodenheimer, Chen, and Bennett, 2009) and projections suggest that by 2020 these numbers will increase to as many as 157 million (almost half the population) (Wu and Green, 2000). In 2005 there were an estimated 63 million Americans with multiple chronic diseases and this number is expected to balloon to 81 million by 2020 (Wu and Green, 2000).

Chronic diseases accounts for 70 percent of all deaths and one-third of the years of potential life lost before age 65 in this country. Approximately 1.7 million Americans die each year as a result of chronic diseases. The Centers for Disease Control estimate that chronic diseases are a significant cause of activity limitation for approximately 25 million Americans (CDC, 2009).

While the human toll is staggering, the economic consequences are equally daunting. The economic burden of chronic conditions accounts for approximately 75 percent of the nation's $2+ trillion annual health care expenditures (CDC, 2009).

Approximately two-thirds of the rise in health care spending is attributed to increases in the prevalence of chronic conditions. From 1987 to 2000, the health spending for non-institutionalized Americans doubled from $314 billion to $628 billion per year; of which $211 billion was directly attributed to increases in chronic condition therapy. It is therefore no surprise that better management of chronic conditions has emerged as a significant challenge to the health care system (Partnership Solution, 2004).

A paradigm shift will be necessary if we seek to establish medical homes based on chronic conditions, as distinct from a program focused on acute communicable and infectious conditions. The majority of chronic care is being provided in a primary care setting that is organized to address acute episodic care (Bodenheimer and Grumbach, 2007; Thrall, 2005). Edward Wagner coined the term “tyranny of the urgent” to describe the phenomenon whereby practitioners are hard pressed by consumers’ acute concerns and in turn fail to achieve the best possible management of chronic conditions (Wagner, Austin, and Von Korff, 1996). Additionally, about forty percent of primary care practices are solo practices and hence not ideally structured to support a coordinated approach to chronic care (Thrall, 2005).

Any reform requires that the care delivered goes further than the current model (Isaac and Knickman, 2004), which is often brief, poorly planned, and involves a passive uninformed consumer interacting with rushed, ill-prepared providers and support staff who may or may not be acting as a team (Wagner, Austin and Von Korff, 1996). Successful management of most chronic conditions requires a sustained partnership between patients and medical providers who can monitor and coordinate patient care (Beal, Doty, Hernandez, et al., 2007). Therefore physician guilds, payers,

and major employer groups have proposed the development of PCMH to improve care offered to individuals living with complex chronic conditions (Sia et al., 2009).

The PCMH model underlines key attributes of primary care (e.g. enhanced access and care coordination), endorses the chronic care model, highlights the necessity for advanced information technology, and promotes reimbursement reform with enhanced access to care and improved outcomes (Reid et al., 2009). Further, proponents of the ongoing PCMH discussions continue to assert that medical homes will be appealing to patients and their families and will significantly improve the quality of care while reducing costs. NCQA, in conjunction with other agencies such as AAFP, AAP, AOA and the American College of Physicians (ACP), have developed roadmap tools to assist in translating this concept into practice. However, the PCMH model has not been extensively tested. To that end, major grant funding agencies (e.g. Commonwealth Fund) have asked industry insiders to assist in defining the best methodological design for testing this model (Barr, 2008).

Additionally, although the NCQA guidelines and Commonwealth Fund have highlighted “levels of medical homeness” (or tiers), the preponderance of the literature have treated this concept largely as a binary issue (Y/N). The Centers for Medicare and Medicaid Services (CMS) has outlined the following criteria for tiers of medical homeness. Tier one is considered entry level and provides basic medical home services. Tier two advances basic services with the use of technology and provides expanded medical homes services (Carrier et al., 2009). Absent from the debate is the impact of levels of medical homes on health care expenditures and utilization.

Significance of the Study

In the face of a health system grappling with quality challenges, escalating costs, increasing human longevity, medical advances against once fatal diseases (e.g. AIDS), and the increasing prevalence of chronic illnesses (Thrall, 2005), a paradigm shift in the organization and delivery of the health care system (i.e. medical homes) is required.

While there is some consensus on the definition of a PCMH, there are no agreed upon methods to measure this phenomenon quantitatively. The consensus of the AAP definition has strengthened the operationalization of the concept, but the measurement has been largely open to interpretation (Bethell, Read, and Browood, 2004). Bethell and colleagues outlined five challenges in standardizing AAP measures in children. These challenges, are consistent across populations are: 1) inadequate empirical information relating to absolute and relative costs/benefits of features of medical homes; 2) deficient numbers of datasets that are comparable with respect to measuring specific components of medical homes; 3) uncertainty over AAP measure/definition of medical home (e.g. ongoing source of care); 4) identifying concepts and validation of these measures; and 5) designation of a specific measure's creation, scoring and grading methods (Bethell, Read and Browood, 2004).

While there is a rapidly growing body of opinion-driven literature on medical homes, there exist significant gaps regarding standard measures that recognize all of the components of the AAP definitions of a medical home. Some empirical evidence is available to indicate the value of individual features of the patient-centered medical home concept (e.g. accessibility and coordination of care has been found to be associated with better preventive care), but few studies examine the combined effects

of the medical home features. With the growth of proponents, it is imperative that the field moves forward by identifying reliable and valid indices in order to test this concept.

This study seeks to address several of the challenges identified by Bethell et al. (2004) by using a nationally representative dataset to complete a psychometric analysis of the proposed index and evaluating the impact of combined effects of the key attributes of PCMH that may influence the care of eight of the most common chronic conditions (diabetes, asthma, high blood pressure, chronic obstructive pulmonary disorder, stroke, depression, arthritis, and heart disease) in primary care. Additionally, this study also seeks to further the discussion on levels of medical homeness.

Study Objectives

The primary objective of this study is to quantify the impact of medical homes on health care use and expenditures among individuals living with chronic diseases. The specific objectives are:

1. To ascertain the psychometric properties of a medical home index (MHI) and its applicability to adults living with chronic conditions.
2. To determine which variables are associated with high scores on the MHI.
3. To determine among individuals living with chronic diseases whether respondents in medical homes have less expenditure and better utilization than similar individuals whose medical care is not managed in a medical home model.
4. To evaluate whether the effect of medical homes on outcomes varies for different chronic conditions.

CHAPTER 2
LITERATURE REVIEW

The burgeoning growth in chronic illnesses is driven by many factors, some of which include advances in the fields of public health, bacteriology, immunology and pharmacology that have led to declines in mortality associated with acute diseases. Today, diseases and injuries that were once life threatening have become chronic in nature (e.g. HIV/AIDS) (Lubkin and Larsen, 2006). Additionally, concerns over the aging of the Baby Boom generation (the first reaching age 65 in 2011) have resulted in an ongoing debate as to the impact on the growth in chronic illnesses and our health system's capacity to meet this ever increasing need (Lubkin and Larsen, 2006). Issues associated with aging and chronic diseases are not uniquely American; they have become a major global public health imperative and all health care systems experience significant challenges in providing optimal care to these individuals.

In the proposed study, eight of the most prevalent and costly chronic conditions, stroke, diabetes, asthma, chronic obstructive pulmonary disorder (COPD), depression, arthritis, heart disease, and high blood pressure, will be examined. These conditions represent the leading causes of mortality and morbidity in the United States. According to the CDC, the six leading causes of death in 2005 were heart disease; cancer; stroke; COPD; unintentional injuries, and diabetes respectively (CDC, 2009). Further, most persons with these conditions are managed in primary care settings. However, most individuals with high blood pressure (Chobabian et al., 2003b), diabetes (Saydah et al., 2004), asthma (Legorreta et al., 2000), and other conditions are poorly managed.

Challenges for the Delivery System and Primary Care

High-quality ambulatory care is well established in the literature as the hallmark of an effective and efficient health care system (Rittenhouse and Shortell, 2009; Bodenheimer and Grumbach, 2007; Starfield, Shi, and Macinko, 2005; Starfield and Shi, 2002; Grumbach et al., 1999; Donaldson, 1996; Starfield, 1994). However, our present health care system is structured toward providing acute episodic care and is challenged to improve the care of individuals with chronic conditions (Commonwealth Fund, 2008; Rittenhouse et al., 2008; IOM, 2001a). Those individuals must often seek care from multiple providers across vast distances with minimal communications and coordination in a system that is not incentivized to integrate (Wegner, Antonelli, and Turchi, 2009). Nevertheless, the acute episodic orientation of our current model continues to lag behind demographic trends of increasing chronic illnesses (Lubkin and Larsen, 2006; Andersen and Knickman, 2001; Wagner, Austin, and Von Kurff, 1996).

Moreover, the evidence supports that the majority of chronic care is delivered in an ambulatory setting that is often inadequate, as shown in studies addressing high blood pressure (Chobanian, Bakris et al., 2003a, 2003b), diabetes (Steinbrook, 2006; Saydah, Fradkin, and Cowie, 2004), congestive heart failure (Masoudi, Havranek, and Krumholz, 2002; Ni, Nauman, and Hershberger, 1998), chronic artial fibrillation (Matchar, Samsa, et al., 2000; Samsa, Matchar et al., 2000), asthma (Patel,Welsh, and Foggs, 2004; Adams, Fuhlbrigge, et al., 2002; Legorreta, Liu et al., 2000), and depression (Kessler, Demler, et al., 2005; Young, Klap, et al., 2001; Simon, Lin, et. al, 1995).

There is consensus pertaining to what comprises high quality chronic care (Wolff and Boult, 2005; Bodenheimer, Wagner and Grumbach, 2002a, 2002b; Wagner, Austin, and Von Kurff, 1996). More than a decade ago Wagner and associates outlined the

common components of high quality chronic care as utilization of clear treatment plans and protocols; practice reorganization that addresses the needs of consumers that require more time and sustained follow-up; emphasis on information and behavioral change of consumers; open access to required expertise; and supportive information systems (IOM, 2001; Wagner, 1998; Wagner, Austin, and Von Kurff, 1996).

Likewise, the IOM stresses that effective chronic care, distinct from acute episodic care, should be a collaborative process that includes optimal communication for the provision of self-management training and decision support, sustained relationships that guarantee active and continuous follow-up to meet clinically targeted goals, and coordinated care (IOM, 2001a). All of which add considerable layers of complexity that the current system is not structured to deliver (IOM, 2001a; Von Korff, Gruman et al., 1997).

Further confounding this issue is the demand placed on primary care providers to deliver chronic care in a system that is organized around a typical 15 minute visit (Bodenheimer and Grumbach, 2007). Providers regularly experience time constraints in managing the consumer needs (acute care, chronic care, and preventive services) (Fiscella and Epstein, 2008; Bodenheimer and Grumbach, 2007; Braddock, Edwards, et al., 1999). It is estimated that for a typical panel of 2,500 patients, it would take approximately 10.6 hours per day for a physician to thoroughly manage common chronic diseases. Prevention would consume another 7.4 hours per day (Ostbye, Yarnall, et al., 2005; Yarnall, Pollak, et al., 2003).

As a result of these time constraints, informed decision-making is limited (Fiscella and Epstein, 2008; Braddock, Edwards, et al., 1999), providers' ability to confirm that

patients understand directions is compromised (Fiscella and Epstein, 2008; Braddock, Fihn, et al., 1997), and any discussion concerning adverse medication effects and cost is typically omitted (Fiscella and Epstein, 2008; Tarn, Paterniti, et al., 2006; Tarn, Heritage, et al., 2006). Many observers have concluded that the existing organization of ambulatory care is unsustainable (Bodenheimer and Grumbach, 2007).

The current organization of the health care delivery system in the United States is complicated and fragmented with processes that are characterized by inefficient use of resources and inadequate access to care (Block, 2006). This fragmentation is considered the underlying cause of some of the current shortcomings (Stange, 2009; Shih et al., 2008). The fragmentation of the system results in interruption of longstanding relationships, inadequate information flow, and uneven incentives that collectively degrade the quality of health care in a significant manner (Cebul, Rebitzer, et al., 2008).

Additionally, consumers find that navigating the system poses significant challenges. The chronically ill require comprehensive and appropriate services but the system lacks the necessary coordination of the many unrelated delivery and financing systems (Lubkin and Larsen, 2006; Andersen and Knickman, 2001). Sofaer (2009) asserts that navigation challenges are vastly underestimated.

It is well accepted that to improve chronic care, the ambulatory care system needs to be reformed (Bodenheimer, Wagner, and Grumbach, 2002; IOM, 2001a; Wagner, 1998). In the IOM's Crossing the Quality Chasm report there are calls for fundamental reforms to the general health care system to improve the overall quality of care (IOM,

2001a). Further, this report concluded that "*The current care systems cannot do the job. Trying harder will not work. Changing systems of care will*" (IOM, 2001a, p.4).

Today's reform concepts emphasize enhancing access to care, while steadily reengineering the health care system to deliver consistently high quality care, and at the same time, containing costs (Rittenhouse and Shortell, 2009). The Patient-centered Medical Home model developed by the AAP has gained significant traction. This model was originally designed to meet the care coordination needs of primary providers and special needs children (Sia et al., 2004). It has evolved to become an approach for delivering comprehensive ambulatory care for all Americans of all ages and medical disorders (Commonwealth Fund, 2008a). The model's primary objective is to provide access to teams of ambulatory care providers that address the consumer's needs at reduced cost (Fiscella and Epstein, 2008; Rosenthal, 2008).

The concept of medical homes was first offered over forty years ago. It was introduced in the book, "Standards of Child Health Care" (1967), published by the AAP's Council on Pediatric Practice (COPP). The original definition of a medical home represented the primary source of a child's medical records, emphasizing its fundamental role as the domicile of medical records for CSHCN. The impetus behind the development of this concept that was the COPP was growing concerned about the inefficiencies in health care services that they attributed to gaps in communication and lack of care coordination. However, the book was not an AAP policy statement and the medical home concept was not addressed as policy until the 1970's (Sia et al., 2004; American Academy of Pediatrics, Council on Pediatric Practice, 1967).

In 1974, following a COPP policy development meeting, a statement entitled "Fragmentation of Health Care Services for Children" recommended that every child deserved a medical home. The original draft stressed the importance of a centralized medical record depository and the advocacy role of the pediatrician to ensure continuity of care without financial and social barriers. Following this policy statement, it was suggested that the term "medical home" on forms and questionnaires replace all terms such as "family physicians", "pediatricians", or "personal physician" (Sia et al., 2004; American Academy of Pediatrics, Committee on Standards of Child Health Care, 1977).

Today the vast majority of Americans desire a medical home (Bodenheimer and Grumbach, 2007; Grumbach and Bodenheimer, 2002). Primary care by definition should serve as a patient-centered medical home (Bodenheimer and Grumbach, 2007; Donaldson et al., 1996). According to the IOM's report entitled "*Primary Care: America's Health in a New Era"* the critical elements of primary care include care provided by primary care clinicians; accessible and integrated services; accountability to a primary care clinician and system that maintains high quality care, patient satisfaction, efficient use of resources, ethical behavior; comprehensive services; sustained partnerships between provider and patient; and care in the context of the family and the community (Donaldson et al., 1996).

Hibbard and Weeks (1987) assert that a consumer is someone who is engaged in his/her care and care decisions, makes independent judgments about a provider's advice, and inquires about alternative information. Implicit in the definition of a medical home is that the individual is a consumer. This research accepts this notion and refers to patients as consumers.

Patient-centered Medical Home

The Patient-centered Medical Home (PCMH) model was established to coordinate the care of consumers by a personal physician working in conjunction with a multi-disciplinary team based on the needs of the individual consumer (Grumbach and Bodenheimer, 2002). A team could include a specialist, midlevel providers, nurses, pharmacist, dietitian, care managers, social workers, and physical and occupation therapists as well as members of the family (Rosenthal, 2008; Barr. 2006). Additionally, success depends on a team's ability to focus on the consumer's needs on a case by case basis, enlisting both medical and social services as required (Lantz, Lichtenstien and Pollak, 2007).

The published AAP definition of medical homes describes thirty-nine core components that summarize health care that is accessible, family centered, coordinated, comprehensive, continuous, culturally competent, and compassionate (American Academy of Pediatrics, 2002). The stated expectation of a mature medical home is the patient-centered integration of both medical and psychosocial services (Rosenthal, 2008; Enthoven, Crosson, and Shortell, 2007).

Key Attributes of Medical Homes

In 2002 the American Academy of Pediatrics expanded the PCMH model and by 2007 a white paper was issued by the AAP, AAFP, ACP, and the AOA outlining the following joint principles of the patient-centered medical homes (AAFP, 2007).

Personal Physician: PCMH proposed to establish an ongoing relationship with a personal physician, who is required to make first contact, and provide comprehensive and continuous care (Barr, 2006). The essence of this care model is the physician's

ability to communicate with the consumer and accurately interpret his or her story (Rosenthal, 2008).

Physician-Directed Team Approach: Effective chronic care is typically conducted through multi-disciplinary groups that include non-physician members. This approach strengthens the team's capacity by involving clinicians with expertise in self-management techniques and fine-tuning of therapeutic protocols. Such an approach is vital to the success of the care delivered (Norris et al., 2002; McAlister et al., 2001).

Whole Consumer Orientation: This concept represents an approach that delivers or arranging for all of the health care needs of the consumer across the health care continuum (Rosenthal, 2009).

Coordinated Care: In the IOM's Crossing the Quality Chasm (2001a), care coordination is highlighted as critical to care across services and to patient safety. The design of our current system can be effective in managing a single health concern but for the chronically ill consumer with multiple comorbid conditions, a medical home will function as a strategic access manager (Rosenthal, 2009). The literature suggests that 90 percent of patients in primary care have on average two complaints. Additionally, a PCP on average manages 3.05 problems per encounter, and these numbers increase significantly in older consumers (Fontin et al., 2005).

Quality and Safety: The PCMH model is committed to delivering care that emphasizes scientific excellence. The implementation of information technology, increased patient-provider communication, shared decision-making, and culturally sensitive care are all elements that help position the PCMH for high quality care.

Enhanced Access: The IOM's Crossing the Quality Chasm has highlighted timeliness of care as a critical area for improvement (IOM, 2001a). Research suggests that improvement in timeliness of care can be achieved with the implementation of modified access models (e.g. open access or same day scheduling) proposed in the PCMH model (Harkinson and Bluenfrucht, 2006; Schall, Duffy, et al., 2004; Murray et al., 2003).

Payment Reform: The PCMH model proposes a payment structure that merges FFS, pay-for performance (P4P), and additional payments for care coordination or integration of services. This is a deviation from the current reimbursement model, which is biased toward procedures and does not adequately pay for care coordination, care management, and non-traditional medical consultation.

Measuring the Quality of PCMH

Multiple indices exist to measure the degree and manner in which a practice achieves various indicators of being a true medical home. In addition, there are several instruments available to collect and retain data thus allowing the measurement of medical home attributes. Those developed by the Center for Medical Home Improvement (CMHI) and the National Committee for Quality Assurance (NCQA) are particularly well documented.

CMHI has proposed three indices to assess medical homes in primary care practices: The Medical Home Index; The Medical Home Index-Short Version; and The Medical Home Family Index. Provider practices utilize these validated self-assessed tools to evaluate the following dimensions of medical homes: accessibility, family centeredness, continuity, comprehensiveness, care coordination, compassionate care, and cultural effectiveness (Center for Medical Home Improvement, 2006).

The NCQA instrument is called the Physician Practice Connection-Patient-Centered Medical Home (PPC-PCMH) program. Its dimensions are in line with the principles established in the white paper noted previously. Its two objectives are to evaluate practice functionality and distinguish providers who deliver a high standard of care (NCQA, 2008). PPC-PCMH is designed to endorse and assess nine practice standards: 1) access and communication, 2) patient follow-up and registry, 3) care management, 4) patient self-management support, 5) electronic prescription capabilities, 6) test tracking, 7) electronic communication, 8) performance improvement and reporting, and 9) referral tracking. In order for a practice to attain the status of a PCMH, at least 25 of 100 points must be achieved and at least 5 of the 9 must pass elements listed above (NCQA, 2008).

According to NCQA, there are four levels of medical homeness. At the minimum level (1) practices must pass 5 of the 9 elements listed above. In other words, practices must attain a 50 percent performance score for the elements. Level of medical homeness is listed below (Table 2-1).

Four Cornerstones of PCMH

Rittenhouse and Shortell (2009) highlight four elements of the PCMH model. They suggest that there are four cornerstones: primary care, patient-centeredness, payment reform, and new-model practice. While each cornerstone is necessary for the success of the PCMH model, each presents significant implementation and management challenges.

Primary Care

According to the IOM, primary care “is the provision of integrated, accessible health care services by clinicians who are accountable for addressing a large majority of

personal health care needs, developing a sustained partnership with patients and practicing in the context of family and community" (Donaldson et al., 1996, p.31). Furthermore, Starfield's (1992) seminal work pointed to primary care as having a central role and described it as "first-contact, continuous, comprehensiveness and coordinated care provided to populations undifferentiated by sex, disease or organ systems". The PCMH model is consistent with both definitions (Rittenhouse and Shortell, 2009).

Decades of research have confirmed the importance of primary care providing improved outcomes at lower cost (Rittenhouse and Shortell, 2009; Bodenheimer and Grumbach, 2007; Starfield, et al, 2005; Starfield and Shi, 2002). Second, because the majority of chronic care is delivered in primary care practices, any improvement initiatives should start there (Anderson-Rothman and Wagner, 2003). Consumers value having providers who are whole person focused, amenable to communication with and have the ability to coordinate care across the medical landscape (Anderson-Rothman and Wagner, 2003; Gittell et al., 2000; Shortell, et al., 2000).

Notwithstanding the benefits primary care offers, it is also well established that primary care in this country is facing a crisis (Goodman and Fisher, 2008; Bodenheimer and Grumbach, 2007; Moore and Showstack, 2003). Some experts argue that PCMH can provide some hope to primary care practitioners through advocacy, as a source of confidence, and providing a level of coordination to consumers that is currently lacking. Other barriers in primary care include growing dissatisfaction among providers, waning interest, inadequate reimbursement, inconsistent quality of care delivered, access challenges and increasing demands on length of visits (Bodenheimer and Grumbach, 2007).

The undervaluing of primary care is believed to be linked to a questionable future supply of the primary care physician (GAO, 2008). General practitioners in this country prior to the middle of last century were the most common type of physician (Moore and Showstack, 2003). Since then, the growth in specialization has led to reductions in the number of medical graduates interested in family medicine (Bodenheimer and Grumbach, 2007; Moore and Showstack, 2003). The 2005 national resident matching report found that the proportion of US medical graduates selecting family medicine residency declined from 14% in 2000 to 8% in 2004 (Pugno et al., 2005).

A growing body of literature now suggests alternatives to primary care should be considered (Anderson-Rothman and Wagner, 2003). Advocates maintain that shifting chronic care from primary care to specialty care is necessary because specialists possess more information pertaining to the management of a given condition that is associated with that specialty. Proponents for this shift advocate that specialists would be more likely to adhere to diagnostic and treatment protocols (Smetana et al., 2007; Harold, Field, and Gurwitz, 1999). They also assert that specialists are more likely to make decisive practice changes to adjust to new scientific developments (Anderson-Rothman and Wagner, 2003). Opponents maintain that shifting chronic care to specialists will result in significant reduction in preventive care (Lafata et al., 2001; MacLean et al., 2000; Rosenblatt et al., 1998); decreased efficiency and increased cost; and neglect of other comorbid conditions (Anderson-Rothman and Wagner, 2003).

Proponents of medical homes have suggested that the PCMH model should bring some degree of resolution to the crisis that primary care is currently facing by providing

financial incentives through payment reform efforts (Rittenhouse and Shortell, 2009; Berenson et al., 2008; Rubenstein, 2008).

Patient-Centered Care

The IOM (2001b) recommends patient-centeredness in the management of chronic conditions. Patient-centered care is health care that establishes a partnership among practitioners, patients, and their families (when appropriate) to ensure that decisions respect patients' wants, needs, and expressed preferences and that patients have the education and support they need to make decisions and participate in their own care. It is also indicated as an important dimension of health care quality. As such, patient-centeredness incorporates “qualities of compassion, empathy, and responsiveness to the needs, values, and expressed preferences of the individual patient" (IOM, 2001a).

Patient-centered care involves active engagement of consumers in their health care experience. This encompasses a partnership approach with optimal levels of patient-provider communications, as well as significant levels of shared decision-making (Rittenhouse and Shortell, 2009). Such an approach represents a major cultural shift as it places patients in the center of the health care system, views consumers as active participants in their care, and expands access to providers through less traditional methods, such as internet or “electronic visits” (Rittenhouse and Shortell, 2009).

Payment Reform

In the United States, fee-for-service (FFS) is the predominant means of physician remuneration (Bodenheimer and Grumbach, 2007). The PCMH model proposes a payment structure that merges FFS, pay-for-performance (P4P), and additional payment for care coordination or integration of services. The current reimbursement

model is biased toward procedures and does not adequately pay for care coordination, care management, and non-traditional medical consultation.

This model calls for monetary credit for case mix differences, uptake and utilization of health information systems, and attainment of quality improvement targets. Highlighting the remuneration for case mix differences is particularly salient for providers delivering care to consumers living with chronic conditions (Rittenhouse and Shortell, 2009; Berenson et al., 2008; and Goroll et al., 2007). The existing reimbursement scheme incentivizes primary providers to deliver as many services as possible with minimal accountability. As a result, there are reductions in timely access to appointments and constraints on the length of time per visit (Bodenheimer and Grumbach, 2007).

It is anticipated that the proposed PCMH model of reimbursement will appeal to PCPs and result in abatement of workforce shortages (Pugno et al., 2005), improve adoption of health information technology (Berenson et al., 2008), enhance access to care (Bodenheimer and Grumbach, 2007), and improve compensation for quality chronic care (Goroll, et al., 2007). Proponents of the PCMH also assert that if this model is sufficiently supported it could result in reduction in waste (Berenson et al., 2008; Goroll et al., 2007).

New-Model Practice

The final cornerstone of medical homes is the new-model practice. This concept signifies a different approach to the “business as usual” delivery model (Rittenhouse and Shortell, 2009). The vision for this model has its roots in the IOM’s Crossing the Quality Chasm (IOM, 2001a). Its pillars are the four traditional concepts of primary care: first-contact, continuity of care over the lifespan, comprehensive care, and care

coordination (Bodenheimer and Grumbach, 2007). This new-model practice emphasizes evidence-based health care that builds on patient safety and quality improvement research completed decades ago (Rittenhouse and Shortell, 2009).

Following the launch of the 2002 Future of Family Medicine, the New-practice concept introduced a number of principles including personal medical home, adoption of patient-centered teams, eradication of access barriers, implementation of health information systems and practices focused on quality and patient safety (Future of Family Medicine, 2004). Each requirement adds its unique benefits and barriers to the implementation of the PCMH.

First, it is noted that the most significant challenge to this model in the US is the lack of infrastructure necessary for implementation (Rittenhouse et al., 2008). Evidence suggests that early implementers of the model are typically in very large group practices (i.e. >140 physicians) that belonged to even larger organizations with substantial resources. Friedberg and colleagues, in their 2007 study of thirteen structural capabilities of the Massachusetts Health Quality Partners, observed that larger practices were significantly associated with a greater number of structural capabilities (9 of a possible 13) when compared to smaller practices. Similarly network affiliated practices were more likely than their non –network affiliated counterparts to have 5 of 13 capabilities (Friedberg et al., 2009).

The second requirement is the formation of patient care teams. Starfield (1992) defines a patient care team as a group of various clinicians who communicate routinely to deliver the best possible care for a defined group of individuals (Wagner, 2000). The team approach is necessary to ensure that physicians meet all the evidence-based care

within the typical 15 minute visit (Bodenheimer and Grumbach, 2007). The delegation (e.g. completion of disease severity survey) of assignments ensures that all tasks are completed.

Moreover, optimal chronic care is generally conducted by a multi-disciplinary group that includes non-physician members (e.g. nurses and pharmacists). An approach that strengthens the team's capacity, by involving clinicians with expertise in self-management techniques and the ability to fine-tune therapeutic protocols, is vital to the success of the care delivered (Norris et al., 2002; McAlister et al., 2001). Multiple studies support the efficacy of the team approach for several chronic conditions, such as arthritis, diabetes and depression (Anderson-Rothman and Wagner, 2003).

The efficacy of teams is not without its challenges, however, team size (Shortell et al., 2004; Cohen and Bailey, 1997) and costs of communication systems (Barr, 1995) are inherent disadvantages (Bodenheimer and Grumbach, 2007). Cohen and Bailey (1997) observed a U-shaped relationship between team size and effectiveness. In a more recent study, Shortell and colleagues found that greater team size was negatively associated with perceived effectiveness (Shortell et al., 2004).

Elimination of access barriers is the third new-practice model requirement. In the IOM's *Crossing the Quality Chasm*, timeliness to care was listed as a critical area for improvement (IOM, 2001a). The ability to get needed care in this country has failed to improve in recent years (Strunk and Cunningham, 2002). Further, almost half of emergency department visits are for non-urgent purposes, indicating an inability to access primary care in a timely manner (Cunningham et al., 1995).

The final component to the implementation of the new-practice model is the adoption and use of health information systems. Proponents envision an almost paperless practice with electronic medical records (EMR) that possess interface capability to diagnostics, hospitals, specialists, and pharmacies (Bodenheimer and Grumbach, 2007).

These systems can provide significant advantages to providers: convenience, improved accessibility, enhanced accuracy of consumer information (Bodenheimer and Grumbach, 2007), and improvement in a clinician's ability to implement therapeutic protocols (Borowitz et al., 2007; Garg et al., 2005). Adoption of EMR has significant implications to the success of medical homes (Schoen et al., 2007).

Nevertheless, adoption of EMR in this country has lagged behind other industrializes nations (Schoen et al., 2007). In the 2007 Commonwealth Fund Survey, that examined the use of electronic medical records in primary care of seven industrialized nations, it was observed that the US was sixth of seven nations at 28% when compared to countries such as the Netherlands at 98%, New Zealand at 92%, and the UK at 89%. Policy-makers have recommended a renewed commitment to a national focus on building the informational infrastructure (IOM, 2001a).

Clearly, EMR are also faced with challenges. The most cited disadvantage is the cost associated with system implementation. In a study of solo and small primary care practices in 12 states, Miller and colleagues (2005) observed that, on average, the startup cost of EMR was $44,000 per full-time physician and ongoing costs stood at around $8,500 per year per physician. However, despite the large financial

commitment, they concluded that EMR benefited the practices on average $33,000 per year per physician through increased accuracy in billing and coding.

Evidence Supporting Patient-Centered Medical Home

The PCMH model and its assessment are complicated by the numerous outcomes that are anticipated by multiple stakeholders. As the model evolved and gained acceptance, each stakeholder has carved out a belief that PCMH will be the answer for specific outcomes. Dubard (2009) asserts that for patients and providers, the desired outcome of interest is patient satisfaction. Public health stakeholders are eager for goals with a wider scope. Improvement in the quality of care for a given population should translate into changes in population-level health indicators and the reduction or elimination of racial and ethnic disparities (Dubard, 2009).

Additionally, administrators and policymakers are focused on decreasing superfluous health services utilization, reducing the need for expensive care, resulting in cost containment and savings. Public programs like Medicare are interested in generating fiscal savings while maintaining provider payment rates and patient enrollments. Finally, professional guilds and societies are concerned with raising interest in primary care and redirection of resources to a system that is struggling for financial viability (Dubard, 2009).

With these desired outcomes in mind, multiple demonstrations are ongoing to assess the feasibility of the PCMH model. The evidence substantiating the PCMH model remains limited because most models are in their formative stages (Cooley et al., 2009; Reid et al., 2009; Cooley, 2004). However, early reports of demonstrations (e.g. National Demonstration Project and Group Health Seattle Clinics) provide positive insights, such as increased preventive care, and chronic disease management, which

translates into better self-care, reductions in hospitalizations and readmissions, decreases in emergency department visits, significant improvements in racial and ethnic disparities, enhanced patient experiences, greater efficiencies realized, and major cost savings.

The increased reform efforts have highlighted an important issue, value, which describes the level of quality in relationship to cost in health care. Medical homes propose to increase the value of care. While everyone demands value from the delivery system, individuals living with chronic illness are particularly invested. The consumer who benefits most from quality care is typically the one who uses the majority of the resources (Nelson et al., 1998).

Prevention in disease management is important because it can be cost-effective and results in significant cost savings (Russell, 2009). The Community Care of North Carolina (CCNC) medical home demonstration was launched in 2006 by the American Academy of Family Physicians to evaluate the model. The asthma initiative, one of the first programs implemented, experienced a 112 % increase in the number of asthmatics receiving influenza vaccination (Nutting et al., 2009). The Marillac Integrated Care demonstration, which merged medical and behavioral care, reported greater emphasis in prevention and early intervention (Hurd, 2008). In North Dakota, there was an 18% increase in the proportion of consumers who received the five recommended diabetes care indicators (ambulatory visit, HbA1C, eye test, lipid exam, and micro albumin test) compared to the control clinics (McCarthy et al., 2008).

Medical homes were also found to be associated with increases in chronic care management. A 2009 study, which examined the impact of medical homes on special

needs children in seven health plans across five states and the District of Columbia, found an increases in chronic condition management (asthma, diabetes, cerebral palsy, epilepsy, attention deficit / hyperactivity and autism), which led to a reduction in the number of emergency visits (Cooley et al., 2009). In a 2009 study, Reid and associates examined the differences between patients' experiences in PCMH compared to standard care. After controlling for case mix differences, they observed that consumers in PCMH clinics were more likely (RR = 2.16) to attend peer-led self-management workshops (Reid et al., 2009).

The PCMH model is associated with reductions in the rates of hospitalizations (Hurd, 2008; Cooley et al., 2009; Nutting et al., 2009). Nutting and colleagues' evaluation of the North Carolina demonstration found that asthmatics that accessed care at their PCMH model experienced a 34% decrease in the rate of hospitalizations during the first year of the study and this lower rate was sustained the following year (Nutting et al., 2009). This trend was also observed in Washington State, where PCMH clinic consumers recorded an 11% reduction in rates of hospitalizations for ambulatory care sensitive conditions. However, Reid and colleagues (2009) did not observe significant differences in all-cause inpatient admissions. With respect to special needs children in medical homes, researchers were able to conclude that medical homes were significantly and negatively associated with hospitalizations (Cooley, 2009). Further, the North Dakota demonstration reported a 6% reduction in the rate of hospitalization the first year (McCarthy et al., 2008).

PCMH is negatively associated with non-urgent ER visits. Multiple demonstrations have reported significant reduction in ER visits. The North Dakota demonstration observed a 24% fall in the number of visits to emergency departments (McCarthy et al., 2008). Marillac Integrated PCMH recorded a 13% decrease in individuals accessing care in the ER (Hurd, 2008). Reid and associates in western Washington State observed that consumers in their PCMH clinics reported significantly fewer (29%) ER visits when compared to their counterparts in traditional clinics (Reid et al., 2009). Blue Cross Blue Shield demonstrations also reported a 24% reduction in ER visits. Additionally, Nutting and colleagues found that asthmatic children in medical homes experienced an 8% decrease in ER visits in the first year (Nutting et al., 2009). In a low income population in California, Roby and colleagues (2010) observed reduction in the odds of ER visits as length of enrollment (months) in PCMH increased ($OR = 0.96$, $p < 0.05$). However, there were increased odds ($OR = 1.38$, $p < 0.05$) in ER visits when consumers reported three or more medical home enrollment changes. (Roby et. al, 2010)

Racial and ethnic disparities are an important threat to health care quality. A key outcome of the medical home model is the mitigation of disparities. The PCMH model depends on its core feature of patient-centeredness, while enlisting other medical and social resources to deal with the challenge (Lantz, Lichtenstein, and Pollack, 2007). A 2007 Commonwealth Fund report suggested that medical homes are associated with improved access to care, reduction in racial and ethnic disparities, and increased care coordination. In medical homes, minorities were just as likely as their white counterparts to get needed care, preventive screening, and have their chronic

conditions adequately managed (Beal et al., 2007). The PCMH model could have significant positive implications for historically disadvantaged groups, such as racial and ethnic minorities, the medically underserved, those with low income, and the uninsured.

Finally, this model is associated with vital cost savings during a time when medical costs are burgeoning. Here again, multiple demonstrations have recorded significant cost savings. The Mercer evaluation of the North Carolina demonstration (using conservative estimates) reported cost saving to the state of $60 million in fiscal year 2003 and, by 2006, a total savings of $161 million. More generous estimations place the cost saving to the state at $300 million in 2006 (Nutting et al., 2009). The Marillac demonstration observed an annualized savings of $685,539 (between January 2003 and April 2004). These savings were a result of reduction in duplications and medical complications (Hurd, 2008). McCarthy and colleagues (2008) found in 2005 the total cost per member per year fell by $530, which translated into savings of $102,000 for 192 consumer slots. Conversely, Reid et al. (2010) did not find a statistically significant overall cost difference between medical homes and their non-medical home counterparts.

Early demonstration results point to considerable positive outcomes that may offset the substantial initial financial start-up cost. According to the Deloitte Report, initial costs are high for the PCP; it requires a one-time investment of approximately $100,000 and ongoing expenses would increase this to about $150,000. They suggest that risks for hospitals (possessing an extensive primary care network) are moderate. This report estimates a reduction in hospital revenue with a 10% decrease in hospitalizations and a 20% reduction in ER visits (Keckley and Underwood, 2008). The

literature is devoid of any return-on-investment studies, as most of the demonstrations are still ongoing. Notwithstanding the size of the financial commitment, Keckley and Underwood concluded that it is their opinion that medical homes could pay for themselves.

While hard data for this model is relatively new, each of the key attributes of PCMH has been tested extensively in the literature and supports positive medical and fiscal outcomes. Because the PCMH model is a combination of these beneficial attributes, it is not surprising that stakeholders are excited at the prospects of medical homes. Below is a brief survey of supporting literature for each key attribute.

Usual Source of Care

According to the Agency for Health Care Research and Quality (AHRQ), usual source of care (USC) is defined as a particular doctor's office, clinic, health center, or other place where an individual regularly visits if he or she is ill or requires advice about personal health matters (AHRQ, 2001).

This concept is extensively discussed in the literature and suggests that having a USC improves access to timely care, and quality of care and results in significant improvements in health status (Blewette et al., 2008; Starfield and Shi, 2004; Xu, 2002). Absence of a USC leads to disruption in continuity of care and imposes major barriers to the receipt of needed care. Previous research has shown that a USC is comparable to insurance in that it facilitates timely access and sufficient receipt of needed care (Xu, 2002).

With respect to utilization of services (hospitalization, ER visits), having a USC has been shown to have a significant inverse relationship. Gill and Mainous (2000) evaluated continuity of care in Delaware for a period of one year using claims data.

They examined the ER visits of individuals with a usual provider over the study period. This study found significant lower odds (0.82) of a single ER visit and even lower odds (0.56) for multiple ER visits when the enrollee visited a single provider over the duration of the study (Gill and Mainous, 2000). Similarly, Ryan and colleagues (2001) recorded that having a usual provider was a consistent predictor of all types of ambulatory care, as well as reduced utilization of emergency room services. Further, Falik et al. (2001) observed that Medicaid recipients, who utilized Federally Qualified Health Centers and who reported having a regular source of care, had lower odds for preventable hospitalizations than their counterparts. DeVoe and colleagues (2007) observed that having both insurance and USC was associated with increased prevention. Additionally, the Blewette et al. (2008) study using National Health Interview Survey (NHIS) found that having USC (provider and site) were consistent with improved preventive activity.

There is also growing evidence that researcher can differentiate between having a regular doctor compared to having a regular site. A study by Xu (2002) observed that having a usual physician was more important than having a usual site for receipt of preventive screenings (e.g. blood pressure and cholesterol).

Despite strong evidence supporting a USC and continuity of care, the financing structure of our system has been in conflict with the consumer's ability to maintain a long standing relationship with his/her provider. This divergence has undermined continuity of care in many ways, which may include managed competition, which promotes employer and consumer decisions made on market-based principles; provider-health plan contractual changes; and proliferation of urgent care systems and increase in carve-out services (Donaldson, 2001). The PCMH model seeks to address

these issues by proposing a continuous relationship with a personal provider directing a team of providers.

Continuity of Care and Outcomes

According to the IOM definition, this concept relates to the sustained partnership that exists between provider and patient (Donaldson et al., 1996). Other definitions include Starfield's (1992 and 1994) longitudinality as long-standing patient-focused care. It is well documented that continuity of care is a core attribute of the quality of primary care and an essential component of an optimally performing health care system (Saultz and Albedaiwi, 2004; Donaldson, 2001).

Despite the fact that there is extensive literature on continuity of care some researchers have indicated that this has proven to be a difficult variable to measure and that rigorous assessment of the exact linkage between continuity and outcome prompt methodological challenges (Saultz and Lochner, 2005). This study references interpersonal continuity, which refers to continuity as a unique long-standing and ongoing personal relationship between the clinician and patient that is characterized by trust and responsibility (Saultz, 2003).

Nevertheless, there is an extensive body of evidence assessing the impact of continuity of care. For the most part this evidence indicates that establishing a sustained patient-provider partnership results in significant beneficial outcomes. In a 2005 literature review, Saultz and Lochner found forty studies examining interpersonal continuity and outcomes. Only five studies failed to report a significant association between interpersonal continuity and outcomes (Overland et al., 2001; Gallagher et al., 2001; Susman et al., 1989; Flynn, 1985; Roos et al., 1980). Twenty-three studies reported a positive relationship for all the outcomes (e.g. preventive active, cost, or

consumer satisfaction) studies and interpersonal continuity. This review found that the majority of the studies observed improved outcomes or lower cost (Saultz and Lochner, 2005).

Continuity is associated with significant increases in preventive care (Blewette et al., 2008; Xu, 2002; Devoe et al., 2007; Starfield, 1998); improved consumer satisfaction (Hurley, Gage and Freund, 1991); better medication and appointment compliance (Garrity et al., 1998), enhanced recognition of the patients' needs, lower rates of hospitalizations, reduced use of emergency room, and less intensive medical care (Saultz and Lochner, 2005; Guthrie and Wyke, 2000; Forrest and Starfield, 1998).

Moreover, vulnerable populations (e.g. the chronically ill or individuals with low income) who typically require a greater degree of continuous care were found to have disproportionately lower rates (DeVoe, 2008). Nutting and colleagues (2003) in a multi-method cross sectional study observed that older persons, females, individuals with lower educational attainment, low income, and consumers with multiple chronic conditions reported significantly higher value in care continuity.

The PCMH model endorses both USC and continuity of care and is expected to result in improvements in preventive care, increases in physician trust, enhanced medication compliance, and significant improvement in medical and fiscal outcomes.

Care Coordination and Outcomes

Coordination, as defined by Starfield (1994), implies an electronic information system that contains patient information. More recently Starfield (1998) expanded the definition to include ease of information use about prior problems and services, as well as an appreciation of this information as it relates to current care. This expanded

definition of coordination places the PCP in the context of a focal care person who makes referrals and tracks all the care received by an individual.

Due to the fragmentation of our system, care coordination is especially important to the chronically ill because they typically use more hospital care, physician services, prescription drugs, and home health services than individuals who are not living with a chronic condition (Partnership for Solution, 2002). Additionally, individuals with multiple chronic conditions are often required to navigate our system with dissimilar components, making it more complicated to obtain necessary services. Negative navigation experiences may result in delays in needed services (Anderson and Knickman, 2001). The medical home proposes to correct this by establishing an ongoing relationship between consumers and providers, as well as ensuring coordination of care.

Studies suggest that improved coordination will result in improved quality of care and thereby cost savings as a result of reduction in unnecessary ER visits, hospitalizations or readmissions (Barry et al., 2002; Walsh et al., 2002; Liptak et al., 1998). Liptak and colleagues studied an intervention of a comprehensive program on special needs in Children's Hospital at Strong Memorial Hospital of the University of Rochester. They found a significant decrease in the average length of stay (83.9 to 10 days); mean annual admission decrease from 2,796 to 1,622; adjusted median hospital inpatient discharges declining from $26.1 to $14.6 million; and cost savings of $77.7 million for inpatient care (Liptak et al., 1998)

Additionally, Gordon et al. (2007) examined the impact of care coordination for children with special health care needs in a tertiary-care primary care partnership

model. This model assigned each participant with a PCP within the community and a special care needs program to assist the PCP, ensuring each child with medically complex needs a medical home. The care coordinators were available weekdays (8am-6pm) and served as the single point of contact at Children's Hospital of Wisconsin for PCPs and parents of special needs children. They observed a statistically significant reduction in the number of hospitalizations, number of hospital days, tertiary care charges and payments for patients enrolled in care coordinated programs. One consequence was an increase in the number of outpatient services (Gordon et al., 2007).

Similarly, Forrest and colleagues (2000) examined the effects of physician coordinated patient care for specialty referral and its impact on referring physician satisfaction. Their findings suggest that the referring physicians' satisfaction rating was significantly improved by feedback from specialists (telephone or letter). They also found that certain elements (patient history, treatment suggestions, follow-up plans, and co-management strategies) included in the specialist letter significantly increased the referring physician's rating of letter quality. They concluded that better coordination between referring physician and specialist achieves an increase in referring physician satisfaction and improves the referral completion. Improvement in the referral process may result in enhanced communication and collaboration between the PCP and the specialty provider (Forrest et al., 2000).

The implementation of PCMH model seeks to engage the PCP as a strategic manager for patients with the support of electronic medical records and this is expected

to significantly increase care coordination. The impact of this increase in care coordination in medical homes should result in multiple beneficial outcomes.

Provider-Patient Communication and Outcomes

Despite technological advances, patient-provider communication is critical to compassionate and competent care. This partnership is essential to accomplish the complex set of self-management behaviors (Golin et al., 1996). Successful physician-patient communication is "the means by which information is imparted between a source and one or more receivers: a process of sharing meanings and using a set of common rules" (Berry, 2007, p.1; Northouse and Northouse, 1998). Communication is a complex phenomenon that can also occur at multiple levels: intrapersonal, interpersonal, group, organizational, and technological. While, communication in a health care setting can be oral, written, or electronic, the interpersonal level is the hallmark of medical practice (Makoul, 2003).

Ong and colleagues (1995) argued that there are three purposes for patient provider communications: exchange of information; establishing a good interpersonal relationship; and decision-making as it relates to treatment. The primary purpose of communication is the mutual exchange of information: from patient to provider (e.g. medical history or symptoms) and from provider to patient (e.g. disease management). The exchange for the provider is imperative to ensure that the correct diagnosis and treatment are made to improve treatment adherence (Brown, Stewart, and Ryan, 2003; Ong et al., 1995). For the consumer, the exchange of information is vital to understanding the management of their disorder and comprehension of the provider's instructions (Ong et al., 1995). With the multi-disciplinary team approach to care it is envisioned that the exchange of information will be significantly increased. This

improvement should lead to greater self-management and adherence to treatment that will impact health outcomes.

Second, Roter and Hall (2006) argue that communication is the instrument through which interpersonal relationships are formed. Interpersonal relationships are considered a prerequisite for effective medical care. Patient-centered communications in medical homes provides an ideal approach that should result in an egalitarian relationship between the provider and the consumer where common ground is achieved (Ong et al., 1995). The literature confirms that achieving common ground, as it relates treatment, has been found to enhance patient adherence to treatment (Heisler, et al. 2003); improve patient satisfaction (Clever et al., 2008); reduce post-visit concerns; decrease referral rates; and increase efficiency (Stewart et al., 2000). The third purpose of patient-provider communication is shared medical decision-making (SDM). An expanded discussion on SDM follows below.

Additionally, the dynamics of communication and the quality of the relationship between patient and provider is associated with both health care expenditure and outcomes (Wallace et al., 2008; AHRQ, 2005). There is a growing body of evidence that suggests that the manner in which providers communicate with their patients can have considerable impact on patients' personal health behaviors and outcomes (Heisler et al., 2007; Finney-Rutten et al., 2006; Aston et al., 2003; Stewart et al., 2000; Stewart et al., 1999).

Improving awareness of patient-provider collaborations and shared management may have a significant impact in treatment adherence management in the chronically ill (Roter and Hall, 2006). Patient-provider communications have been shown to be

associated with improved quality of care as it relates to pain management, high blood pressure, high blood glucose, reduced recovery time, and improved emotional health and functional status (Smith et al., 2006; Stewart et al., 2000; Stewart et al., 1999; Stewart, 1995). Additionally, physician communication is considered to be an important determinant of patient satisfaction (Weiss and Lonnquist, 2006) and a contributor to the reduction of racial/ethnic disparities (IOM, 2003; Clemens-Cope and Kenney, 2007). Further, patient-provider communication is a contributor to the reduction of racial/ethnic disparities (IOM, 2003; Clemens-Cope and Kenney, 2007).

More and more patient-provider collaborations are being advocated for because informed consumers are more likely to participate in their care, make intelligent decisions, find common understanding with providers, and adhere to treatment protocols (Epstein, Alsper, and Quill, 2004). Adequate communication is necessary to alter a relationship from a physician dominated one to one that is patient-centered (Epstein, Alsper, and Quill, 2004).

It is envisioned that in medical homes, optimal patient-provider communications will result in improvements in quality of care; enhancements in patient satisfaction; reduction in racial and ethnic disparities; an increase in treatment adherence; improvement in health outcomes; and a decrease in cost and utilization.

Shared Decision-Making and Outcomes

For decades research has focused on the relationship between medical decision-making and consumers' informational needs. Today, shared decision-making (SDM) is being encouraged as an ideal model of clinical decision-making and an ethical imperative (Whitney, 2003). Individual patients have a variety of preferences in their care processes and outcomes; hence shared decision-making guarantees that the

patient's voice is being heard as treatment options are provided. Informed decision-making is estimated to occur in only 9% of ambulatory clinics and physicians ask consumers whether they have questions in less than half that number (Epstein, Alsper, and Quill, 2004; Braddock et al., 1997).

Nevertheless, the literature supports that SDM is ethically appropriate and promotes patient autonomy (Edwards, Davies, and Edwards, 2008; Ashcroft, Hope and Parker, 2001); enhances standards of care (Coulter, 1997); is associated with greater adherence to treatment (Greenfield, Kaplan, and Ware, 1985); and improves health outcomes (Greenfield et al., 1988; Greenfield, Kaplan, and Ware, 1985).

Moreover, patient participation in care decisions for chronic conditions (e.g. diabetes) is increasingly being touted for several reasons: multiple treatment options are available, that require the patient to engage in an intricate set of behavioral changes (Golin et al., 2002; Frewer et al., 2001); involvement in decision-making can empower patients to engage in self-care (Barry, 2002; Frewer et al., 2001) and improved decision-making has been found to result in positive health outcomes (Greenfield et al., 1988).

However, other research suggests that some patients are not interested in being involved in care decisions (Levinson et al., 2005; Golin et al., 2002) and may be less likely to want to be involved in care than their non-chronically ill counterparts (Arora and McHorney, 2000). Despite this, Sullivan (2003) asserts that it is a consumer's right to understand his/her condition, prognosis, and any treatment choices regardless of a lack of desire to participate in decision-making.

As primary care physicians evolve toward adopting the medical homes concept it is imperative that they begin engaging their patients. Providers and their patients must be taught to recognize the literacy skills of their consumers (DeVoe et al., 2007). Based on general communication literature, improvement strategies are identified as active listening and offering small digestible quantities of information, then stopping to ascertain if the consumer understands (Epstein, Alsper, and Quill, 2004).

Epstein and associates (2004) recommend several steps to assist providers to further improve collaborations with patients and they are understanding the patients' experience and expectations; building partnerships; offering evidence (including a balanced discussion); providing recommendations, and checking for understanding. As with optimal patient-provider communication, it is proposed that improvements in SDM in a PCMH results in an informed and engaged consumer who is empowered to employ self-care activities that should translate into positive health outcomes and reduced health care cost.

In summary, the extensive literature, which positively supports the key attributes of the PCMH model, suggests that significant gains can be made with implementation of this model for the care of the chronically ill from both a medical and fiscal standpoint.

Analytic Framework

Conceptual Model of Medical Home Utilization

This dissertation is underpinned by a proposed theoretical framework called the Conceptual Model of Medical Homes Utilization, which is driven by the literature. This framework proposes the following domains: medical home characteristics; individual characteristics (predisposing, enabling, and need) from the Andersen Behavioral Model of Health Care Service Access; and outcomes (medical and fiscal) (See Figure 2-1).

Andersen Behavioral Model of Health Care Service Access: Individual Characteristics

This framework was originally developed by Andersen and colleagues in the 1960s to define and measure equitable access, elucidate family health care utilization, and support policies that promoted equitable access (Andersen, 1995). The basis of this conceptual framework outlines health service access as a function of predisposing factors, enabling factors, and need factors (Andersen and Aday, 1978). The Andersen Behavioral Model has received considerable attention in health services research and the majority of studies in recent decades that have examined access to health care have used this framework to guide their research.

The individual characteristics construct is divided into three subcategories: predisposing, enabling and need factors. Predisposing factors represent biological imperatives (demographics), sociological factors (social structure) and psychological factors (health belief). Demographic characteristics (i.e. age, race, and sex), according to Andersen, are biological imperatives that suggest the likelihood of an individual's need for services. Social structure is broadly measured and determines a person's societal status (i.e. occupation, education, culture, social networks, and influences). Health beliefs are an individual's knowledge, attitudes, and values that drive their perception of need and service use. Andersen (1995) asserts that in order to promote access, a variable must be potentially "mutable" or driven by a specific policy change that may result in behavioral change. Andersen assigns each of these characteristics a level of mutability. Both demographic and social structure factors are assigned either a low degree of mutability or immutable. Health beliefs are typically measured with a medium degree of mutability (Andersen, 1995).

Predisposing characteristics generally refer to individual level characteristics that influence services utilization. They are neither directly related to the need for care nor are they responsible for utilization. In a review, De Boer and colleagues (1997) examined fifty-three articles on hospitalizations and physician visits across multiple chronic conditions and countries. They observed that predisposing characteristics (e.g. age, sex and marital status) in the chronically ill have not been found to be predictors of hospitalizations. More recent studies have examined race and ethnicity and suggest that African Americans and Hispanics have significantly lower rates of health service utilization than non-Hispanic whites (America College of Physicians, 2000; Eggers and Greenberg, 2000; Mayberry, Mili, and Ofili, 2000).

Based on empirical evidence, this model proposes a unidirectional relationship between predisposing variables and PCMH access. Predisposing characteristics also affect the outcome variables and therefore are linked to outcome.

Need characteristics serve to explain an individual's help-seeking behaviors. Andersen (1995) expresses need as perceived need (person driven) and evaluated need (provider-driven). Perceived need or self-assessed need is considered mutable and may increase or decrease through education. Additionally, evaluated need is professionally determined and may be altered to influence use (Andersen, 1995). Considerable discrepancies exist between perceived and evaluated need. Increasing disease severity in the chronically ill is a significant predictor of hospitalizations and physician visits. So, the link between need variables and physician behavior is less evident (De Boer, 1997). However, studies examining stroke patients with lower health

functioning and complications, as well as increased co-morbid conditions experienced more hospitalizations (Evers et al., 2002).

This study proposes that the relationship between PCMH utilization and need characteristics is multi-directional. While an individual's disease severity drives the propensity to seek care in a PCMH. However, use of their services should increase chronic disease management (McCarthy et al., 2008), and improve patient-provider communication, which should translate into greater treatment adherence and self-management (Roter and Hall, 2006; Heisler et al., 2003; Heisler et al., 2002). Consequently, reduction in disease severity should be expected. Here we expect need variables to also have some impact on our outcomes.

Enabling characteristics are the third category of factors that explains an individual's ability to obtain health care services. These characteristics pertain to facilitators of or impediments to service use for both individual level resources (financing of care: income and spending) and organizational or community-level factors (provider-patient ratio) (Andersen, 1995). Earlier studies placed emphasis on enabling resources by evaluating community-level socioeconomic status at differing income levels (Billings, 1990; Billings et al., 1996; Laditka and Laditka, 1999) and insurance coverage (Weissman et al., 1992). De Boer and colleagues (1997) observed mixed results as they pertain to the impact of income and health care use, finding that individuals with lower incomes have higher rates of hospitalizations and physician visits. Hence, this study hypothesizes that the relationship between enabling characteristics (i.e. income) and PCMH utilization is unidirectional.

The impact of health plan characteristics on medical care quality and utilization has been the source of much debate. A study by Tye et al. (2004) observed that compared to older managed care typologies by teasing out specific characteristics they were able to observe a less imprecise impact on service utilization. Early studies indicated that preventive screening was higher in health maintenance organizations (HMO), but more recent analysis suggest more unclear results (Phillips et al., 2004; Wee et al. 2001; Hsia et al. 2000; Reschovsky and Hargraves 2000; Solanki and Schauffler 1999; Tu, Kemper, and Wong 1999; Gordon, Rundall and Parker 1998; Phillips, Kerlikowske et al. 1998; Makuc, Freid and Parsons 1994). The ambiguity of these results suggests that comparisons between aggregate plan types (e.g. HMO vs. non-HMO) are no longer relevant and any examination should consider specific plan characteristics. The proposed model suggests a multidirectional relationship, whereby specific health plan characteristics are more likely to have contractual agreements with medical homes. The productivity of medical care may induce a health plan to impose certain requirements (e.g. utilization management) (Figure 2-1).

Table 2-1. NCQA levels of medical homeness

Level of qualifying	Points	Must pass elements at 50%
Level 3	75 – 100	10 of 10
Level 2	50 - 74	10 of 10
Level 1	25 – 49	5 of 10
Not a recognized PCMH	0 - 24	< 5

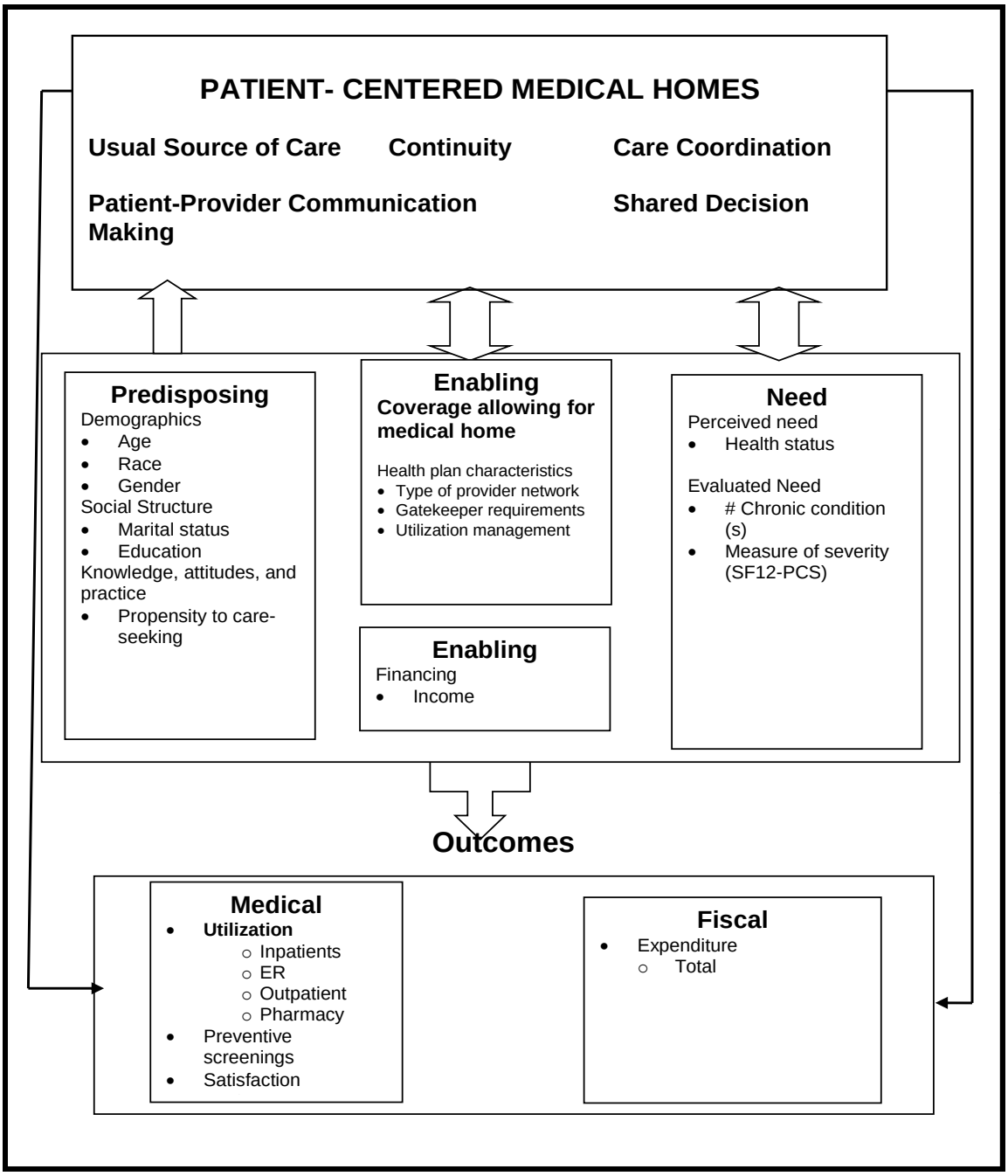


Figure 2-1. Medical homes conceptual model

CHAPTER 3
METHODS

Research Questions and Hypotheses

This study seeks to answer the following research questions. Does the proposed medical home index reveal an interpretable factor structure of the construct? Do certain individual characteristics predict medical home participation? Do medical homes impact outcomes (fiscal and medical) of individuals living with chronic conditions? Does a specific chronic condition moderate the effects of medical homes on outcomes?

Hypothesis for RQ1. There will be an interpretable factor structure of the construct.

Hypothesis for RQ 2. Predisposing, enabling, and need characteristics will be associated with medical home participation.

Hypotheses for RQ 3.

a) Respondents with chronic conditions in medical homes have lower total expenditures compared to their chronically ill counterparts not in medical homes.

b) Respondents with chronic conditions in medical homes have greater numbers of outpatient visits compared to those not in medical homes.

c) Respondents with chronic conditions in medical homes experience fewer inpatient hospitalizations than those not in medical homes.

d) Respondents with chronic conditions in medical homes report fewer emergency room visits than those not in medical homes.

Hypothesis for RQ 4. No chronic condition will out-perform others in a medical home setting.

Data Source

This study utilized the Medical Expenditure Panel Survey Household Component (MEPS-HC) to examine the concept of medical homes in a chronically ill adult

population based on certain findings from the literature (AHRQ, 2008). Bethell and colleagues (2005) examined multiple population-based data sets to measure the AAP definition for children with special health care needs. Their study concluded that the National Survey of Children with Special Health Care Needs (CSHCN) and the CAHPS-CC2.0H provide the most comprehensive data for this population and that, while MEPS is less comprehensive, it does provide sufficient measures.

Medical Expenditure Survey

The MEPS is a nationally representative survey of medical care use and spending of non-institutionalized US civilians. The Agency for Health care Research and Quality sponsors this initiative (AHRQ, 2008). It is designed to provide estimates on insurance coverage, source of health care payment, and annual health services use and expenditure of its population. This survey also includes information from employers, medical providers, and insurance providers to augment data ascertained from respondents. MEPS is a family of three inter-related components: household component (HC), medical provider component (MPC), and insurance survey (IC). MEPS is designed to allow for both family and person level estimates (AHRQ, 2008; Cohen, 2003; 2002). This study used the household components of MEPS data to acquire individual-level estimates.

MEPS- HC Data

The household component is the core component of MEPS. The sampling frame for MEP-HC is drawn from the respondents of the National Health Interview Survey (NHIS). NHIS is a multi-stage cluster with unequal probability selection sample design. It is conducted by the National Centers for Health Statistics and is an annual household survey of approximately 42,000 households (or 109,000+ individuals). NHIS offers

national estimates of non-institutionalized US civilians (AHRQ, 2008; Cohen, 2002). The use of the NHIS sampling frame gives MEPS considerable advantages: cost savings by reducing screening cost; enhanced capacity for longitudinal follow-up by linking with NHIS respondents for an additional two years; and increases in the number and dispersion of primary sampling units (195 PSU), which provides for greater precision (Cohen, 2002).

MEPS-HC captures information relevant to the household and the individual: demographic characteristics, health status, access to health care services, service utilization, payments associated with services, care and insurance coverage satisfaction, income, and employment status. MEP-HC design includes stratification, clustering, multiple stage selection and disproportionate sampling. Sampling weights are also integrated to reflect adjustments for survey non-response and population totals from the Current Population Survey (Cohen, Makuc, and Ezzati-Rice, 2007; McCollum et al., 2007; Cohen, 2003).

Given that MEPS utilizes complex sampling, weights are required to ascertain unbiased national estimates of person-level changes in health care utilization and expenditure. There are two weighting variables in MEPS: person-level weights in the annual data file and longitudinal weights in the panel file. The focus of this research was to obtain cross sectional estimates using four years of the MEPS (2004-2007) and therefore it is appropriate to use person-level weights.

Generally, the information is collected using a computer-assisted personal interviewing technology with adult informants who provide information about themselves and any member of the household under the age of 17 years. Older respondents

provide their own information. On average the interview is about 90 minutes long. MEPS-HC collects exhaustive self-reported information on demographics, income, access to care, service utilization and expenditures, and insurance coverage. Further, MEPS samples providers, identified by the respondent, to compile additional information that augments or validates the self-reported information. Information is compiled on diagnoses, charges, and payments. Other data points include prescribed medication (prescription, quantity, etc.) and inpatient stays (DRG).

The survey is a series of overlapping panel designs with a total of five rounds of in-person interviews completed over a 30 month period to generate the annual service use and cost for two full calendar years (Figure 3-1). Each round of interviews is spaced out at approximately five to six month intervals, with each round of interviews asking about the period from the last interview (Cohen, 2003).

The response rates of MEPS appear to be declining, ranging from as high as 70.7% (1996) to 58.3% (2006). The response rates for this study period were 63.1% (2004) and 61.3% (2005). Weighted sequential hot-deck imputation was used to impute missing data (Machlin and Dougherty, 2007).

Sample Inclusion/Exclusion Criteria

- All respondents who indicated having a usual source of care.
- All respondents aged 18 years and older with one or more International Statistical Classification of Diseases and Related Health Problems (ICD-9) code of these following chronic conditions in MEPS: a) diabetes (DM) ICD-9 250.xx; b) asthma ICD-9 493.xx; c) high Blood Pressure (HTN) 401.xx; d) chronic obstructive pulmonary disease (COPD) ICD-9 490.xx, 492.xx, 494.xx, 496.xx; e) stroke ICD-9 430-438; f) depression ICD-9 296.xx, 311.xx; g) arthritis ICD-9 714-715, 720, V135; and h) coronary heart disease (CHD) ICD-9 411-414, V458.

Description of Outcome Measures and Independent Variables

Outcome Measures

The outcome of interest was divided into the two categories in the theoretical framework: medical and fiscal outcomes. Medical outcomes included service utilizations (inpatient, outpatient, Emergency Room visits, and pharmacy). The fiscal outcome measure of interest is total expenditure.

Utilization Measures

This study examined five measures of utilization which were total numbers of hospitalizations, length of inpatient stays, outpatient care visits, ER visits, and prescription drug uses. These variables were constructed from the MEPS Events Files as the total counts over the study period.

Hospitalizations: This measure is the total number of discharges from hospital and the length of stays. This variable was retrieved from the Hospital Inpatient Stay File.

Physician Visits: This measure is the total number of physician visits over the study period. Physician visits has been used in previous medical homes studies as an indicator of utilization. Physician visits are found in the MEPS Event Files (office and hospital based outpatient). Oral consults between provider and consumer will also be considered a provider visit.

Emergency Room Visits: This measure includes the total number of ER visits over the study period. ER visits are found in the MEPS Event Files.

Prescription Drug Use: This measure is the total number of prescription drugs used for the duration of the study period. This variable was found in the Prescription Drug File. Insulin and diabetic equipment and supplies are also included.

Expenditure Measure

Total health care expenditure is all expenses associated with utilization and services. According to Zuvekas and Cohen (2002), total health care expenditure in MEPS is the sum of all payments made (third party + out-of-pocket payments), rather than the sum of payments billed by the providers for care delivered. In health services research it important to tease out the definition of charges (fees billed by providers to individuals or payers) and expenditure (direct payments to providers or health service organizations by individuals or payers) (AHRQ 2002; Berk and Monheit, 2002). In this study the measure of expenditures is the annual health care expenditure.

Independent Variable

Construction of a Medical Home Index

Historically the existence of a medical home was assessed by the existence of a usual source of care (Ortega, et al., 2000; Adams and Johnson, 2000). Over time the definition expanded to the commonly known definition provided by the AAP (2002) that asserts that PCMH is more than just a place and refers to a partnership approach to primary care that engages the health provider, individual patient, and families members (where appropriate). The care provided is accessible, family centered, coordinated, comprehensive, continuous, culturally competent, and compassionate (American Academy of Pediatrics, 2002). The first step in conducting this study required an index that indicated whether or not an individual's care was consistent with principles of PCMH. The following are medical homes indices that exist in the literature to accomplish this task.

Commonwealth Fund Medical Home Index: Defined by four items that are included in the index: existence of a usual source of care (USC), experience no difficulty

contacting provider by telephone, experience no difficulty getting care after hours, and reported that their office visits were always on schedule and well organized. Psychometric properties not reported (Beal et al., 2006).

Keickhefer Medical Home Index (KMHI)*:* A ten item index: visits the USC for new health problems, visits the USC for preventive health care, visits the USC for referrals to other health providers, difficulty obtaining an appointment, appointment wait time, degree of difficulty contacting provider by phone, provider listens and gives information, satisfaction with overall care, and satisfaction with staff. The internal consistency or Cronbach alpha was recorded to be 0.71 (Keickhefer et al., 2005).

The use of the Commonwealth Fund index for this study, however, would not allow this study the opportunity to subdivide the items into domains consistent with the AAP definition. While the KMHI affords for such divisions, it does not cover all the domains. KMHI includes enhanced access, care coordination, quality, and safety (patient-provider communication and satisfaction).

The AAP definition of the medical home concept, however, encompasses a few more core features: accessible, continuous, comprehensive, whole-person oriented, compassionate, culturally sensitive and coordinated care. The proposed index utilizes five of the AAP domains: enhanced access, continuity of care, comprehensiveness, coordinated care, and quality and safety focused (encompasses culturally effective care, optimal patient-provider communication, and shared decision-making). All of the items included are representative of constructs consistent with the AAP definition (AAP, 2004).

Distinct from the KMHI, this research includes additional measures that encompass more of the AAP definition domains which are care continuity, comprehensive care, and additional measures relating to quality and safety. With respect to a quality and safety focus, this research asserts that patient satisfaction is an outcome and inserts measures relating to culturally effective care and shared decision-making.

In this research, having a medical home indicates the receipt of care that is consistent with the AAP domains listed above. To assess whether an individual received care consistent with medical homes, the less conservative "on average" approach was employed. According to Bethell and colleagues (2004) the "on average" approach indicates an individual's medical homeness when optimal care is received on average across all domains. Alternatively, they also utilized the conservative "on every" approach, which requires that an individual receive the highest level of care in each of the domains. Table 3.1 outlines the questions relevant to the index and the proposed scoring associated with each option.

Enhanced access (EC): Seven- item that ascertains if access to care is improved in a medical home. All items were scored as either zero or one: three items (existence of a USC, conditions for accessing care at the USC, and expanded hour of operation); yes (1) and no (0). Two items pertaining to ability to contact via phone and contacting after hours ascertain the degree of difficulty: not at all difficult (1); not too difficult (1); somewhat difficult (0) and very difficult (0). Respondent were also asked whether they were able to get appointments when it's needed: always (1), usually (1), sometimes (0) and never (0).

Continuity of care (UCI): This domain is the proportion of consumers seeing the same provider over the study period. Using the event files, this variable was calculated as a clinician index based only on total number of ambulatory visits to USC divided by total ambulatory visits over the study period (Jee & Cabana, 2006).

Usual Clinician Index = # ambulatory visits to USC / # overall visits in study.

In this study UCI will be categorized into groups similar to research completed by Rodriquez et al. (2007). However, this study will make use of two groups, UCI between 0.50 and 1.0 (1) and no UCI less than 0.50 (0).

Comprehensiveness of care (COMC): This domain is operationalized as three questions that ascertain respondents' level of difficulty receiving needed care (specialist, medical, and prescription drugs): not a problem (1); small problem (0) and big problem (0).

Coordination of care (COOC): This domain contains two questions. MEPS ask respondent whether their provider asks about other treatments and if they go to their USC for referrals: yes (1) and no (0).

Quality and safety-focused care (QNS): This is a seven-item domain that encompasses three aspect of quality care: optimal patient-provider communication care, shared decision-making, and culturally component care:

- Optimal patient provider communication*:* Uses the four MEPS questions that captured patient's perception about provider communications: respect, provider listens to patient, spends sufficient time and explains so individual understands. Options are: always (1), usually (1), sometimes (0), and never (0).
- Shared decision-making*:* Using the two MEPS questions that capture a patient's perception concerning involvement in care decisions (ask for consumer involvement in care and give consumer some control). Options are: always (1), usually (1), sometimes (0), and never (0).

- Culturally effective care**:** Single item domain that ascertains whether provider speaks language of consumer or offers translation services: yes (1), and no (0).

The primary independent variable of interest is the medical home index. Using the proposed twenty item index that is consistent with the AAP definition of PCMH, this study will assign chronically ill adults to medial homes. The AAP definition of medical homes has led to the advancement of the operationalization of the concept and hence there is a growing body of literature on the medical home. However, the challenge remains to standardize the measures that would lead to less variation in interpretations of the definition (Bethell et al., 2005). One of the strengths of this study is that it will evaluate the psychometric properties of the medical home index developed for use with the MEPS, an area of very little research.

The medical home variable was operationalized as both a dichotomous variable (Yes/No) based on a cut point established by the distribution and as degrees of medical homeness (categorical variable based on cut points established by the quartile distribution). Using the NCQA scoring as a guideline, a dichotomous cut point (Yes/No) at the 25^{th} percentile was assigned as not being in a medical home and the remaining percentiles were assigned as having a medical home. Similarly, the levels of medical homeness (high, medium, and low) were based on the three remaining percentiles in descending order.

Control Variables

The association between PCMH and the outcome measures can be altered by the difference in some individual characteristics (e.g. disease severity). Hence these variables were included as control variables. Control variables were grouped according to the Andersen Behavioral Model of Health Care Service Access.

Predisposing Variables

Demographic variables included in this study were age, race/ethnicity, sex and residence. Age was operationalized in four categories: 18-24, 25-44, 45-64, and 65 and older. Race and ethnicity were categorized into: non-Hispanic white, non-Hispanic African-American, Hispanic, and other. Sex was dichotomized as female or male. Place of residence was divided into rural/urban and census regions. Residential regions were the following census regions: Northeast, South, Midwest, and West. Urban/rural difference was dichotomized.

Social structure included marital status and educational attainment. Marital status was reclassified as married, widowed/divorced/separated, and never married. Educational attainment was categorized in five groups: less than high school, completed high school, any college, completed college, and graduate school.

Knowledge and practices in this study include two questions on their propensity to seek care questions that are indicative of individual health conscientiousness and prevention orientation. Propensity toward prevention (Phillips et al., 2004; Tye et al., 2004) was operationalized as the frequency of dental check-ups: twice a year or more, once a year, less than once a year, and rarely or never. Health conscientiousness was categorized as an individual's likelihood of receiving a routine medical checkup: within the past year, within the past 2 years, within the past 3-5 years, and more than 5 years (Xu, 2002).

Need Variables

There are two types of need variables used in this study: perceived need (self-rated health status) and evaluated need (number of chronic conditions and measure of disease severity). Self-rated health status was ascertained in MEPS by asking

respondents how they rate their health status. This ordinal variable was categorized as: excellent, very good, good, fair, and poor.

The number of chronic conditions was calculated as a count variable of the chronic conditions stated by each respondent. The SF-12 physical component was used to calculate the measure of disease severity. SF-12 was produced as an abridged version of SF-36 while remaining as closely as possible to the physical and mental components of its parent scale. SF-12 is composed of questions pertaining to physical functioning, pain, and general health. SF-12 has been validated in many countries. The score range from 0 to 100 (mean 50 and standard deviation 10), with high scores indicative of better physical functioning (Ware, Kosinski, and Keller, 1998).

Enabling Variables

The income variable in MEPS was calculated from each person using various sources like wages, interest, pensions, unemployment compensation, workers compensation, social security, public assistance, child support, cash transfers, royalties, rental income, etc. Income is categorized as: poor (at or below the poverty line PL), near poor (over the PL-125% PL), low income (125% - <200% PL), middle income (200% - <400%), and high income (over 400%).

The insurance variable was categorized as any private, uninsured, and three levels of publicly insured (Medicare, Medicaid+ SCHIP, and Other). The second insurance variable was operationalized using a health plan typology discussed by Tye and colleagues (2004). This study includes variables from the Managed Care section. The gatekeeper requirement is ascertained from the question in MEPS that asks respondents if their health plan requires an individual to sign up with a particular PCP (yes/no). A defined network is operationalized using two MEPS questions: if there is a

book or list of providers associated with the plan (yes/no); will that plan pay for cost of visits to doctors outside of network (yes/no).

Finally, a dummy variable indicating the year of participation in the study was included as a control variable. Inclusion of this variable is important to control for time-varying error to control for possible unobserved factors (Wooldridge, 2006).

Study Design and Statistical Analysis

This study utilized a retrospective quasi-experimental design that involved the comparison of chronically ill adults in a treatment group (access chronic care in a PCMH) to a control group (care outside a PCMH) over the study. Individuals were assigned to treatment groups based on the twenty-item index described above.

Social science research make use of certain naturally occurring exogenous events to observe outcomes with a treatment group (in a medical home) and control or comparison group (Wooldridge, 2006). Cook and Campbell (1979) state that quasi experiments, unlike randomized controlled trials (RCT), are not characterized by initial random assignment for inferring treatment-caused changed. Consequently, these non-equivalent groups differ from each other in many other ways beside the treatment effects. Under these circumstances it is often difficult to ascertain the direction of causation in natural experiments because of threats to internal validity (selection, maturation, attenuation, etc.) of the study (Cook and Campbell, 1979). Certain statistical and econometric techniques can be used to control for these threats and will be discussed later.

Multiple strategies were employed using both Statistical Analysis Software version 9.1 (SAS, 2004) and Stata 9.2 (StataCorp, College Station, TX). Alpha level will be set at 0.05 or the theoretical relevance to the study. Descriptive analyses were completed

on the following variables: age, sex, race/ethnicity, income, and insurance. Bivariate analyses were also completed to examine the relationship between the independent variables and dependent variables. The current study also assessed the psychometric properties of the proposed medical home index.

Psychometric Properties of the Medical Homes Index

The methodological paradigm of psychometrics was developed in an effort to measure assorted psychological and sociological phenomena (DeVellis, 2003). It is concerned with the attributes of a particular scale/index: type of data generated by the scale and the reliability and validity of data captured (Furr and Bacharach, 2007). This study examined the reliability and validity of the proposed medical home index.

Reliability can be defined in multiple ways: the extent to which an instrument measures consistently under varying circumstances (Streiner and Norman, 2003, p. 6) or the reflection of the quantity of random and systematic error that is built in the measurement (Streiner and Norman, 2003, p. 126). There are three ways to measure reliability: internal consistency, stability, and standards of acceptable reliability. Each measure embodies different properties. This study utilized the most commonly used measure, internal consistency.

Internal consistency corresponds to item homogeneity or the extent to which the items in an index jointly measure the underlying construct (Henson, 2001). Cronbach alpha or coefficient alpha explains the percentage variance that an experimental scale would explain for a hypothetical true scale. A high level of internal consistency is desired because when the error is high, the score becomes more difficult to interpret (Henson, 2001). A generally acceptable Cronbach's alpha used in the development of

an index is 0.70, but no higher than 0.90 (Nunnally, 1978). The following equation defines the Cronbach alpha (Cronbach, 1951)

$$\alpha = k / (k-1) [1- (\Sigma\sigma^2_k / \sigma^2_{Total})], \quad (3.1)$$

where

k = number of items
$\Sigma\sigma^2_k$ = sum of the variance of all the items
σ^2_{Total} = variance of the total score

Using equation (3.1), the internal consistency was calculated for each domain, as well as the internal consistency of the medical home index.

Validity is defined as a scale's ability to measure what it is designed to measure (Streiner and Norman, 2003, p. 172). Validation of a scale requires empirical investigations depending on the type of validity being studied (Nunnally, 1978). There are multiple types of validity: concurrent, content, and construct (Streiner and Norman, 2003). It is important to evaluate the construct validity or the accuracy of the index's operationalization, as this has significant ramification in the interpretation of the results.

Multivariate Analysis

RQ1: Does the proposed medical home index reveal an interpretable factor structure of the construct? According to Nunnally (1978), factor analysis is a broad group of techniques that conceptualizes clustering of variables and mathematical procedures that ascertain which variables belong to which cluster (factor). Factor analysis is valuable for determining whether highly inter-correlated variables fragment into common factors, which are weighted combinations of variables (Streiner and Norman, 2003). This research conducted an exploratory factor analysis as an initial step in the development of the medical home index. The application of factor analytic

techniques is completed to reduce the number of variables and to identify structure in the relationships among variables (Portney and Watkins, 2000; Nunnally, 1978).

Exploratory factor analysis is a stepwise approach: step one requires the condensing of variables into smaller numbers of factor regardless of the interpretation, and step two is the rotation of factors or the linear combination of the original factors (Nunnally, 1978). The factor analysis approach used in this study is the principal component analysis (PCA) that represents the most advantageous method of condensing variables into a few common factors (Nunnally, 1978).

This method was devised by Pearson in 1901 and later modified by Hotelling in 1933 (Jolliffe, 2002; Nunnally, 1978). PCA was performed to determine whether the proposed medical home index does in fact measure one distinct construct. This is a technique that is used in multivariate data analysis to "reduce the dimensionality of datasets consisting of large numbers of interrelated variables, while retaining as much as possible of the variation present in the data set" (Jolliffe, 2002).

PCA expresses the amount of variance accounted for by each identified principal component calculated in a given analysis (Nunnally, 1978). Each principal component is a linear combination of original variables with coefficient values that are equivalent to the eigenvector of the correlation or covariance matrix (Portney and Watkins, 2000; Hatcher, 1994).

It is possible to compute a score for each respondent on a principal component. The actual scores on the twenty-item index would be optimally weighted and then totaled to calculate their scores for each component. Equation (3.2) is the general form of the formula used to calculate the first principal component extracted (Hatcher, 1994).

$$A_1 = \alpha_{11}(X_1) + \alpha_{12}(X_2) + ... \alpha_{1p}(X_p), \quad (3.2)$$

where

A1 = the respondent's index score on principal component 1 (the first component extracted)
α1p = the regression coefficient (or weight) for observed variable j, derived from creating principal component 1
Xp = the respondent's index score on observed variable p.

The first component extracted explains a major portion of the variance. Similarly, a score was calculated for the remaining principal components. Each successive component accounts for a bit more of the total variance until all variance is explained. The regression coefficients computed are known as eigen-equations. This specialized equation tabulates weights or eigenvalues, which refer to the total variance explained by each factor. A scree plot was generated to provide a geographical image of the eigenvalues in descending order. A cutoff point of 1.00 (Kaiser Criterion) was imposed for theoretical significance (Portney and Watkins, 2000; Hatcher, 1994).

The results of the PCA are a factor matrix that provides the factor loadings for every variable on each factor. Factor loadings are correlations between each factor and variable. They are interpreted as correlation coefficients (ranging from 0.00 to 1.00) with positive and negative values. A factor loading greater than 0.40 is indicative of a strong relationship (Portney and Watkins, 2000; Hatcher, 1994).

The next step is a factor rotation, which is a complex multidimensional statistical solution where each variable is highly correlated to only one factor. A varimax factor rotation (or orthogonal rotation) with a Kaiser criterion was used. The varimax rotation occurs when the factors are kept at right angles, with an assumption of independence, and maintains maximum separation. The results provide a rotated factor matrix, which

explains the spatial coordination of each variable. By examining each row across the matrix, the factor with the highest loading for each variable can be determined. The naming of factors was completed based on the theoretical construct.

In this study, all the variables were coded to equal zero or one, which poses significant threat to the underlying assumption of normality. The literature confirms that several options are available to a researcher encountering this challenge. One such option is the use of other statistical packages, such as Mplus or SAS polychoric macros, which utilize tetrachoric correlations (which assumes that the underlying binary variable is normally distributed) in computing the factor solution. The responses to the twenty items were subjected to a polychoric exploratory factor analysis using the principal component method to extract factors followed by a varimax (orthogonal) rotation.

From this analysis it was anticipated that a factor would emerge that reflected one distinct medical home construct. Following the exploratory factor analysis, items were added or eliminated.

RQ 2 and RQ 3: Do certain individual characteristics predict medical home participation? Do medical homes impact outcomes (medical and fiscal) of individuals living with chronic conditions? Quantifying the impact of medical homes in the study context is challenging because individuals are not randomly assigned. Individuals, for various reasons, select a provider and provider group with certain characteristics that may affect the outcomes. The resulting bias associated with this selection occurs when one or more variables is correlated with the error term. These variables are correlated with factors (measured or mis-measured) and may become a proxy for these factors (Ettner, 2004).

There can be both non-random observed and unobserved consumer preferences. The observed preferences can be accounted for in the model. Because the primary requirement for inclusion is having a usual source of care, this study examines this literature for consumer preferences. The expansiveness of work on USC suggests that the following unobserved consumer preferences could include risk aversion, health conscientiousness, and patients with more complex conditions and co-morbidity (Wendel and Dumitras, 2005; Xu, 2002). These characteristics may also affect service utilization/expenditure and choice of being in a regular source of care (i.e. medical home) (Wendel and Dumitras, 2005).

In the presence of unobserved heterogeneity (omitted variables), the contemporaneous correlation between the explanatory variable and the error term results in biased coefficients (Berg and Mansley, 2004). This bias represents a significant threat to the internal validity of the study. A single-equation estimation that does not include these correlations in the equations (i.e. having a medical home and service utilization) may result in misleading information to health care policymakers, causing them to over- or under endorse the benefits of having a medical home (Wooldridge, 2006; Xu, 2002).

To test for the existence of endogeneity, a Hausman test (Hausman, 1978) was employed. This was completed by regressing PCMH on all of the exogenous variables and obtaining the predicted probabilities (residuals) from this model. The residuals were then added to the initial model as a new variable. A significant coefficient for the residual indicates the existence of endogeneity and the need for additional steps to mitigate endogeneity (e.g. instrumental variable regression).

Multiple econometric strategies can be employed to eliminate or diminish this threat and these include a treatment effect model, instrumental variable methods, and propensity score matching. Propensity score matching was not chosen because it balances out only observed characteristics and not unobserved characteristics (Ettner, 2004). The instrumental variable (IV) method is a very common econometric method that is employed under these circumstances. This study suggested two methods to answer research question number two. In an effort to mitigate endogeneity, this study conducted an instrumental variable estimation (utilization) and gamma regression (expenditures).

Instrumental variable estimation

According to Angrist and Krueger (2001) the IV method was first seen in the early supply and demand work of P.G. Wright in 1928. Since then, this model has been employed in most areas of research. Today, instrumental variable estimation is one of the most widely used in health services literature to control for endogeneity and selection bias.

This approach is used in observational studies when the standard regressions yield biased estimates as a result of simultaneous causality, measurement error, selection bias, and omitted variable bias. All of these compromise a model's predictive capabilities as well as produce biased estimates (Stock and Watson, 2003). The central tenet of the IV model is to use a third variable, known as an instrumental variable, and this instrument functions as a pseudo-randomization method.

Borrowing from the USC literature, this study asserts that having a usual source of care, which is the requirement for being enrolled in a PCMH, is a choice that may be correlated with the error term in a regression of service use, and if there are

unobservable consumer preferences, a single-equation estimation not incorporating the correlations in the equations may provide bias estimates. Employing a two-step approach is designed to achieve an unbiased coefficient by allowing the two models to correlate directly and thereby eliminating the omitted variable bias (Ettner, 2004).

The most common IV estimator method is the two-stage least squares (2SLS) model. However, the conventional 2SLS assumes the regression model has a continuous outcome variable. In health services research the majority of outcome variables are nonlinear, usually binary or count data (Terza, 2007). When the outcome variable is count data, Wooldridge (2002) indicates use of a 2SLS/two-stage residual inclusion (2SRI) model for count data. This study utilized 2SLS by modeling the probability of being in a medical home, including the efficient instrument.

First equations or the reduced form models the decision to be in a medical home. There are two dependent variables: the dichotomous medical home (1 = Yes; No = 0) and levels of medical homeness (level 0-3). The independent variables are patient characteristics (that include numbers of comorbid conditions, propensity to seek care, geographic location, urban/rural, and chronic condition). Also included in the first equation are instrumental variables. Four variables were proposed as instruments: 1) attitudes towards having insurance, 2) received food stamps, 3) employer offer insurance, and 4) numbers of employees in plan.

The binomial logit model estimates the probability of being in a medical home (Y/N) for a given set of patient characteristics. The odds ratios and the 95% confidence intervals associated with being in a PCMH will be presented. The predicted probabilities (residuals) ascertained from this model will be used to replace the actual value of being

in a PCMH in the second model. Goodness of fit test was conducted to determine model fitness.

$$Y= \beta_0 + \beta_1 * X + \beta_2 * A + \delta, \quad (3.3ai)$$

Where

- Y = probability of being in PCMH 1 = in medical home; 0= not in medical home
- β_0 = constant
- $\beta_1 X$ = vector of patient characteristics (predisposing, needs, enabling and other factors)
- $\beta_2 A$ = instrumental variable (s)
- δ = random error term

An ordered logit model estimates the probability of being in a medical home (levels 1-4) for a given set of patient characteristics. An ordered logit model assumes that the coefficients are constant across categories (i.e. “not in medical home” versus “low level,” etc.).

$$Y= \beta_0 + \beta_1 * X + \beta_2 * A + \delta \quad (3.3aii)$$

where

- Y_{1-4} = probability of being in PCMH level 0-3
- β_0 = constant
- $\beta_1 X$ = vector of patient characteristics (predisposing, needs, enabling and other factors)
- $\beta_2 A$ = instrumental variable (s)
- δ = random error term

Instrumental Variables Angrist and Krueger (2001) stressed that it is imperative that a valid instrument be selected because the instrument is required to remove the variation from the treatment and hence the unobserved characteristics. A bad instrument that is correlated with the omitted variable or the error term (ε) in the structural equation could result in even larger bias than OLS. Weak instruments are those that are inadequately correlated to the endogenous regressor (s) and yield estimates that are closer to the

OLS results. Additionally, Angrist and Krueger (2001) suggest using fewer instruments to reduce bias.

An efficient instrument has three requirements: be highly correlated with treatment (PCMH), have no direct influence on the outcome, and assumed to be exogenous (Dougherty, 2007; Stukel et al., 2007; Newhouse and McClellan, 1998). Figures 3-2 and 3-3 depict these relationships. The second equation will be a generalized linear model (GLM), either gamma regression or a negative binominal regression, depending on the distribution of the outcome of interest.

Two-part model

This study used the two-part model (2PM) made popular by the Rand Health Insurance Study to ascertain the impact of medical homes on health care expenditures. The 2PM is particularly salient because health care data are characterized by a distribution that has right skewness that is a result of a large segment of the population reporting no use of health care thus no expenditure (Manning et al., 1987).

$$E(\text{total expenditure}) = \hat{u}_i\,[(1-\pi_i)\exp(x_i\beta_3)\Phi_3 + \pi_i\exp(x_i\beta_4)\Phi_4], \qquad (3.4a)$$

where

$\hat{u}_i = \Phi(x_i\beta_1)$	=	estimated probability of any medical cost
$\pi_i = \Phi(x_i\beta_2)$	=	estimated conditional probability for medical cost (inpatient)
$\exp(x_i\beta_3)\Phi_3$	=	estimated conditional probability for medical cost (outpatient only)
$\exp(x_i\beta_4)\Phi_4$	=	estimated conditional expense for medical services if any inpatient
Φ_3, Φ_4	=	estimated retransformation (smearing) factors of the error terms for outpatient & inpatient expenditure equation

The initial 2PM equation separates the users from the non-users. The equation models the probability of non-zero values conditional on any use during a given year with a logit model. This model will be employed to addresses the issue of a large

proportion of the population that does not utilize medical services (Manning et al., 1987).

The second equation performed will be an ordinary linear regression (OLS), gamma regression (GLM), or negative binominal, depending on the outcome of interest. The OLS assumes normality of error terms, linearity, error terms that are independent and identically distributed, error terms that are fixed in repeated samples, and number of observation is greater than number of independent variables (Wooldridge, 2006; Kennedy, 2008). Multiple tests were performed to test that these assumptions were met (the Jarque-Bera test will be conducted to test for skewness and kurtosis, the Hosmer-Lemeshow for linear, multiple transformation, the White's Test for heteroskedasticity, etc.).

Transformation of the expenditure is necessary to meet OLS assumptions. The log transformation of total expenditure was used to eliminate the undesirable skewness of the data. Duan (1983, 1984) argues that this transformation yields roughly normal error terms.In order to interpret the logarithmic transformed dollars, Duan's smearing estimator will be utilized to retransform into real dollars (Duan, 1983).

$$E(z) = \exp E(X\beta) * S, \qquad (3.4b)$$

where Smearing estimator $S = (1/ n)\ \Sigma e_i$ and $e_1 \sim N(0, \sigma^2)$ [e_i = residuals].

Manning and colleagues (1987) assert that this smearing estimator will yield weakly consistent (asymptotically unbiased) estimates of the retransformed dollars.

Generalized linear model (GLM) regression

The GLM is an extension of the ordinal least squares regression (OLS) that permits a variety of distributional assumptions. To run a GLM, a "family" and a "link function" are required and these are based on the data. The family identifies the

distribution that reveals the mean-variance relationship. For example, the gamma variance is proportional to square of means and the variance is constant (Fahrmeir and Tutz, 2001). There are no distributional assumptions required for GLM.

This study employed GLM models using a gamma distribution (expenditure) and negative binomial distribution (utilization), with both models using a log link function. The use of a GLM model is particularly attractive because a log link function does not require a smearing estimator. However, Manning and colleagues (2005) suggest that using a log link with heavy tailed data (kurtosis >4) leads to model inefficiencies.

A generalized linear model using a gamma distribution has been shown to be suitable for health care expenditure data because it assumes a constant coefficient of variation (Dodd et al., 2006). It is possible to achieve more efficient estimates by conducting a gamma GLM using the log link function (Manning, Basu, and Mullahy, 2005). GLM regression will be used to estimate health care expenditures in this study.

The second, or structural equation models the outcome measure (e.g. service utilization). The independent variables are the residuals of the reduced form equation that included instrument(s) and vector patient characteristics variables to mitigate potential selection bias.

$$Z = \alpha_0 + \alpha_1 * Y + \alpha_2 * C + \varepsilon, \qquad (3.5a)$$

where

Z = outcome of interest (expenditures)
α_0 = constant
$\alpha_1 Y$ = residuals from the reduced form equation
$\alpha_2 C$ = vector variables of relevant patient characteristics
ε = random error term

Negative binomial regression

Linear prediction of count data may yield biased, inconsistent, and inefficient coefficients. Several models are designed for count data prediction, such as the poisson or the negative binomial model (Hardin and Hilbe, 2001). The negative binomial (NB) is a generalization of the poisson regression. This model assumes: 1) the error term is poisson distributed, 2) it models the natural logarithm of the dependent variable as a linear function of the coefficients, and 3) the mean is equivalent to the variance (Hardin and Hilbe, 2001).

$$\Pr(y|\mu) = e^{-\mu}\mu^{y} / y! \quad \text{where } y = 0, 1, 2 \ldots n, \qquad (3.5b)$$

where

μ = number of expected event over a fixed time (utilization)
y = variable indicating the number of times the event actually occurred

Under certain conditions these assumptions result in poor fit, however, and NB model is used. When fitted using maximum likelihood, NB usually assumes a Poisson-gamma mixture model (Hardin and Hilbe, 2001). The Poisson variance equation is specified as:

$$\text{Var}(y_i \mid x_i) = E(y^i \mid x_i) = u_i \qquad (3.5c)$$

The NB variance equation accounts for the over dispersion by quadratic term, alpha (α):

$$\text{Var}(y_i \mid x_i) = \mu_i + \alpha\mu_i \qquad (3.5d)$$

It is an appropriate model for count data where the distribution is discrete and non-negative.

Moderator models

RQ4: Does a specific chronic condition moderate the effect medical homes have on outcomes? Baron and Kenny (1986) define a moderator as a variable that

affects the direction and/or the strength of the associations between the independent and dependent variables. In other words, a moderating effect is considered an interaction between the key independent variable (PCMH) and the factor that denotes the suitable condition of its operation (Baron and Kenney, 1986).

This study determined whether or not the presence of a particular chronic illness modifies the effect of medical homes on outcomes. For each dependent variable, interaction terms were included in the previously discussed models to detect if a specific disease moderated the effect (Baron and Kenney, 1986). The following equation defines regression (already tested above for assumptions) with the moderator (interaction) term inserted. Baron and Kenney recommend dichotomizing the moderator under the condition that both independent and moderator terms are continuous.

$$Y = \alpha + \beta_1 CD_x + \beta_2 PCMH + \beta_3(CD_x)(PCMH) + \beta_4\lambda + \varepsilon, \quad (3.6)$$

where

- Y = outcome of interest (visits, expenditure)
- β1 = effect of chronic disease (X) when medical home = zero
- β2 = effect of medical home when chronic disease (X) = zero
- β3 = how much the effect of chronic disease (X) changes when medical home score goes from 0 to 1
- β4 = coefficient of vector λ
- λ = vector of covariates

The moderator hypothesis is supported if the interaction is significant (Baron and Kenney, 1986). We are therefore interested in the direction and magnitude of β_3 to determine if there exists a moderating effect of a particular chronic condition. A moderator is a third variable that affects the zero-order correlation between two other variables (Baron and Kenny, 1986).

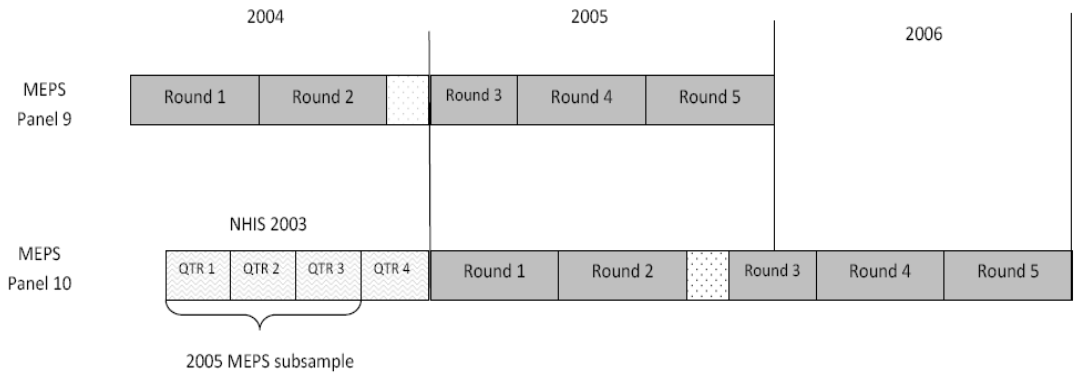


Figure 3-1. MEPS overlapping panel design source: Adapted from Cohen, Makuc, and Ezzati-Rice. 2007. Health Insurance Coverage During 24-Month Period: A Comparison of Estimates from Two National Health Surveys. Health Services Outcomes Research Methodology, 7, 125-144.

Table 3-1. Medical home index: 20 items based on the domains of the AAP definitions

Domain	Question	Scores
	Have a Usual Source of Care	(1)
EC	1. Would go to USC for ongoing problems	(1)
	2. Would go to USC for new health problems	(1)
	3. Would go to USC for preventive health care	(1)
	4. Found no difficulty contacting by phone during regular business hours	(1)
	a. Not at all difficult	(1)
	b. Not too difficult	(0)
	c. Somewhat difficult	(0)
	d. Very difficult	
	5. Found no difficulty getting care or medical advice after hours in case of urgent medical needs	
	a. Not at all difficult	(1)
	b. Not too difficult	(1)
	c. Somewhat difficult	(0)
	d. Very difficult	(0)
	6. Practice offer expanded hours (nights and weekends)	(1)
	7. In the past 12 months, how often did you get an appointment when needed	
	a. Always	(1)
	b. Usually	(1)
	c. Sometimes	(0)
	d. Never	(0)

Table 3-1. Continued

UCI	*Continuity of care index*	
	8. Usual Clinician Index = # ambulatory visits to usual provider / # overall ambulatory visits in study	(1)
	a. UCI (0.50≤UCI <1.0)	(0)
	b. No UCI (UCI<0.50)	
COMC	9. How much of a problem was it that person did not get medical care, test, or treatment him / her or doctor believed necessary?	
	a. Not a problem	(1)
	b. Small problem	(0)
	c. Big problem	(0)
	10. In the past 12 months, how much of a problem, if any, was it to see a specialist that you needed to see?	
	a. Not a problem	(1)
	b. Small problem	(0)
	c. Big problem	(0)
	11. How much of a problem was it that person did not get prescription medicines him / her or doctor believed necessary?	
	a. Not a problem	(1)
	b. Small problem	(0)
	c. Big problem	(0)
COOC	12. Would go to for referrals to other health professionals	(1)
	13. Provider ask about other treatments	(1)

Table 3-1. Continued

QNS		
	Shared Decision-making	
	14. How often does your provider at your USC ask you to help make the decision?	(1)
	a. Always	(1)
	b. Usually	(0)
	c. Sometimes	(0)
	d. Never	
		(1)
	15. Give you some control over your treatment?	(1)
	a. Always	(0)
	b. Usually	(0)
	c. Sometimes	
	d. Never	
	Patient –Provider Communication	
	16. Show respect for what you have to say?	
	a. Always	(1)
	b. Usually	(1)
	c. Sometimes	(0)
	d. Never	(0)
	17. Listen carefully to you?	
	a. Always	(1)
	b. Usually	(1)
	c. Sometimes	(0)
	d. Never	(0)
	18. Spend enough time with you?	(1)
	a. Always	(1)
	b. Usually	(0)
	c. Sometimes	(0)
	d. Never	
	19. Explain so you understood?	
	a. Always	(1)
	b. Usually	(1)
	c. Sometimes	(0)
	d. Never	(0)
	Culturally Competent Care	
	20. Does someone speak the language or provide translation services?	(1)

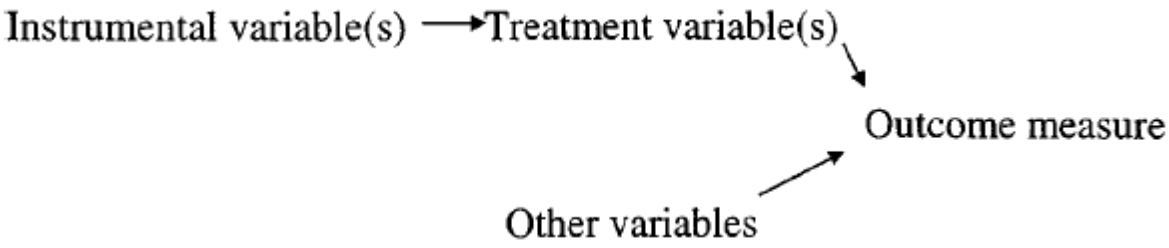


Figure 3-2. Schematic of instrumental variable estimation. Source: Newhouse, JP. and McClellan, M. 1998. Econometrics In Outcomes Research: The Use Of Instrumental Variables. *Annual Review of Public Health,* 19, 17 - 34.

CHAPTER 4
RESULTS

The results of this study are outlined in three sections: factor analysis results with a discussion on the internal consistency of the final items; demographics and socioeconomic characteristics of the study participants (by medical home status); and multivariate analysis of utilization and expenditures. Figure 4-1 presents the number of individuals eligible for the study. Over the duration of the study (2004-2007) there were a total of 133,473 individuals sampled.

RQ 1: Does the proposed medical home index reveal an interpretable factor structure of the construct? An exploratory factor analysis was completed to ascertain the construct of a Patient-centered Medical Homes (PCMH) index. The newly generated index characterized valid constructs of medical homeness. Initially, a total of twenty items were proposed for this index. One item (Provider speaks consumer's language) was eliminated due to sample size constraints (approximate ninety-five percent of data was missing).

Using the Kaiser criteria (eigenvalues > 1.00) resulted in the retention of three factors. Scree plots (which are graphic representations) were also used to examine the fraction of total variance in the data. The scree plots and eigenvalues confirmed a three factor structure for the PCMH concept (See Figure 4-2).

The interpretation of the rotated factor pattern was completed by imposing a cutoff point of 0.4 or greater. The first factor included the following items: specialist referral, contacting USC by phone, USC extended office hours, provider included person in decision, difficulty contacting USC afterhours, provider explained options to persons, unable to get necessary care and prescriptions ($\alpha = 0.32$). The second factor included

the following items relating to USC: for new health problems, preventive health care, referrals, and ongoing health problem (α = 0.85). The third factor included the following items: problem getting specialist referral, unable to get necessary care, and unable to get prescription (α = 0.61). The overall Cronbach's alpha for the three factors equaled 0.63. However, a three factor PCMH was rejected because of inadequate reliability or a Cronbach's alpha cutoff of 0.49 (Hatcher, 1994).

A summary two-factor PCMH is presented in Tables 4-1 and 4-2. All items that loaded on a given factor at the established cut-point were included. The first factor included the following items: got appointment you wanted, doctor listened to you, provider explained so you understood, provider showed you respect, provider spent sufficient time with you, problem getting specialist referrals, ease of contacting USC by phone, provider included person in decision-making, difficulty contacting USC afterhours, provider explained option to person (s), unable to get necessary care, and unable to get prescription (α = 0.67). The second factor included the following items relating to USC: for new health problems, preventive health care, referrals, and ongoing health problem (α = 0.85). The overall Cronbach's alpha for three factors equaled 0.64. Only one variable loaded on both factors. Twelve items loaded on Factor one and four items loaded on Factor two.

Several theoretical domains were observed in the two factors: quality and safety-focused care [optimal provider patient communication (4 items) and shared decision-making (2 items)]; coordinated care (1 item); comprehensive care (3 items), and enhanced access (7 items). Three items did not load: continuity of care, extended practice hours, and did provider ask about other treatments (See Table 4-1 and 4-2)

Sample Description

Table 4-3 displays the predisposing, enabling and need characteristics of all the eligible participants. This study was restricted to include all adults (age 18 and older) who indicated having a usual source of care and ICD-9 code for the following chronic disorders: diabetes (250), asthma (493), high blood pressure (401), chronic obstructive pulmonary disease (490, 492, 494 and 496), stroke (430-438), depression (296 and 311), arthritis (714-715, 720 and V135), and coronary heart disease (411-414 and V458).

During the study period, a total of 3,125 individuals were identified using the proposed patient-centered medical homes index. Approximately 59% (1,841) of respondents received care in practices that meet this study's medical homes criteria, while 41% (1,284) of the sample did not meet the medical homes criteria. Additionally, 41% (753) of respondents were classified in low level medical homes, 26% (482) in medium level, and 33% in highest level medical homes. The most prevalent condition was high blood pressure (37.8%), followed by diabetes (21.1%), depression (17.2%), asthma (7.8%), COPD (6.2%), arthritis (5.1%), CHD (2.6%), and stroke (2.3%) (See Table 4-3).

Predisposing: The age distribution of the study was as follows: adults 18-34 years accounted for 8% of sample, those 35-49 years 21%, those 50-64 years comprised the largest (38%), and respondents 65 years and older (33%). The sample was 58% female and predominately white (82%), followed by African Americans (12%), and others (6%). In addition, Hispanics accounted for approximately 9% of the study sample.

Sixty-one percent of the sample was married; 29% widowed, divorced, or separated and 11% never married. The largest proportion or eligible individuals completed high school (52%), 16% had less than a high school diploma, 15% completed a four year degree, 10% had graduate degree, and 8% were classified as other. Additionally, the majority of the sample (82%) resided in an MSA or urban areas. The study eligible population was also more likely to be from the South (37%) and least likely to from the West (20%).

Need: More than half (57%) of the respondents who met the eligibility criteria recorded good or fair health status. Respondents were less healthy than the average population, with a mean physical component score of 42. Additionally, the mean number of chronic conditions was approximately 3.

Enabling: Almost 83% of the sample belonged to a family making more than 200% of the federal poverty level (FPL). The majority of the adult sample had some form of insurance (71% privately and 24% publically insured). Approximately 59% of eligible adults had private insurance with no gatekeeper requirement. In addition, 46% were in plans without an established provider network. Additionally, eligible adults reported that 91% of them did not require food stamps (instrumental variable).

Bivariate Analysis

Weighted sample characteristics by medical home status are presented in Table 4-4. Chi-square and ttests were computed to ascertain whether individuals' characteristics were significantly associated with levels of medical homeness (no, low, medium, and high).

Predisposing Characteristics

These results indicate that there is a statistically significant relationship between levels of medical homeness and age groups ($p < 0.01$). African Americans accounted for approximately 13% of the racial makeup in medical homes and 10% of non-medical homes. Hispanics comprised 9.5% of medical homes and 9% of non-medical homes.

Geographic region was significantly associated with levels of medical homeness ($p = 0.04$). Respondents residing in the southern region of the United States comprised the largest group across levels of medical homeness. Likewise, marital status was statistically associated with levels medical homeness ($p = 0.01$). There was also a significant relationship between educational attainment and levels of medical homeness ($p = 0.01$). The proportion of respondents in medical homes with less than a high school diploma was greater than those in a non-medical home (17.1% and 13.5%, respectively). Additionally, there were more respondents with a graduate degree in the lowest level of medical home compared to higher levels (9% vs. 7.3%, respectively).

Two measures of a respondent's propensity to seek care were also examined. In all levels of medical homeness over 80% of respondents indicated that they completed a routine checkup within the past year of study. There was no significant association between seeking routine medical check-ups and levels of medical homeness ($p = 0.07$). Conversely, propensity to seek routine dental checkups was significantly associated with levels of medical homeness ($p < 0.01$). Individuals who reported seeking routine dental care twice a year decrease as levels of medical homeness increased.

Need Characteristics

There was a significant relationship between levels of medical homeness and perceived health status ($p < 0.01$). Health status diminished as levels of medical

homeness increased: at the lowest level of medical homes, 29% of respondents reported being in fair to poor health; medium level reported 41%, and high level reported 51%.

We conducted ttests to determine whether the mean differed significantly for number of chronic conditions and Physical Component Score (PCS) of the Short Form Health Survey (SF-12). Respondents not in a medical home had significantly fewer co-morbid conditions (mean = 2.83 vs. 3.04, $p = 0.00$) than individuals in a medical homes. Likewise, adults in medical homes also had significantly lower health functioning based on the physical component scores ($p < 0.01$). The mean score of individuals in medical homes was 38.29 (sd. = 12.79) compared to non-medical homes respondents with mean PCS score of 41.75 (sd. = 12.39).

Enabling Characteristics

Approximately 74% of individuals in non-medical home practices were from more affluent households (> 300% federal poverty line). The proportion of individuals who reported being from more affluent households' decreased (68.5%, 66.5%, and 58.3%) as medical home levels increased. This relationship was significant ($p < 0.01$). Noteworthy is the apparent increase in respondents from poorer households (< 100 FPL) as the medical home categories increased (11.4%, 12.4%, and 19.7%).

Insurance status was significantly associated with being in a medical home. Approximately 95% of respondents in lowest level of medical homes were either privately insured (71%) or publicly insured (25%). The proportion of uninsured individuals in the highest medical home level (10%) was more than two times greater compared to the lowest level (4%). Similarly, 97% of respondents not in a medical home were either privately insured (76%) or publicly insured (21%).

Insurer characteristics as they relate to gatekeeping requirements and established networks were also evaluated. Both characteristics (gatekeeper and established network) were significantly associated with levels of medical homeness. Sixty-five percent of respondents in non-medical homes reported being in private plans with no gatekeeper requirements. Finally, as levels of medical homes increase, the percent of individuals reporting being in private plans with an established network decreased (21%, 15%, and 14%).

In summary, respondents in medical homes were: better educated, living in the South, had poorer self-rated health status, had more co-morbid conditions, had lower health functioning (PCS), were in non-private health plans with no gatekeeping requirements and were less likely to be prevention oriented (dental).

Medical Homes and Health Care Expenditures and Utilization

Tables 4-5 shows the mean health care utilization and expenditure by medical home status and levels. Two sample ttests were conducted to ascertain statistical differences between the two samples (evidence of medical homeness Y/N). The Satterthwaite method for unequal variance was used if the variances were not equal.

Chronically ill adults in medical homes experienced significantly more unadjusted hospital discharges (0.35) than their counterparts (0.30). Similarly, they also reported longer length of unadjusted hospitals stays (2.17) than individuals not in medical homes (1.65). With respect to level of medical homeness, individuals in the medium level of medical homeness had slightly higher numbers of hospital discharges and longer lengths of stay. There were no significant differences in the mean number of physician visits (outpatient and office-based). In both instances the mean numbers of visits were

fairly similar in the lower and upper levels of medical homes, with an increase in mean visits at the medium level.

Conversely, the mean number of prescription drugs (40.29) filled by individuals in medical homes was higher and significantly different from their counterparts not in medical homes (35.10). With respect to levels of medical homes and prescription drugs, individuals in the medium level of medical homeness filled on average more prescriptions than their counterparts in low and high levels. Similarly, mean numbers of emergency room visits (0.50) were significantly higher for individuals in medical homes than adults not in medical homes (0.36). The mean numbers of emergency room visits increased as the levels of medical homes increased (0.39, 0.48, and 0.65, respectively). Finally, there were no significant differences in the mean expenditures of individuals in medical homes compared to their counterparts. Noteworthy is the significant differences in the physical functioning and number of chronic conditions between the two groups.

Tables 4-7 and 4-8 show the mean expenditures and utilization after adjusting for physical functioning. The average physical component summary (PCS) score from the SF-12 is 50. Individuals with above national average PCS scores in medical homes reported lower average utilization for all indicators when compared to their counterparts not in medical homes. Similarly, for individuals with less than the national average of physical functioning, the trend of lower utilization held true, with the exceptions of length of stay, number of prescription drugs, and number of ER visits. Individuals with below national average physical functioning who were in medical homes reported a significantly greater mean number of ER visits (0.60) compared to their counterparts not in a medical home (0.43; $p = 0.00$). Chronically ill adults (lower than national PCS) in a

medical home also reported on average receiving significantly more for prescription drugs ($46.27) versus their counterparts not in medical homes ($41.50; $p = 0.00$).

Multivariate Analysis

The purpose of this multivariate analysis was to determine the independent impact of being in a medical home on health care expenditure and utilization. These analyses controlled for the predisposing, enabling, and need characteristics associated with being in a medical home. The results are divided into sections according to the hypotheses. The adjusted association of being in a medical home and health care utilization and expenditures was determined by conducting a two-part model with instrumental variable to control for endogeneity. The results of the multivariate analyses are presented in Tables 4-9-4-18.

Test for Potential Endogeneity and IV Relevance

A Hausman test was employed by regressing PCMH on all of the exogenous variables and predicting the residuals from this model. The residuals were then added to the initial model as a new variable. The coefficient was significant for the PCMH variable ($p = 0.01$). Note that a significant coefficient would have indicated the existence of endogeneity that would bias the estimates and required additional modeling to mitigate the effects. Therefore, instrumental variable regression was employed to predict medical home participation.

Additionally, the *F* statistic from the first stage of the 2SLS was examined to determine instrument relevance. This condition means that the instrument (food stamps) is sufficiently correlated to PCMH. When the correlation is low the instruments is said to be “weak or irrelevant” and results in significant bias (Bascle, 2008). The *F* statistic from the first stage of the 2SLS equaled 10.33 ($p = 0.001$). Stock and Yogo (2004)

recommend that in the presence of one endogenous regressor, F statistics of 2SLS should be greater than 9.08. Therefore, this instrument has met Stock and Yogo's threshold and can be considered relevant. A test for instrument exogeneity (Sargan test) was also performed and it was concluded that the equation was just identified indicating the one instrument was sufficient (Wooldridge, 2004).

RQ 2: Do certain individual characteristics predict medical home participation? The first part of the two-part model was an instrumental variable logistic regression and an ordered logistic regression to determine the probability of being in a patient-centered medical home. The coefficients, their linearized standard errors, and *p* values of significance tests (ttest) from the regression are given in Table 4-9. Holding everything constant, several predisposing characteristics were significantly associated with being in a PCMH. The odds of being in a medical home decreased as age increased. Younger chronically ill adults (18-24 years) had significantly higher odds (OR = 2.3) of being in a medical home relative to their older counterparts in age group 45-64 years and 2.7 times greater odds relative to respondents 65 and older.

Similarly, certain census regions were significantly associated with being in a medical home. Respondents residing in the South had 31% greater odds of being in a medical home relative to their counterparts living in the Northeast. Additionally, respondents residing in the West had 64% greater odds of reporting care with evidence of medical homeness compared to Northeast. Married respondents reported 38% greater odds of being in PCMH when compared to their never married counterparts. The same pattern was observed for the ordered logit regression results except for marital status, which was no longer significant.

Holding everything constant, perceived health status was statistically significantly different for individuals in medical homes. Respondents who reported being in good, fair, or poor health were, respectively, 1.43, 1.7, and 2.06 times more likely to be in a patient-centered medical home than their healthier counterparts. As the physical functioning score increased, the odds (OR = 0.98) of being in a medical home decreased. Additionally, for every additional chronic condition that a respondent reported, there was 10% increase in the odds of being in a medical home. The same pattern held in the ordered logistic regression.

Another variable that was significantly associated with being in a medical home was insurance status. Uninsured respondents had 30% greater odds of having care consistent with medical homes than insured patients.

The syntax for goodness of fit assessments, such as a likelihood ratio test and Akaike's Information Criterion (AIC), could not be attained using STATA "svy" analysis. Del, developed by Hildebrand and colleagues (1977), was calculated for logit, ordered logit, and multi-nominal logit. The Del measures for the binary logit equaled (0.18) and ordered logit (0.18).

Additionally, to ascertain the fit of the ordered logistic model, the levels of PCMH were collapsed into two negative categories ("not in medical" and "low PCMH") and two positive categories ("medium PCMH" and "high PCMH") to test the ordered logit's assumption of one dimensionality. A Hausman-styled specification test, which purports a null hypothesis of the ordered logit is mis-specified, was completed and yielded an F statistic = 1.26 (p = 0.14) from which we can reject the null hypothesis and accept the ordered regression as correctly specified.

RQ 3: Do medical homes impact outcomes (fiscal and medical) of individuals living with chronic conditions? Several models (e.g. negative binomial regression or generalized gamma regression) were conducted depending on the distribution of the dependent variable of interest.

A. Total Expenditures.

The hypothesized relationships state that being in a medical home resulted in lower total health care expenditure. This was ascertained using a GLM regression conditional on any expenditure. The dependent variable (total expenditures) was log transformed with a kurtosis of 3.38 and a skewness of -0.21 (See Table 4-6). Manning and Mullahy (2001) recommend use of a GLM regression under these circumstances. Both GLM and log transformed OLS models were run to compare fit. The coefficients, linearized standard errors, and *p* values of significance tests (ttest) from the OLS and GLM regressions are presented in Table 4-10 (columns 2-4 and 5-7, respectively).

No significant relationship was observed between total health expenditures and medical homes (Y/N or levels). Holding everything constant, being in a low-level medical home ($p = 0.35$) and high level ($p = 0.51$) had lower total health care expenditures (although not significant) than their non-medical home counterparts. Respondents in medium level ($p = 0.90$) had higher total health care expenditures relative to individuals not in a medical home.

In the levels of medical homeness model, several predisposing, enabling, and need characteristics were observed to be significant. Compared with the respective reference groups, significantly lower expenditures were found for respondents who were publicly insured (0.05) and those who reported having a routine physician visit within the previous two years ($p = 0.02$). Individuals who were in good health ($p = 0.02$) or fair

health (p = 0.04) had significantly higher health care expenditures than those who reported excellent health. Further, for each additional chronic condition, there was an 18% increase in the health expenditures (p < 0.01). Conversely, as the physical component summary score increased, there was a decrease in total health care expenditures (p < 0.01).

GLM assumption and model fit tests: Figures 4-4 and 4-5 show the normal probability plot ("pnorm") of the total expenditures and log transformed total expenditures, respectively. Additionally, Figure 4-3 depicts the kernel density plot, which indicates that the predicted probability of the GLM regression is fairly close to being normally distributed. The quintile probability plot ("qnorm") in Figure 4-6 suggests a slight deviation from normality. The modified Hosmer-Lemeshow (H-L) test failed to provide evidence of linearity (p < 0.01). A modified Park test (p < 0.01) confirmed the presence of heteroskedasticity. Despite these deviations, Manning and colleagues (2005) argue that GLM provides an alternative that is more robust to distributional violations. Finally, Figures 4-7 and 4-8 suggest a good fit for most of the data with the exception of some extreme values that are explained by high health care expenditures.

Log transformed OLS assumption and model fit tests: A modified H-L test provided evidence of linearity (p = 0.11). A modified Park test confirmed homoscedasticity. When the model is linear, the coefficient on the square of the Pregibon link regression should be insignificantly different from zero. Pregibon's Link test confirmed that linear assumption was not violated (p = 0.07).

Bootstrap Prediction: Both the GLM and the log transformed OLS model underwent a bootstrap procedure (1000 iterations) to obtain the 95% confidence

intervals to determine whether the mean difference was statistically significant. The results from both models (GLM and OLS models) are presented in Table 4-11. On average, the health care expenditures for consumers in medical homes (after adjusting for covariates) was statistically less than for individuals who did not access care in a PCMH.

For the binary PCMH (Y/N) model, the mean expenditures for consumers in a medical home was $10,006.99 compared to their counterparts ($10,840.77). The GLM bootstrapped mean difference was negative $833.78 (CI: -$861.27, -$806.28). Total health care expenditures (GLM model) also varied significantly in the levels of medical homeness model. The average expenditure for low level medical homeness was $9,941, medium medical homeness $10,968, and high medical homeness $9,781.

Comparison of GLM and OLS: In the TPM model conditional on expenditure, both OLS and GLM yielded non-significant PCMH (Y/N) coefficients. The magnitude and direction were different for log-transformed OLS model (0.57) compared to GLM (-0.22). Conversely, the magnitude and direction of most of the covariates were fairly close.

In summary**,** medical homes had no significant impact on total health expenditures. The bootstrapped procedure, however, suggests that individuals in medical homes have lower expenditures on average ($834) than their non-medical homes counterparts.

B. All Physician Visits.

The hypothesis relationship was medical homes lead to increased physician visits. Two models were completed to predict provider visits. The results of GLM and negative binomial regression are presented in Table 4-12 with the coefficients, incidence rate ratio, and *p* values of significance tests (ttest) from the negative binomial

regression. No significant relationship was observed between physician visits and medical homes (Y/N or levels of medical home).

In the GLM, for levels of medical homeness, significant covariates were observed. Compared to their respective reference groups, significantly lower rates of physician visits were reported by respondents who indicated that they received routine dental care once a year ($p = 0.02$), less than once per year ($p = 0.05$), and never ($p = 0.00$). Conversely, individuals who reported being in very good health ($p = 0.02$) and good health ($p < 0.02$) had significantly higher numbers of physician visits than those in excellent health. Similarly, for each additional chronic condition there was a 20% increase in physician visits. On the other hand, as the physical functioning score increased there was a 2% decrease in physician visits ($p = 0.00$).

For complex survey designs, such as MEPS, Stata does not support model fitness test (e.g. likelihood ratio). However, Stata does provide a point estimate (negative binomial) of the dispersion parameter alpha ($\alpha = 0.619$) that has a 95% confidence interval (0.56 – 0.69). Note, an alpha value greater than one suggests under-dispersion, which indicates the variance is smaller than the mean (Wooldridge, 2006). Additionally, a design adjusted Wald test (multi-parameter predictors or hypotheses for linear combination of parameters) was run and yielded an F statistic of 10.98 ($p = 0.00$), which suggests that the model adequately fit the data. Figures 4-14 and 4-15 are graphic representation of model fitness for the GLM regression. A modified H-L test provides evidence of linearity ($p = 0.72$) and the Pregibon Link test (0.92) further supports linearity.

Additionally, the GLM model for physician visits underwent a bootstrap procedure (1000 iterations) to obtain the 95% confidence interval. The results are presented in Table 4-13. On average, consumers in medical homes (after adjusting for covariates) had a statistically greater number of visits than individuals who did not access care in a PCMH. The mean physician visits for PCMH consumers were 15.39 compared to their counterparts which had an average of 15.00 visits. The statistically significant bootstrapped mean difference was -0.39 (CI: -0.39, -0.38). The mean number of physician visits varied significantly by level of medical homes; consumers not in medical homes averaged 15.5 visits, low level medical homes 13.9 visits, medium medical homeness 17.1 visits, and high medical homeness average 14.3 visits.

C. Prescription Drugs.

The hypothesis was medical homes leads to increased prescription utilizations. The result of the negative binomial regression is presented in Table 4-14 with the coefficients, incidence rate ratio, and *p* values of significance tests (ttest) from the negative binomial regression.

There was no significant relationship between prescription drug utilization and medical homes (Y/N or levels). Holding everything constant, respondents in low level PCMH ($p = 0.41$), medium level ($p = 0.75$), and high level ($p = 0.40$) reported lower rates of prescription drugs than their non-medical home counterparts.

In the levels of medical homeness model, significant covariates were observed. Compared to their respective reference groups, significantly higher rates of prescription drugs were procured by individuals from poor families ($p = 0.03$), respondents residing in the Midwest ($p = 0.05$) and the South ($p = 0.05$). Additionally, individuals who reported being in good health ($p = 0.01$), fair health ($p = 0.01$) or poor health ($p = 0.02$)

filled prescription drugs at higher rates than their counterparts. Further, for each additional chronic condition, there was an increase in the rate of prescription drugs by a factor 1.28 ($p < 0.01$). Finally, as the physical component summary score increased, there was a decrease in the rate of prescription drugs by a factor of 0.99 ($p = 0.00$).

Several models were examined for goodness of fit and the negative binomial was selected. Between models, there were little differences in the magnitude and the direction of most of the coefficients. The PCMH coefficients were not significant in any models, zero inflated negative binomial regression model (0.31), or negative binomial regression (0.26). Figure 4-13 shows a graphic depiction of model fitness. It should be noted that neither model was adequate for predicting small numbers of prescription drugs. Additionally, a two-part model (conditional on any use) was completed, but model fitness indicated that these models were even less likely to adequately predict prescription drug use. The negative binomial model (levels of medical homeness) reported an alpha ($\alpha = 0.45$) at a 95% confidence interval (0.41-0.49) and an adjusted Wald test with an F statistic = 24.72 ($p < 0.01$).

In summary, medical homeness had no significant impact on prescription drug utilization.

D. Emergency Room Visits.

The hypothesized relationship asserts that medical homes lead to lower ER utilizations. The results are presented in Table 4-15 with the coefficients, incidence rate ratio, and p values of significance tests (ttest) from the negative binomial regression. No significant relationship was observed between ER and medical homes (Y/N or levels). In both models (Y/N and levels), as physical functioning score increased there

was a significant decrease in the number of emergency room visits by a factor of 0.98 (p = 0.01).

The negative binomial model reported an alpha (α = 1.01) at 95% confidence interval (0.74 - 1.65) and an adjusted Wald test with an F statistic = 5.00 (p = 0.00). Figure 4-9 displays the observed counts of emergency room visits versus the expected count from the negative binominal regression. This graph confirms that the negative binominal model is an excellent fit.

In summary, medical homeness had no significant impact on ER utilization.

E. Inpatient Discharges.

The hypothesis was that medical homes lead to fewer inpatient discharges. The results are presented in Table 4-16 with the coefficients, incidence rate ratio, and p values of significance tests (ttest) from the negative binomial regression. No significant relationship was observed between inpatient utilization and medical homes (Y/N or levels).

In the levels of medical of homeness model, significant results were observed for one variable. Holding everything constant, physical functioning score increased there was a significant decrease in the number of inpatient discharges by a factor 0.96 (p = 0.001).

The negative binomial model reported an alpha (α = 0.58) at 95% confidence interval (0.31 - 1.07) and an adjusted Wald test with an F statistic = 7.94 (p = 0.00). Figure 4-11 displays the observed counts of inpatient discharges versus the predicted count from the negative binominal regression. From this graph, we can verify that the negative binominal model is a good fit.

In summary, individuals in medical homes had no significant impact on inpatient discharges.

F. Lengths of Hospital Stays.

The hypothesis stated that medical homes lead to fewer inpatient days. The results are presented in Table 4-17 with the coefficients, incidence rate ratio, and *p* values of significance tests (ttest) from the negative binomial regression. There was no significant relationship between length of stay and medical homeness on all levels. However, in the PCMH (Y/N) model a significant difference was observed ($p = 0.03$).

In this model, significant covariates were observed. Compared to their respective reference groups, significantly more nights in hospital were reported by individuals from poor families ($p = 0.01$) and those who reported having a routine medical checkup within the past three to five years ($p = 0.05$). Conversely, respondents with significantly fewer nights in hospital were the uninsured ($p =0.00$), publicly insured (0.02), and those who reported having had a routine medical checkup within the past two years ($p = 0.00$). Finally, as the physical functioning score increased there was a significant decrease in the number of nights in hospital by a factor of 0.96 ($p < 0.01$).

The negative binomial model reported an alpha ($\alpha = 9.36$) with a 95% confidence interval (7.81 - 11.23) and an adjusted Wald test with an *F* statistic = 8.23 ($p = 0.00$). Figure 4-10 displays the observed counts of nights in the hospital versus the predicted count from the negative binominal regression. This confirms that the negative binominal model is an excellent fit.

RQ 4: Did any chronic condition modify the effect of patient-centered medical home? Several models (e.g. negative binomial regression or generalized

linear regression) were conducted depending on the distribution of the dependent variable of interest.

For each dependent variable, the same models were run, but with added interaction terms (being in PCMH * a given chronic disease). Chronic conditions without at least 50 persons in each category of medical homeness (Y/N) were not included in analysis (stroke and coronary heart disease). Table 4-18 depicts which disease moderated the effect of being in a PCMH. A significant moderator term explains whether the effect of medical home (Y/N) is different for respondents with a given chronic condition (Y/ N). Most of the moderator terms in the models were not significant, but four models (nights in hospital, ER visits, total expenditures, and physician visits) had significant moderator terms.

The moderator terms (PCMH * a given condition) in the negative binomial regression for length of stay yielded significant results for high blood pressure (IRR = 0.50, $p = 0.01$) and diabetes (IRR = 2.26, $p = 0.05$). The addition of the moderator term in the model also resulted in significant PCMH (0.00). This means that individuals living with high blood pressure who accessed care in a medical home had significantly shorter hospital stays. Conversely, individuals living with diabetes who access care in a medical home had significantly longer hospital stays.

The moderator term of “diabetes and medical homes” (IRR = 2.17, $p = 0.01$) was the only significant term in the ER visits model. This means that persons living with diabetes who access their care in medical home had significantly more ER visits even after controlling for all the covariates. Similarly, there was only one significant moderator term in the total expenditures model. The high blood pressure * PCMH term (-0.24, $p =$

0.05) suggests that respondents living with high blood pressure in medical homes spent 24% more on total health care expenditures than non-hypertensives not in medical homes. Finally, the physician visits model observed a significant high blood pressure moderator term (-0.23, $p = 0.05$). This suggests that respondents with high blood pressure in medical homes had 23 percent fewer physician visits.

In summary, high blood pressure moderated the effects of medical homes, which resulted in fewer physician visits, shorter stays in hospital, and lower total health care expenditures. Conversely, diabetics in medical homes had significantly longer stays.

Table 4-1. Internal consistency of final factors

Medical home factors	Alpha (0.64)	Variables
Interaction with provider	0.67	Doctor listened to you
		Doctor showed respect
		Doctor explained so understood
		Doctor spent enough time with you
		Got medical appointment when wanted
		Problem getting specialist referral
		Unable to get necessary medical care
		Provider explained options to you
		How difficult is it to contact USC by phone?
		How difficult is it to contact USC after hours?
		Provider asked you to help decide
		Unable to get necessary prescription medicine (s)
Accommodation	0.83	Go to USC for new health problem
		Go to USC for preventive health care
		Go to USC for referrals
		Go to USC for ongoing health problem

Extraction method: Principal axis factoring
Rotation method: Orthogonal with Kaiser normalization

Table 4-2. Domains of final factors

Medical home factors	Variables
Quality and safety focus	*Provider-patient communications*
	Doctor listened to you
	Doctor showed respect
	Doctor explained so you understood
	Doctor spent enough time with you
	Shared decision-making
	Provider explained options to you
	Provider asked you to help decide
Coordinated care	Go to USC for referrals
Comprehensive care	Problem getting specialist referral
	Unable to get necessary medical care
	Unable to get necessary prescription medicine (s)
Enhanced access	Go to USC for new health problem
	Go to USC for preventive health care
	Go to USC for ongoing health problem
	Got medical appointment when wanted
	How difficult is it to contact USC after hours?
	How difficult is it to contact USC by phone?

Table 4-3. Weighted sample characteristics

Variables	Un-weighted N	Weighted N	Weight (%)
Have a usual source of care (total)	15,338	146,131,681	
Yes	13,492	130,131,767	89.1
No	1,846	15,999,914	10.9
Evidence of patient-centered medical homeness (Y/N)			
Have a Usual Source of Care	3,125	30,406,185	
Yes	3,125	30,406,185	
Predisposing Factors			
Age	3,096	30,101,317	
18-34	237	2,415,228	8.0
35-49	655	6,348,680	21.1
50-64	1,167	11,455,556	38.1
65 +	1,037	9,881,853	32.8
Sex	3,125	30,406,184	
Male	1,228	12,803,999	42.1
Female	1,897	17,602,185	57.9
Race	3,125	30,406,185	
White	2,413	25,003,305	82.2
African American	524	3,632,487	11.9
Other	188	1,770,393	5.8
Hispanic ethnicity	3,125	30,406,184	
Yes	514	2,787,550	9.2
No	2,611	27,618,634	90.8
MSA	3,125	30,406,184	
Rural	612	5,452,510	17.9
Urban	2,513	24,953,674	82.1
Region	3,125	30,406,185	
Northeast	597	6,506,441	21.4
Midwest	603	6,419,186	21.1
South	1,248	11,356,650	37.3
West	677	6,123,908	20.1

(Table 4-3. Continued)

Variables	Un-weighted N	Weighted N	Weight (%)
Marital status	3,124	30,401,955	
Married	1,809	18,546,182	61.0
Widowed /Divorced/Separated	997	8,656,031	28.5
Never married	318	3,199,742	10.5
Educational attainment	3,113	30,310,228	
No high school diploma	737	4,714,264	15.6
Completed high school/GED	1,539	15,665,576	51.7
Completed 4 year degree	388	4,555,552	15.0
Graduate school	231	2,993,660	9.9
Other	218	2,381,176	7.9
How long since last routine checkup	3,065	29,867,656	
Within past year	2,599	25,249,773	84.5
Within past 2 years	215	2,209,368	7.4
Within past 3-5 years	169	1,646,313	5.5
Never	82	762,202	2.6
How long since last dental checkup	3,090	30,099,669	
Twice a year or more	1,084	12,885,092	42.8
Once a year	655	6,156,256	20.5
Less than once a year	710	5,862,101	19.5
Never	641	5,196,220	17.3
Need Factors			
Perceived health status	3,123	30,392,146	
Excellent	207	2,588,092	8.5
Very good	663	7,398,858	24.3
Good	1,044	10,252,745	33.7
Fair	800	7,028,079	23.1
Poor	409	3,124,372	10.3
Number of chronic condition(s)			
Mean number conditions	2.94		
Maximum	5.00		
Minimum	0.00		

(Table 4-3. Continued)

Variables	Un-weighted N	Weighted N	Weight (%)
Physical component (SF-12)			
Mean	41.17		
Maximum	72.17		
Minimum	5.90		
Enabling			
Income	3,125	30,406,185	
<100% FPL	577	3,802,721	12.5
101-200% FPL	213	1,472,529	4.8
201-300% FPL	494	4,197,718	13.8
301-400% FPL	823	8,398,808	27.6
>400% FPL	1,018	12,534,409	41.2
Insurance	3,125	30,406,185	
Any private	1,911	21,460,658	70.6
Public only	1,020	7,413,245	24.4
Uninsured	194	1,532,282	5.0
Coverage			
Gatekeeper/PCP requirement	3,035	29,392,837	
Yes, private plan with gatekeeper	144	1,682,365	5.7
No, private plan with gatekeeper	1,543	17,303,609	58.9
Not privately insured	1,348	10,406,863	35.4
Established network	3,017	29,313,700	
Covered by private plan with doctor list	456	5,407,349	18.4
Covered by private plan without doctor list	1,213	13,499,488	46.1
Not covered by private plan	1,348	10,406,863	35.5
Other			
Disease	3,125	30,406,183	
Diabetes	750	6,413,918	21.1
High blood pressure	1,148	11,508,326	37.8
Stroke	72	707,373	2.3
Asthma	243	2,360,177	7.8
COPD	176	1,872,704	6.2
CHD	78	778,587	2.6
Depression	501	5,220,797	17.2
Arthritis	157	1,544,301	5.1

(Table.4-3. Continued)

Variables	Un-weighted N	Weighted N	Weight (%)
Time	3,125	30,406,184	
2004	889	8,608,146	28.3
2005	813	7,792,131	25.6
2006	921	8,568,950	28.2
2007	502	5,436,957	17.9
Instrumental Variable			
Did anyone receive food stamps?	3,103	30,150,928	
Yes	455	2,855,990	9.5
No	2,648	27,294,938	90.5

Table 4-4. Weighted sample characteristics by medical home status

Variables	Evidence of medical homeness			Levels of medical homeness			
	Yes	No	P value	Low	Medium	High	P value
Have a Usual Source of Care	17,238,794	13,167,390		7,188,168	4,530,196	5,520,431	
Yes	100.0%	100.0%		100.0%	100.0%	100.0%	
No	0.0%	0.0%		0.0%	0.0%	0.0%	
Predisposing Factors							
Age	17,058,980	13,042,338	<.01	7,093,949	4,503,334	5,461,696	<.01
18-34	10.0%	5.4%		7.6%	7.9%	14.9%	
35-49	21.9%	20.1%		19.5%	24.9%	22.4%	
50-64	37.4%	38.9%		35.9%	36.9%	39.7%	
65 +	30.7%	35.6%		37.0%	30.3%	23.0%	
Sex	17,238,794	13,167,390	0.67	7,188,168	4,530,196	5,520,431	0.74
Male	41.7%	42.6%		41.8%	39.6%	43.3%	
Female	58.3%	57.4%		58.2%	60.4%	56.7%	
Race	17,238,794	13,167,390	0.46	7,188,168	4,530,196	5,520,431	0.04
White	80.9%	84.0%		82.8%	79.5%	79.7%	
African American	13.0%	10.6%		12.2%	15.0%	12.3%	
Other	6.1%	5.4%		5.1%	5.5%	8.0%	
Hispanic ethnicity	17,238,794	13,167,390	0.45	7,188,168	4,530,196	5,520,431	0.28
Yes	9.5%	8.7%		41.8%	39.6%	43.3%	
No	90.5%	91.3%		58.2%	60.4%	56.7%	

(Table 4-4. Continued)

Variables	Evidence of medical homeness			Levels of medical homeness			
	Yes	No	P value	Low	Medium	High	P value
MSA	17,238,794	13,167,390	0.68	7,188,168	4,530,196	5,520,431	0.25
Rural	18.2%	17.6%		16.2%	21.2%	18.3%	
Urban	81.8%	82.4%		83.8%	78.8%	81.7%	
Region	17,238,794	13,167,390	0.01	7,188,168	4,530,196	5,520,431	0.04
Northeast	19.0%	24.6%		20.9%	17.4%	17.7%	
Midwest	20.8%	21.5%		21.7%	21.1%	19.3%	
South	38.6%	35.7%		36.6%	40.6%	39.6%	
West	21.6%	18.2%		20.7%	21.0%	23.4%	
Marital status	17,238,794	13,163,161	0.37	7,188,168	4,530,196	5,520,431	0.02
Married	59.9%	62.5%		61.7%	62.9%	55.1%	
Widowed/Divorced /Separated	28.9%	27.9%		29.1%	27.8%	29.7%	
Never married	11.2%	9.7%		9.2%	9.3%	15.3%	
Educational attainment	17,174,080	13,136,148	<.01	7,152,462	4,530,196	5,491,422	0.02
No high school diploma	17.1%	13.5%		16.4%	18.0%	17.4%	
Completed high school/GED	53.6%	49.1%		51.5%	54.3%	55.7%	
Completed 4 year degree	13.6%	16.9%		15.2%	12.6%	12.3%	
Graduate school	8.1%	12.2%		9.0%	7.8%	7.2%	
Other	7.6%	8.2%		7.9%	7.3%	7.3%	

(Table 4-4. Continued)

Variables	Evidence of medical homeness			Levels of medical homeness			
	Yes	No	P value	Low	Medium	High	P value
How long since last routine checkup	16,921,858	12,945,798	0.16	7,088,317	4,480,627	5,352,914	0.07
Within past year	82.7%	86.9%		84.8%	82.2%	80.4%	
Within past 2 years	8.3%	6.3%		6.5%	10.5%	8.8%	
Within past 3-5 years	6.3%	4.5%		5.7%	6.2%	7.2%	
Never	2.7%	2.3%		3.1%	1.1%	3.7%	
How long since last dental checkup	17,072,129	13,027,540	<.01	7,165,350	4,456,170	5,450,609	<.01
Twice a year or more	39.7%	46.9%		45.4%	39.8%	32.0%	
Once a year	19.6%	21.6%		17.4%	19.1%	22.8%	
Less than once a year	22.0%	16.2%		18.9%	21.9%	26.0%	
Never	18.8%	15.3%		18.3%	19.1%	19.2%	
Need Factors							
Perceived health status	17,234,432	13,157,714	<.01	7,188,168	4,530,196	5,516,069	<.01
Excellent	6.7%	10.9%		8.1%	6.0%	5.4%	
Very good	21.3%	28.4%		26.9%	22.5%	12.9%	
Good	32.8%	35.0%		35.8%	30.3%	30.7%	
Fair	26.0%	19.3%		19.7%	28.1%	32.5%	
Poor	13.3%	6.4%		9.4%	13.0%	18.4%	
Number of chronic condition(s)							
Mean Number Conditions	3.04	2.83	<.01				
Maximum	0.00	5.00					
Minimum	0.00	5.00					

(Table 4-4. Continued)

Variables	Evidence of medical homeness			Levels of medical homeness			
	Yes	No	P value	Low	Medium	High	P value
Physical Component (SF-12)							
Mean	38.29	41.79	<.01				
Maximum	70.31	65.08					
Minimum	5.90	7.46					
Enabling							
Income	17,238,794	13,167,390	<.01	7,188,168	4,530,196	5,520,431	<.01
<100% FPL	14.3%	10.1%		11.4%	12.4%	19.7%	
101-200% FPL	5.8%	3.6%		5.4%	5.3%	6.7%	
201-300% FPL	15.1%	12.1%		14.6%	15.8%	15.3%	
301-400% FPL	27.6%	27.7%		27.1%	27.2%	28.5%	
>400% FPL	37.1%	46.6%		41.4%	39.3%	29.8%	
Insurance	17,238,794	13,167,390	<.01	7,188,168	4,530,196	5,520,431	<.01
Any private	66.1%	76.5%		71.1%	67.0%	58.8%	
Public only	27.2%	20.7%		24.6%	26.7%	31.0%	
Uninsured	6.7%	2.8%		4.3%	6.3%	10.2%	
Coverage							
Gatekeeper/PCP Requirement	16,665,171	12,727,666	<.01	6,937,008	4,389,492	5,338,671	<.01
Yes, private plan with gatekeeper	5.4%	6.2%		4.7%	7.7%	4.3%	
No, private plan with gatekeeper	54.2%	65.0%		61.1%	53.2%	46.0%	
Not privately insured	40.4%	28.8%		34.1%	39.1%	49.7%	

(Table 4-4. Continued)

Variables	Evidence of medical homeness			Levels of medical homeness			
	Yes	No	P value	Low	Medium	High	P value
Established network	16,556,171	12,757,529	<.01	6,884,907	4,394,995	5,276,269	<.01
Covered by private plan with doctor list	17.1%	20.2%		20.7%	14.8%	14.2%	
Covered by private plan without doctor list	42.2%	51.0%		44.9%	46.1%	35.5%	
Not covered by private plan	40.7%	28.7%		34.4%	39.1%	50.3%	
Disease	17,238,794	13,167,390	<.01	7,188,168	4,530,196	5,520,431	<.01
Diabetes	21.4%	20.7%		22.1%	18.2%	23.1%	
High blood pressure	34.5%	42.3%		37.6%	38.8%	26.9%	
Stroke	2.2%	2.5%		2.6%	2.4%	1.4%	
Asthma	8.4%	7.0%		7.0%	9.0%	9.6%	
COPD	6.0%	6.3%		6.6%	4.2%	6.8%	
CHD	2.7%	2.4%		3.3%	2.5%	2.2%	
Depression	19.9%	13.6%		16.2%	20.1%	24.6%	
Arthritis	4.9%	5.3%		4.6%	4.8%	5.4%	
Time	17,238,794	13,167,390	0.16	7,188,168	4,530,196	5,520,431	0.05
2004	29.9%	26.2%		27.1%	30.2%	33.2%	
2005	24.4%	27.2%		27.4%	21.4%	23.1%	
2006	27.4%	29.2%		25.2%	29.9%	28.2%	
2007	18.3%	17.4%		20.3%	18.5%	15.4%	

*Significance at 0.05 level
**Significance at 0.01 level

Table 4-5. Mean health services unadjusted utilization and expenditure

	Evidence of medical homeness		Levels of medical homeness		
Variables	Yes	No	Low	Medium	High
Utilization	1,841	1,284	753	482	606
Inpatient discharges	0.35	0.30*	0.34	0.36	0.34
Length of Stay	2.17	1.65*	1.98	2.73	1.99
Office based visits	12.88	12.68	12.61	14.55	11.89
Outpatient based visits	1.35	1.33	1.32	1.36	1.37
Total RXs	40.29	35.10*	39.01	43.65	39.22
E.R. Visits	0.50	0.36*	0.39	0.48	0.65
Psychical Component SF-12	38.29	41.79*	39.82	38.04	36.59
Number of chronic condition(s)	3.04	2.83*	2.97	3.11	3.08
Expenditures					
Total expenditure	$10,279.01	$10,242.17	$10,225.69	$11,531.16	$9,349.34
RX expenditure	$2,689.71	$2,542.90	$2,526.99	$2,973.28	$2,666.35
E.R. facility expenditure	$275.55	$259.12	$234.48	$254.86	$343.03
E.R. doctor expenditure	$54.82	$48.50	$39.70	$55.05	$73.44
Inpatient facility expenditure	$3,048.28	$3,166.43	$3,185.16	$3,384.41	$2,610.83
Inpatient doctor expenditure	$424.77	$427.55	$462.85	$537.57	$287.74
Office based visit expenditure	$2,010.50	$2,093.13	$1,912.65	$2,310.91	$1,893.15
Office based doctor expenditure	$1,440.17	$1,431.19	$1,376.52	$1,477.96	$1,489.19

*Significance at 0.05 level

Table 4-6. Description of dependent variables

Variables	N	Mean	Min	Max	Skewness	Kurtosis
PCMH	3,125	6.26	0.00	16.00	1.45	6.07
PCMH (Y/N)	3,125	0.59	0.00	1.00	-0.36	1.13
PCMH (level)	3,125	1.13	0.00	3.00	0.51	1.78
Discharges	3,125	0.33	0.00	7.00	3.19	16.97
Length of hospital stay	3,125	1.93	0.00	152.00	9.68	137.87
RX	3,125	38.12	0.00	320.00	1.93	8.44
All visits	3,125	14.09	0.00	215.00	4.34	31.84
Log All visits	3,125	2.29	0.00	5.38	0.01	3.14
ER visits	3,125	0.44	0.00	12.00	4.30	32.26
Total expenditures	3,125	$10,246.31	0.00	$440,524.00	8.23	153.94
Log expenditures	3,125	$8.53	0.00	13.00	-0.21	3.38

Table 4-7. Mean utilization by Patient-centered medical home status: Controlling for physical component summary score (PCS)

Variables	Medical Home Yes	No
Above Average	N = 418	N=417
Inpatient Discharges	0.11	0.12
Length of Stay	0.29	0.40
Office Based Visits	8.66	9.24
Outpatient Based Visits	0.60	0.77
Total Rx	19.94	21.79
E.R. Visits	0.16	0.20
Psychical Component SF12	55.24	55.18
Number of Chronic Conditions	2.16	2.03
Below Average	N = 1423	N = 867
Inpatient Discharges	0.42	0.38
Length of Stay	2.73	2.25
Office Based Visits	14.12	14.34
Outpatient Based Visits	1.57	1.60
Total Rx	46.27	41.50*
E.R. Visits	0.60	0.43*
Psychical Component SF12	33.23	35.25*
Number of Chronic Conditions	3.30	3.22

*Significance at 0.05 level

Table 4-8. Mean expenditures by patient-centered medical home status: Controlling for physical component summary score (PCS)

Variables	Medical Homes Yes	No
Above Average	N = 418	N=417
Total Expenditure	$4,570.00	$5,090.77
RX Expenditure	$1,350.35	$1,460.01
E.R. Facility Expenditure	$78.52	$108.99
E.R. Doctor Expenditure	$30.08	$26.34
Inpatient Facility Expenditure	$603.28	$778.29
Inpatient Doctor Expenditure	$107.36	$135.07
Office Based Visit Expenditure	$1,242.35	$1,536.91
Office Based Doctor Expenditure	$900.54	$910.03
Physical Component SF12	55.24	55.18
Number of Chronic Condition	2.16	2.03
Below Average	N = 1423	N = 867
Total Expenditure	$11,955.99	$12,719.83
RX Expenditure	$3,083.14	$3,063.74
E.R. Facility Expenditure	$333.42	$331.32
E.R. Doctor Expenditure	$62.09	$59.17
Inpatient Facility Expenditure	$3,766.48	$4,315.05
Inpatient Doctor Expenditure	$518.01	$568.22
Office Based Visit Expenditure	$2,236.14	$2,360.66
Office Based Doctor Expenditure	$1,598.68	$1,681.85
Physical Component SF12	33.23	35.25*
Number of Chronic Condition	3.3	3.21

*Significance at $p < 0.05$

Table 4-9. Regressions (Logit and Ordered) predicting belonging to medical home (Y/N and levels)

Variables	Binary Logit model			Ordered Logit		
	Odds Ratio	SE	p value	Odds Ratio	SE	p value
Predisposing Factors						
Age						
18-24	Reference					
25-44	0.79	0.29	0.53	0.74	0.27	0.41
45-64	0.44	0.16	0.02*	0.42	0.16	0.02*
65 +	0.37	0.14	0.01*	0.33	0.13	0.00*
Sex						
Female	Reference					
Male	1.10	0.11	0.33	0.89	0.08	0.18
Race						
White	Reference					
African American	1.22	0.17	0.16	1.09	0.13	0.48
Other	1.08	0.23	0.74	1.20	0.22	0.32
Hispanic ethnicity						
No	Reference					
Yes	0.93	0.15	0.63	1.07	0.15	0.63
MSA						
Urban	Reference					
Rural	0.89	0.12	0.40	1.03	0.13	0.82
Region						
Northeast	Reference					
Midwest	1.19	0.18	0.25	1.19	0.17	0.21
South	1.31	0.20	0.07**	1.42	0.19	0.01*
West	1.64	0.24	0.00*	1.67	0.23	0.00*
Marital status						
Married	Reference					
Widowed/Divorced/Separated	0.91	0.11	0.40	0.94	0.10	0.57
Never married	0.73	0.13	0.08**	0.85	0.15	0.36

(Table 4-9. Continued)

Variables	Binary Logit model			Ordered Logit		
Educational attainment						
Graduate school	Reference					
No high school diploma	1.33	0.27	0.16	1.18	0.23	0.38
Completed high school/GED	1.30	0.24	0.16	1.25	0.23	0.22
Completed 4 year degree	1.11	0.22	0.61	1.10	0.21	0.60
Other	1.17	0.31	0.55	1.14	0.29	0.62
How long since last routine checkup						
Within past year	Reference					
Within past 2 years	1.33	0.24	0.11	1.40	0.21	0.03*
Within past 3-5 years	1.16	0.39	0.66	1.12	0.31	0.69
Never	1.66	0.70	0.23	1.60	0.53	0.16
How long since last dental checkup						
Twice a year or more	Reference					
Once a year	0.83	0.11	0.15	0.91	0.11	0.42
Less than once a year	1.09	0.14	0.53	1.11	0.13	0.38
Never	0.93	0.14	0.62	0.93	0.11	0.54
Need Factors						
Perceived health status						
Excellent	Reference					
Very good	1.21	0.22	0.31	1.14	0.20	0.45
Good	1.43	0.26	0.05*	1.46	0.26	0.04*
Fair	1.71	0.36	0.01*	1.98	0.41	0.00*
Poor	2.06	0.58	0.01*	2.35	0.64	0.00*
Number of chronic condition(s)	1.07	0.03	0.03*	1.07	0.03	0.02*
Physical Component (SF-12)	0.99	0.01	0.05*	0.99	0.00	0.03*
Enabling						
Income						
>400% FPL	Reference					
<100% FPL	0.93	0.16	0.67	1.03	0.16	0.86
101-200% FPL	1.32	0.34	0.28	1.31	0.28	0.22
201-300% FPL	1.17	0.19	0.34	1.17	0.16	0.28
301-400% FPL	1.01	0.13	0.94	1.04	0.12	0.72

(Table 4-9. Continued)

Variables	Binary Logit model			Ordered Logit		
Insurance						
Any private	Reference					
Public only	1.08	0.15	0.57	1.09	0.13	0.47
Uninsured	2.30	0.58	0.00*	2.61	0.58	0.00*
Gatekeeper/PCP requirement						
No, private plan with gatekeeper	Reference					
Yes, private plan with gatekeeper	0.99	0.23	0.97	1.04	0.22	0.87
Established network						
Private plan without doctor list	Reference					
Private plan with doctor list	1.05	0.15	0.75	0.99	0.12	0.93
Other						
Did anyone receive food stamps						
Yes	Reference					
No	0.65	0.13	0.03*	0.75	0.11	0.06**
Time						
2004	Reference					
2005	0.77	0.11	0.05*	0.75	0.09	0.02*
2006	0.84	0.12	0.23	0.86	0.11	0.24
2007	0.96	0.16	0.78	0.89	0.12	0.40

*Significance at 0.05 level
**Significance at 0.01 level

Table 4-10. Regression (GLM) predicting amount of total expenditures

Total Expenditures (GLM)	Medical homes levels (0-3)			Medical homes (Y/N)		
	Coefficient	SE	p value	Coefficient	SE	p value
Patient-centered medical homes						
No	..	..	..			
Yes	..	..	..	-0.78	1.21	0.52
Patient-centered Medical Homes						
Not in PCMH	Reference					
Low level	-4.13	4.39	0.35	..	..	..
Medium level	0.55	4.60	0.90	..	..	..
High level	-2.11	3.23	0.51	..	..	..
Predisposing Factors						
Age						
18-24	Reference					
25-44	-0.73	0.38	0.85	-0.01	0.36	0.97
45-64	-0.12	0.55	0.82	0.11	0.46	0.98
65 +	-0.20	0.64	0.76	-0.01	0.50	0.99
Sex						
Female	Reference					
Male	0.28	0.09	0.76	0.04	0.08	0.56
Race						
White	Reference					
African American	0.00	0.10	0.99	0.01	0.11	0.94
Other	-0.07	0.16	0.67	-0.10	0.15	0.48
Hispanic ethnicity						
No	Reference					
Yes	0.12	0.14	0.41	0.12	0.14	0.41
MSA						
Urban	Reference					
Rural	-0.05	0.09	0.57	-0.05	0.09	0.55
Region						
Northeast	Reference					
Midwest	0.21	0.11	0.06**	0.17	0.10	0.09**
South	0.26	0.17	0.14	0.16	0.12	0.16
West	0.34	0.23	0.13	0.24	0.16	0.15

(Table 4-10. Continued)

Total Expenditures (GLM)	Medical homes levels (0-3)			Medical homes (Y/N)		
Marital status						
Married	Reference					
Widowed/Divorced/Separated	0.06	0.08	0.47	0.07	0.08	0.43
Never married	-0.02	0.16	0.89	-0.01	0.16	0.94
Educational attainment						
Graduate school	Reference					
No high school diploma	0.08	0.16	0.62	0.07	0.17	0.70
Completed high school/GED	-0.01	0.14	0.96	-0.05	0.14	0.73
Completed 4 year degree	0.08	0.13	0.53	0.05	0.12	0.71
Other						
How long since last routine checkup						
Within past year	Reference					
Within past 2 years	-0.47	0.19	0.02*	-0.52	0.15	0.00*
Within past 3-5 years	0.38	0.27	0.17	0.36	0.27	0.19
Never	0.39	0.43	0.37	0.33	0.39	0.40
How long since last dental checkup						
Twice a year or more	Reference					
Once a year	0.00	0.13	0.97	0.00	0.13	1.00
Less than once a year	-0.01	0.11	0.93	-0.03	0.11	0.81
Never	-0.06	0.13	0.63	-0.06	0.12	0.65
Need Factors						
Perceived health status						
Excellent	Reference					
Very good	0.29	0.16	0.08**	0.26	0.17	0.13
Good	0.52	0.22	0.02*	0.43	0.19	0.02*
Fair	0.68	0.35	0.05*	0.51	0.24	0.04*
Poor	0.76	0.43	0.08*	0.62	0.30	0.04*
Number of chronic condition(s)	0.18	0.04	0.00*	0.17	0.03	0.00*
Physical Component (SF-12)	-0.03	0.01	0.00*	-0.03	0.00	0.00*

(Table 4-10. Continued)

Total Expenditures (GLM)	Medical homes levels (0-3)			Medical homes (Y/N)		
Enabling						
Income						
>400% FPL	Reference					
<100% FPL	0.01	0.13	0.93	-0.02	0.12	0.87
101-200% FPL	-0.04	0.17	0.79	-0.08	0.15	0.59
201-300% FPL	0.01	0.14	0.91	-0.01	0.12	0.91
301-400% FPL	0.05	0.10	0.63	0.03	0.09	0.77
Insurance						
Any private	Reference					
Public only	-0.24	0.12	0.05*	-0.25	0.12	0.03*
Uninsured	-0.43	0.45	0.34	-0.53	0.25	0.04*
Coverage - Gatekeeper/PCP Requirement						
No, private plan with gatekeeper	Reference					
Yes, private plan with gatekeeper	0.01	0.16	0.96	-0.01	0.16	0.97
Established network						
Private plan without doctor list	Reference					
Private plan with doctor list	-0.07	0.09	0.44	-0.05	0.09	0.58
Other						
Primary care provider						
No	Reference					
Yes	0.22	0.22	0.30	-0.22	0.22	0.32
Time						
2004	Reference					
2005	-0.15	0.15	0.34	-0.10	0.12	0.43
2006	-0.13	0.11	0.22	-0.11	0.10	0.26
2007	-0.30	0.12	0.01*	-0.27	0.11	0.02*

*Significance at 0.05 level
**Significance at 0.01 level

Table 4-11. Bootstrap prediction of expenditure differences after GLM and log-transformed OLS

Variables	N	Mean	SD	95% CI
Log - transformed OLS				
PCMH - Yes	1000	$10,181.59	$6,952.27	
PCMH - No	1000	$11,178.41	$6,332.31	
Difference (No - Yes)	1000	$996.82*	$619.96	($1029.65, $963.98)
GLM				
PCMH - Yes	1000	$10,006.99	$6,197.59	
PCMH - No	1000	$10,840.77	$6,713.97	
Difference (No - Yes)	1000	$833.78*	$516.38	($861.27, $806.28)
Levels of PCMH				
OLS				
No PCMH	1000	$11,114.81	$6,853.55	
Low PCMH	1000	$9,941.18	$6,129.88	
Medium PCMH	1000	$10,968.19	$6,763.14	
High PCMH	1,000	$9,780.97	$6,031.09	
Difference No - Low	1000	-$1,173.63*	$723.67	(-$1210.96, -$1136.29)
Difference No - Med	1000	-$146.62*	$90.41	(-$151.17, -$142.06)
Difference No - High	1000	-$1,333.84*	$822.46	(-$1376.64, -$1291.03)
Difference Low - Med	1000	$1,027.01*	$633.27	($994.28, $1059.73)
Difference Med - High	1000	-$1,187.22*	$732.05	(-$1225.11, -$1149.33)

*Significance at 0.05 level

Table 4-12. General linear regression and negative binomial regression predicting ambulatory visits

All physician visits	Medical home levels (0-3)			GLM: medical homes (Y/N)			NB: medical homes (Y/N)		
	Coefficient	SE	p value	Coefficient	SE	p value	Rate Ratio	SE	p value
Patient-centered medical homes									
No	Reference								
Yes	..	..	..	0.05	1.43	0.98	0.73	1.05	0.83
Patient-centered medical homes									
Not in PCMH	Reference								
Low level	3.09	3.23	0.34	..	..	..	..	..	..
Medium level	-2.20	2.02	0.28	..	..	..	..	..	..
High level	5.80	5.92	0.33	..	..	..	..	..	..
Predisposing Factors									
Age									
18-24	Reference								
25-44	0.09	0.36	0.81	0.23	0.34	0.50	1.21	0.42	0.59
45-64	-0.34	0.55	0.54	0.00	0.44	1.00	0.91	0.41	0.84
65 +	-0.34	0.67	0.62	0.10	0.49	0.83	0.99	0.5	0.98
Sex									
Female	Reference								
Male	0.38	0.09	0.68	0.09	0.08	0.24	0.94	0.07	0.42
Race									
White	Reference								
African American	0.11	0.12	0.34	0.1	0.13	0.27	1.11	0.15	0.42
Other	0.34	0.26	0.18	0.29	0.27	0.47	1.33	0.33	0.25

(Table 4-12. Continued)

All physician visits	Medical home levels (0-3)			GLM: medical homes (Y/N)			NB: medical homes (Y/N)		
Hispanic ethnicity									
No	Reference								
Yes	0.12	0.11	0.30	0.11	0.11	0.32	0.89	0.1	0.30
MSA									
Urban	Reference								
Rural	0.11	0.07	0.10**	0.1	0.07	0.14	0.9	0.06	0.12
Region									
Northeast	Reference								
Midwest	0.04	0.13	0.75	-0.04	0.10	0.70	0.98	0.1	0.86
South	0.14	0.19	0.46	-0.01	0.12	0.95	1.02	0.12	0.87
West	0.19	0.26	0.47	0.01	0.18	0.95	1.03	0.18	0.87
Marital status									
Married	Reference								
Widowed/Divorced/Separated	-0.01	0.08	0.86	0.00	0.09	1.00	1.00	0.09	0.98
Never married	0.17	0.17	0.31	0.28	0.18	0.12	1.26	0.22	0.2
Educational attainment									
Graduate school	Reference								
No high school diploma	-0.04	0.18	0.81	-0.11	0.19	0.54	0.9	0.17	0.56
Completed high school/GED	0.00	0.18	0.99	-0.08	0.16	0.64	0.93	0.15	0.65
Completed 4 year degree	-0.07	0.15	0.61	-0.11	0.14	0.42	0.89	0.13	0.42
Other	0.16	0.18	0.37	0.08	0.17	0.64	1.1	0.19	0.56

(Table 4-12. Continued)

All physician visits	Medical home levels (0-3)			GLM: medical homes (Y/N)			NB: medical homes (Y/N)		
How long since last routine checkup									
Within past year	Reference								
Within past 2 years	-0.35	0.20	0.09**	0.43	0.15	0.00*	0.65	0.10	0.01*
Within past 3 - 5 years	-0.32	0.22	0.15	-0.20	0.19	0.28	0.71	0.15	0.11
Never	0.18	0.46	0.70	0.08	0.47	0.87	1.12	0.51	0.81
How long since last dental checkup									
Twice a year or more	Reference								
Once a year	-0.21	0.09	0.02*	-0.23	0.09	0.08**	0.84	0.08	0.07**
Less than once a year	-0.20	0.10	0.05*	-0.28	0.08	0.01*	0.80	0.07	0.01*
Never	-0.29	0.08	0.00*	-0.43	0.15	0.00*	0.76	0.06	0.00*
Perceived health status									
Excellent	Reference								
Very good	0.26	0.11	0.02*	0.22	0.11	0.05*	1.25	0.14	0.05*
Good	0.46	0.20	0.02*	0.31	0.15	0.04*	1.39	0.21	0.02*
Fair	0.52	0.36	0.16	0.26	0.22	0.23	1.34	0.3	0.18
Poor	0.50	0.43	0.25	0.21	0.26	0.42	1.33	0.35	0.28
Number of chronic condition(s)	0.20	0.04	0.00*	0.16	0.31	0.00*	1.19	0.04	0.00*
Physical Component (SF-12)	-0.02	0.01	0.00*	-0.02	0.01	0.00*	0.98	0.01	0.00*

(Table 4-12. Continued)

All physician visits	Medical home levels (0-3)			GLM: medical homes (Y/N)			NB: medical homes (Y/N)		
Enabling									
Income									
>400% FPL	Reference								
<100% FPL	-0.18	0.10	0.06**	-0.19	0.09	0.04*	0.8	0.08	0.03*
101-200% FPL	-0.17	0.18	0.35	-0.28	0.14	0.05*	0.79	0.11	0.10**
201-300% FPL	-0.10	0.11	0.38	-0.17	0.1	0.09	0.87	0.08	0.14
301-400% FPL				-0.08	0.07	0.3	0.93	0.07	0.34
Insurance									
Any private	Reference								
Public only	0.02	0.11	0.86	-0.01	0.1	0.96	1.00	0.1	0.98
Uninsured	-0.14	0.48	0.77	-0.3	0.3	0.31	0.69	0.2	0.21
Gatekeeper/PCP requirement									
No, private plan with gatekeeper	Reference								
Yes, private plan with gatekeeper	-0.06	0.13	0.63	-0.08	0.13	0.54	0.94	0.12	0.61
Established network									
Covered by private plan without dr. list	Reference								
Covered by private plan with dr. list	0.05	0.08	0.52	0.05	0.08	0.52	1.06	0.08	0.48
Other									
Primary care provider									
No	Reference								
Yes	-0.34	0.21	0.10	-0.37	0.2	0.06**	0.72	0.15	0.11

(Table 4-12. Continued)

All physician visits	Medical home levels (0-3)			GLM: medical homes (Y/N)			NB: medical homes (Y/N)		
Time									
2004	Reference								
2005	-0.03	0.16	0.85	0.07	0.11	0.55	1.05	0.12	0.68
2006	-0.12	0.10	0.21	-0.05	0.09	0.54	0.93	0.08	0.37
2007	-0.28	0.11	0.01*	-0.24	0.09	0.01*	0.78	0.07	0.01*

*Significance at 0.05 level
**Significance at 0.01 level

Table 4-13. Bootstrap prediction of physician visits differences after GLM

Variables	N	Mean	SD	95% CI
GLM				
PCMH - Yes	1000	15.39	7.04	
PCMH - No	1000	15.00	6.86	
Difference (No - Yes)	1000	-0.39*	0.18	(-0.39, -0.38)
Levels of PCMH				
No PCMH	1000	15.50	7.10	
Low PCMH	1000	13.89	6.36	
Medium PCMH	1000	17.12	7.84	
High PCMH	1,000	14.32	6.56	
Difference No - Low	1000	1.61*	0.74	(1.65, 1.58)
Difference No - Med	1000	-1.62*	0.74	(-1.58, -1.66)
Difference No- High	1000	1.19*	0.54	(1.21, 1.16)

*Significance at 0.05 level

Table 4-14. Negative binomial regression predicting prescription drug use

Prescription drugs	Medical homes levels (0-3)			Medical homes (Y/N)		
	Rate Ratio	SE	p value	Rate Ratio	SE	p value
Patient-centered medical homes						
No	Reference	..	..			
Yes	..	..	..	0.26	0.26	0.17
Patient-centered medical homes						
Not in PCMH	Reference					
Low level	0.05	0.18	0.41	..	..	..
Medium level	0.34	1.15	0.75	..	..	..
High level	0.13	0.31	0.40	..	..	..
Predisposing Factors						
Age						
18-24	Reference					
25-44	1.22	0.29	0.42	1.29	0.30	0.26
45-64	1.24	0.44	0.55	1.38	0.39	0.25
65 +	1.05	0.46	0.92	1.23	0.39	0.53
Sex						
Female	Reference					
Male	1.01	0.06	0.91	1.03	0.05	0.59
Race						
White	Reference					
African American	1.05	0.07	0.51	1.08	0.08	0.33
Other	1.05	0.14	0.74	1.00	0.12	1.00
Hispanic ethnicity						
No	Reference					
Yes	0.93	0.09	0.46	0.92	0.09	0.41
MSA						
Urban	Reference					
Rural	0.92	0.05	0.14	0.93	0.06	0.22
Region						
Northeast	Reference					
Midwest	1.19	0.11	0.05*	1.16	0.09	0.06**
South	1.30	0.17	0.05*	1.21	0.11	0.04*
West	1.33	0.25	0.12	1.24	0.16	0.1

(Table 4-14. Continued)

Prescription drugs	Medical homes levels (0-3)			Medical homes (Y/N)		
Marital status						
Married	Reference					
Widowed/Divorced/Separated	1.03	0.06	0.69	1.02	0.07	0.75
Never married	0.97	0.10	0.78	0.95	0.11	0.65
Educational attainment						
Graduate school	Reference					
No high school diploma	1.25	0.16	0.08**	1.26	0.16	0.07**
Completed high school/GED	1.19	0.13	0.11	1.17	0.12	0.13
Completed 4 year degree	1.16	0.10	0.24	1.1	0.1	0.32
Other	0.98	0.11	0.84	0.96	0.11	0.76
How long since last routine checkup						
Within past year	Reference					
Within past 2 years	0.93	0.14	0.64	0.89	0.1	0.29
Within past 3-5 years	1.09	0.28	0.75	1.08	0.27	0.78
Never	1.40	0.53	0.38	1.34	0.47	0.41
How long since last dental checkup						
Twice a year or more	Reference					
Once a year	0.97	0.07	0.66	0.95	0.08	0.52
Less than once a year	1.06	0.07	0.36	1.05	0.07	0.45
Never	1.09	0.28	0.75	1.08	0.08	0.29
Need Factors						
Perceived health status						
Excellent	Reference					
Very good	1.21	0.13	0.08**	1.21	0.13	0.08**
Good	1.56	0.26	0.01*	1.46	0.19	0.00*
Fair	2.02	0.55	0.01*	1.75	0.31	0.00*
Poor	2.21	0.72	0.02*	1.94	0.42	0.00*
Number of chronic condition(s)	1.28	0.04	0.00*	1.27	0.03	0.00*
Physical Component (SF-12)	0.99	0.00	0.01*	0.99	0.004	0.00*

(Table 4-14. Continued)

Prescription drugs	Medical homes levels (0-3)			Medical homes (Y/N)		
Enabling						
Income						
>400% FPL	Reference					
<100% FPL	1.22	0.11	0.03*	1.19	0.11	0.06**
101-200% FPL	1.15	0.15	0.30	1.12	0.13	0.34
201-300% FPL	1.19	0.11	0.06**	1.17	0.1	0.06**
301-400% FPL	1.06	0.06	0.33	1.04	0.06	0.53
Insurance						
Any private	Reference					
Public only	1.24	0.09	0.00*	1.23	0.09	0.00*
Uninsured	1.13	0.40	0.74	1.02	0.22	0.92
Gatekeeper/PCP requirement						
No, private plan with gatekeeper	Reference					
Yes, private plan with gatekeeper	1.16	0.12	0.15	1.14	0.12	0.21
Established network						
Private plan without doctor list	Reference					
Private plan with doctor list	1.23	0.07	0.00*	1.25	0.08	0.00*
Other						
Primary care provider						
No	Reference					
Yes	1.02	0.11	0.88	1.02	0.11	0.85
Time						
2004	Reference					
2005	0.97	0.11	0.77	1.01	0.08	0.9
2006	1.03	0.07	0.67	1.04	0.07	0.52
2007	0.90	0.08	0.19	0.93	0.07	0.33

*Significance at 0.05 level
**Significance at 0.01 level

Table 4-15. Negative binomial regression predicting ER visits

Emergency room visits	Medical homes levels (0-3)			Medical homes (Y/N)		
	Rate Ratio	SE	p value	Rate Ratio	SE	p value
Patient-centered medical homes						
No	..	..	..			
Yes	..	..	..	1.32	2.69	0.89
Patient-centered medical homes						
Not in PCMH	Reference					
Low level	0.01	0.11	0.62	..	..	..
Medium level	4.01	31.33	0.86	..	..	..
High level	0.30	1.65	0.83	..	..	..
Predisposing Factors						
Age						
18-24	Reference					
25-44	0.50	0.27	0.20	0.54	0.27	0.22
45-64	0.39	0.31	0.24	0.45	0.28	0.21
65 +	0.37	0.37	0.32	0.46	0.33	0.28
Sex						
Female	Reference					
Male	0.89	0.12	0.41	1.01	0.15	0.48
Race						
White	Reference					
African American	1.05	0.19	0.79	1.02	0.19	0.90
Other	0.96	0.28	0.88	0.95	0.26	0.86
Hispanic ethnicity						
No	Reference					
Yes	0.85	0.18	0.44	1.19	0.24	0.38
MSA						
Urban	Reference					
Rural	0.89	0.15	0.48	1.15	0.20	0.42
Region						
Northeast	Reference					
Midwest	1.23	0.31	0.41	1.17	0.28	0.51
South	1.20	0.34	0.53	1.10	0.22	0.64
West	1.25	0.50	0.58	1.14	0.32	0.65

(Table 4-15. Continued)

Emergency room visits	Medical homes levels (0-3)			Medical homes (Y/N)		
Marital status						
Married	Reference					
Widowed/Divorced/Separated	1.23	0.19	0.18	1.25	0.20	0.16
Never married	1.20	0.31	0.49	1.25	0.34	0.41
Educational attainment						
Graduate school	Reference					
No high school diploma	1.52	0.52	0.22	1.41	0.51	0.34
Completed high school/GED	1.75	0.59	0.10	1.63	0.55	0.15
Completed 4 year degree	1.49	0.47	0.20	1.42	0.45	0.27
Other	1.48	0.56	0.29	1.40	0.55	0.40
How long since last routine checkup						
Within past year	Reference					
Within past 2 years	1.00	0.44	1.00	0.94	0.34	0.87
Within past 3-5 years	0.62	0.37	0.42	0.60	0.35	0.38
Never	0.92	0.68	0.91	0.86	0.59	0.83
How long since last dental checkup						
Twice a year or more	Reference					
Once a year	1.01	0.19	0.98	1.04	0.20	0.85
Less than once a year	1.40	0.28	0.09**	1.39	0.24	0.06**
Never	1.36	0.23	0.08**	1.38	0.23	0.06**
Need Factors						
Perceived health status						
Excellent	Reference					
Very good	1.16	0.41	0.68	1.09	0.36	0.81
Good	1.53	0.65	0.32	1.33	0.45	0.41
Fair	2.22	1.35	0.19	1.82	0.74	0.14
Poor	2.71	1.92	0.16	2.27	1.07	0.08**
Number of chronic condition(s)	1.08	0.07	0.21	1.07	0.05	0.19
Physical Component (SF1-2)	0.98	0.01	0.01*	0.98	0.01	0.01*

(Table 4-15. Continued)

Emergency room visits	Medical homes levels (0-3)			Medical homes (Y/N)		
Enabling						
Income						
>400% FPL	Reference					
<100% FPL	1.01	0.23	0.97	1.01	0.22	0.97
101-200% FPL	0.67	0.21	0.21	0.65	0.18	0.12
201-300% FPL	0.98	0.22	0.93	0.95	0.21	0.81
301-400% FPL	0.99	0.17	0.97	0.98	0.16	0.92
Insurance						
Any private	Reference					
Public only	1.15	0.27	0.54	1.13	0.25	0.59
Uninsured	1.25	1.03	0.79	1.18	0.65	0.77
Gatekeeper/PCP requirement						
No, private plan with gatekeeper	Reference					
Yes, private plan with gatekeeper	0.78	0.28	0.49	0.77	0.28	0.48
Established network						
Private plan without doctor list	Reference					
Private plan with doctor list	0.89	0.15	0.51	0.90	0.15	0.53
Other						
Primary care provider						
No	Reference					
Yes	0.95	0.24	0.85	0.96	0.25	0.88
Time						
2004	Reference					
2005	0.91	0.23	0.72	0.96	0.20	0.86
2006	0.86	0.16	0.41	0.88	0.16	0.48
2007	0.44	0.11	0.01*	0.44	0.10	0.00*

*Significance at 0.05 level
**Significance at 0.01 level

Table 4-16. Negative binomial regression predicting inpatient discharges

Inpatient discharges	Medical homes levels (0-3)			Medical homes (Y/N)		
	Rate Ratio	SE	p value	Rate Ratio	SE	p value
Patient-centered medical homes						
No	..	..	..	Reference		
Yes	..	..	..	5.44	10.81	0.4
Patient-centered medical homes						
Not in PCMH	Reference					
Low level	0.01	0.04	0.48	..	..	..
Medium level	22,427.18	145,296.90	0.12	..	..	..
High level	0.03	0.13	0.47	..	..	..
Predisposing Factors						
Age						
18-24	Reference					
25-44	1.43	1.02	0.62	1.52	1.11	0.56
45-64	1.00	0.82	1.00	1.32	0.98	0.71
65 +	1.44	1.35	0.70	1.99	1.54	0.37
Sex						
Female	Reference					
Male	1.14	0.16	0.36	0.86	0.11	0.24
Race						
White	Reference					
African American	0.99	0.16	0.94	0.92	0.16	0.65
Other	0.95	0.29	0.87	0.9	0.25	0.71

(Table 4-16. Continued)

Inpatient discharges	Medical homes levels (0-3)			Medical homes (Y/N)		
Hispanic ethnicity						
No	Reference					
Yes	1.03	0.22	0.90	1.01	0.21	0.96
MSA						
Urban	Reference					
Rural	0.79	0.12	0.10**	1.28	0.18	0.09**
Region						
Northeast	Reference					
Midwest	0.85	0.17	0.42	0.81	0.15	0.24
South	1.19	0.36	0.58	1.1	0.23	0.63
West	0.88	0.34	0.75	0.77	0.2	0.32
Marital Status						
Married	Reference					
Widowed/Divorced/Separated	1.15	0.17	0.36	1.19	0.18	0.25
Never married	1.05	0.26	0.86	1.18	0.3	0.53
Educational attainment						
Graduate school	Reference					
No high school diploma	1.46	0.56	0.32	1.32	0.52	0.48
Completed high school/GED	1.20	0.43	0.61	1.11	0.39	0.77
Completed 4 year degree	1.34	0.44	0.37	1.29	0.41	0.43
Other	1.57	0.65	0.27	1.49	0.6	0.33

(Table 4-16. Continued)

Inpatient discharges	Medical homes levels (0-3)			Medical homes (Y/N)		
How long since last routine checkup						
Within past year	Reference					
Within past 2 years	0.59	0.22	0.15	0.56	0.17	0.06
Within past 3-5 years	1.56	0.70	0.32	1.48	0.66	0.38
Never	1.08	0.77	0.91	0.96	0.64	0.95
How long since last dental checkup						
Twice a year or more	Reference					
Once a year	1.16	0.26	0.50	1.24	0.28	0.35
Less than once a year	1.14	0.22	0.50	1.1	0.21	0.6
Never	0.97	0.21	0.89	0.98	0.21	0.94
Need Factors						
Perceived health status						
Excellent	Reference					
Very good	1.00	0.42	1.00	0.93	0.38	0.85
Good	1.08	0.48	0.86	0.97	0.36	0.93
Fair	1.40	0.86	0.59	1.22	0.53	0.64
Poor	1.38	0.98	0.65	1.12	0.55	0.82
Number of chronic condition(s)	1.00	0.06	1.00	0.98	0.05	0.67
Physical Component (SF-12)	0.96	0.01	0.00*	0.97	0.01	0.00*
Enabling						
Income						
>400% FPL	Reference					
<100% FPL	1.45	0.34	0.11	1.43	0.33	0.13

(Table 4-16. Continued)

Inpatient discharges	Medical homes levels (0-3)			Medical homes (Y/N)		
101-200% FPL	1.15	0.36	0.65	1.06	0.3	0.82
201-300% FPL	1.42	0.35	0.16	1.35	0.31	0.19
301-400% FPL	0.97	0.16	0.86	0.99	0.17	0.93
Insurance						
Any private	Reference					
Public only	0.78	0.16	0.21	0.75	0.14	0.13
Uninsured	0.82	0.74	0.83	0.55	0.3	0.27
Gatekeeper/PCP requirement						
No, private plan with gatekeeper	Reference					
Yes, private plan with gatekeeper	1.01	0.32	0.99	1.02	0.31	0.95
Established network						
Private plan without doctor list	Reference					
Private plan with doctor list	1.05	0.21	0.80	1.03	0.21	0.9
Other						
Primary care provider						
No	Reference					
Yes	0.70	0.17	0.15	0.73	0.18	0.19
Time						
2004	Reference					
2005	0.75	0.21	0.31	0.81	0.18	0.36
2006	0.82	0.15	0.28	0.87	0.15	0.41
2007	0.69	0.16	0.10	0.69	0.14	0.07**

*Significance at 0.05 level
**Significance at 0.01 level

Table 4-17. Negative binomial regression predicting length of inpatient stay

Nights in hospital	Medical homes levels (0-3)			Medical homes (Y/N)		
	Rate Ratio	SE	p value	Rate Ratio	SE	p value
Patient-centered medical homes						
No	..	..	..	Reference		
Yes	..	..	..	663.46	1992.96	0.03*
Patient-centered medical homes						
Not in PCMH	Reference					
Low level	215,998.90	2,828,520	0.35	..	..	..
Medium level	0.46	6.35	0.96	..	..	..
High level	152,07	1,369,889.	0.19	..	..	..
Predisposing Factors						
Age						
18-24	Reference					
25-44	1.63	1.35	0.55	1.39	1.07	0.67
45-64	3.63	1.30	0.28	2.68	2.54	0.30
65 +	7.24	10.50	0.17	4.49	4.88	0.17
Sex						
Female	Reference					
Male	1.54	0.34	0.06**	0.70	0.14	0.08**
Race						
White	Reference					
African American	1.40	0.38	0.22	1.21	0.37	0.52
Other	0.46	0.20	0.08**	0.58	0.23	0.18

(Table 4-17. Continued)

Nights in hospital	Medical homes levels (0-3)			Medical homes (Y/N)		
Hispanic ethnicity						
No	Reference					
Yes	0.73	0.23	0.32	1.36	0.42	0.33
MSA						
Urban	Reference					
Rural	0.70	0.18	0.16	1.57	0.40	0.08**
Region						
Northeast	Reference					
Midwest	0.51	0.18	0.06**	0.54	0.18	0.06**
South	0.52	0.24	0.16	0.65	0.21	0.19
West	0.46	0.26	0.17	0.56	0.24	0.18
Marital Status						
Married	Reference					
Widowed/Divorced /Separated	1.51	0.37	0.09**	1.57	0.39	0.07**
Never married	1.11	0.40	0.78	1.28	0.48	0.51
Educational attainment						
Graduate school	Reference					
No high school diploma	1.62	0.77	0.31	1.44	0.71	0.46
Completed high school/GED	1.19	0.56	0.72	1.20	0.54	0.68
Completed 4 year degree	1.11	0.45	0.80	1.14	0.45	0.74
Other	1.75	0.92	0.29	1.72	0.87	0.28

(Table 4-17. Continued)

Nights in hospital	Medical homes levels (0-3)			Medical homes (Y/N)		
How long since last routine checkup						
Within past year	Reference					
Within past 2 years	0.24	0.12	0.00*	0.28	0.12	0.00*
Within past 3-5 years	3.98	2.73	0.05*	3.91	2.65	0.05*
Never	0.48	0.38	0.36	0.52	0.37	0.35
How long since last dental checkup						
Twice a year or more	Reference					
Once a year	1.15	0.37	0.66	1.29	0.43	0.45
Less than once a year	0.69	0.19	0.19	0.74	0.20	0.26
Never	0.83	0.26	0.56	0.80	0.24	0.47
Need Factors						
Perceived Health Status						
Excellent	Reference					
Very good	1.08	0.52	0.87	1.03	0.48	0.94
Good	0.96	0.59	0.95	1.11	0.55	0.83
Fair	0.67	0.56	0.63	1.04	0.58	0.94
Poor	0.65	0.65	0.67	1.04	0.71	0.96
Number of chronic condition(s)	0.91	0.09	0.36	0.93	0.08	0.40
Physical Component (SF-12)	0.97	0.01	0.01*	0.96	0.01	0.00*
Enabling						
Income						
>400% FPL	Reference					
<100% FPL	1.76	0.51	0.06**	2.05	0.59	0.01*

(Table 4-17. Continued)

Nights in hospital	Medical homes levels (0-3)			Medical homes (Y/N)		
101-200% FPL	0.92	0.45	0.87	1.00	0.44	1.00
201-300% FPL	1.44	0.56	0.34	1.51	0.54	0.25
301-400% FPL	1.32	0.33	0.27	1.41	0.35	0.17
Insurance						
Any private	Reference					
Public only	0.50	0.15	0.02*	0.51	0.14	0.02*
Uninsured	0.06	0.07	0.01*	0.10	0.07	0.00*
Gatekeeper/PCP requirement						
No, private plan with gatekeeper	Reference					
Yes, private plan with gatekeeper	0.45	0.17	0.04*	0.50	0.19	0.06**
Established network						
Private plan without doctor list	Reference					
Private plan with doctor list	0.85	0.21	0.51	0.78	0.20	0.32
Other						
Primary care provider						
No	Reference					
Yes	0.60	0.24	0.21	0.60	0.24	0.20
Time						
2004	Reference					
2005	1.33	0.55	0.50	1.17	0.38	0.63
2006	0.87	0.24	0.61	0.85	0.22	0.55
2007	0.52	0.17	0.05*	0.45	0.14	0.01*

*Significance at 0.05 level
**Significance at 0.01 level

Table 4-18. Moderator models: Expenditures and utilizations

Hypothesis	Diabetes	High blood pressure	Asthma	COPD	Arthritis	Depression
a. Total expenditures	…	X	…	…	…	…
b. Inpatient Discharges	...	...	...	...	...	…
Nights in Hospital	X	X	...	…	…	…
c. ER visits	X	...	...	...	...	...
d. Prescription drugs	…	...	...	...	…	...
e. Physician visits	...	X	...	...	...	...

X Significance at 0.05 level

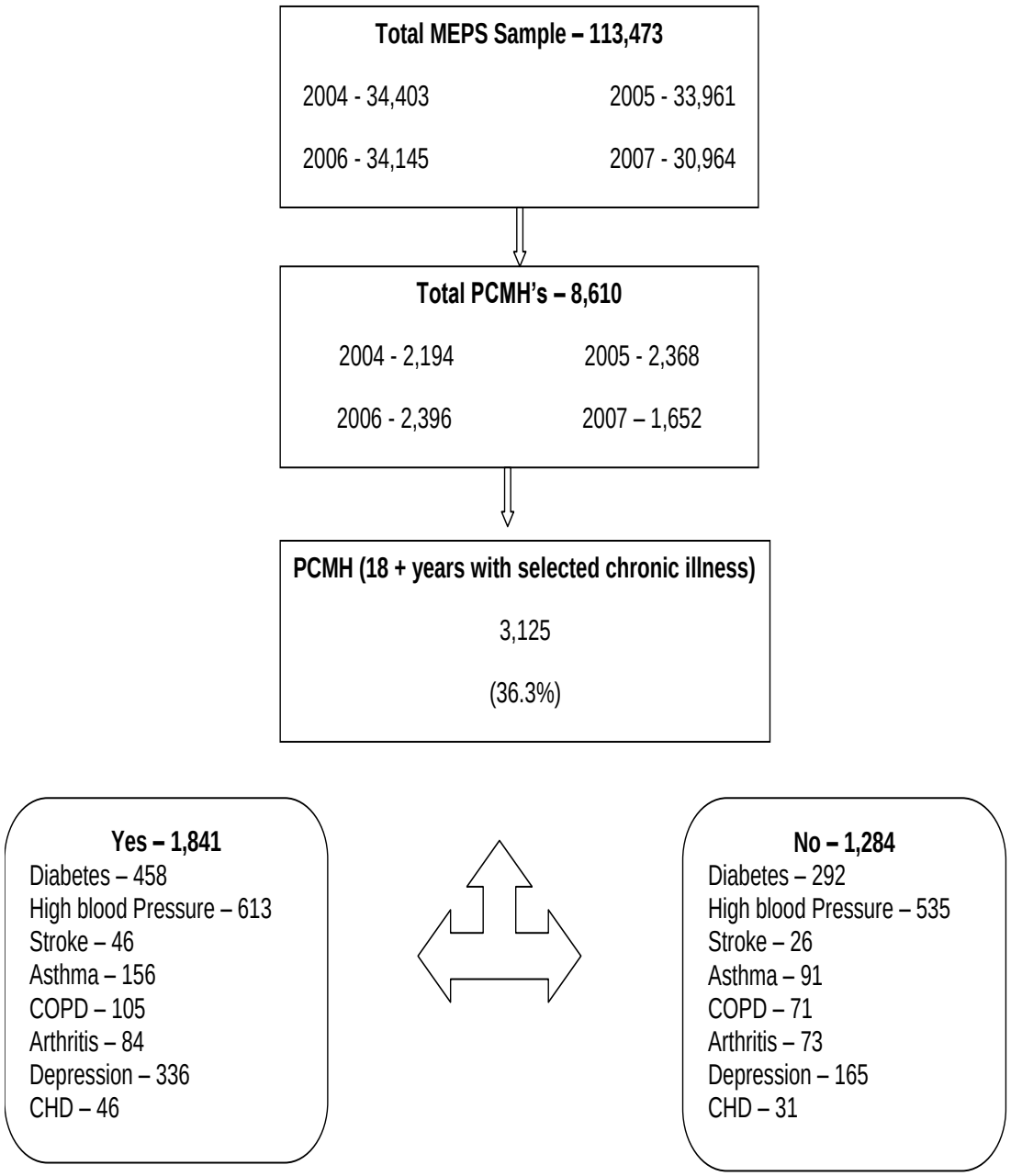


Figure 4-1. Study composition

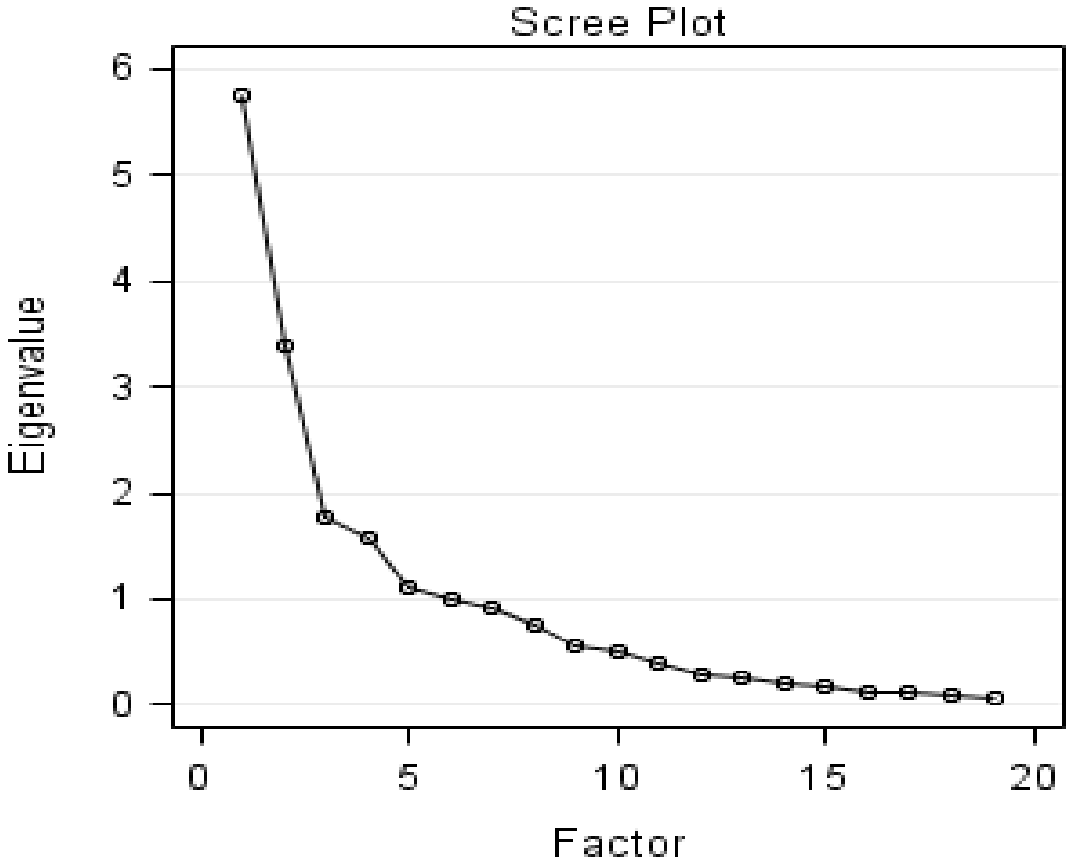


Figure 4-2. Scree plot initial factor method: principal components

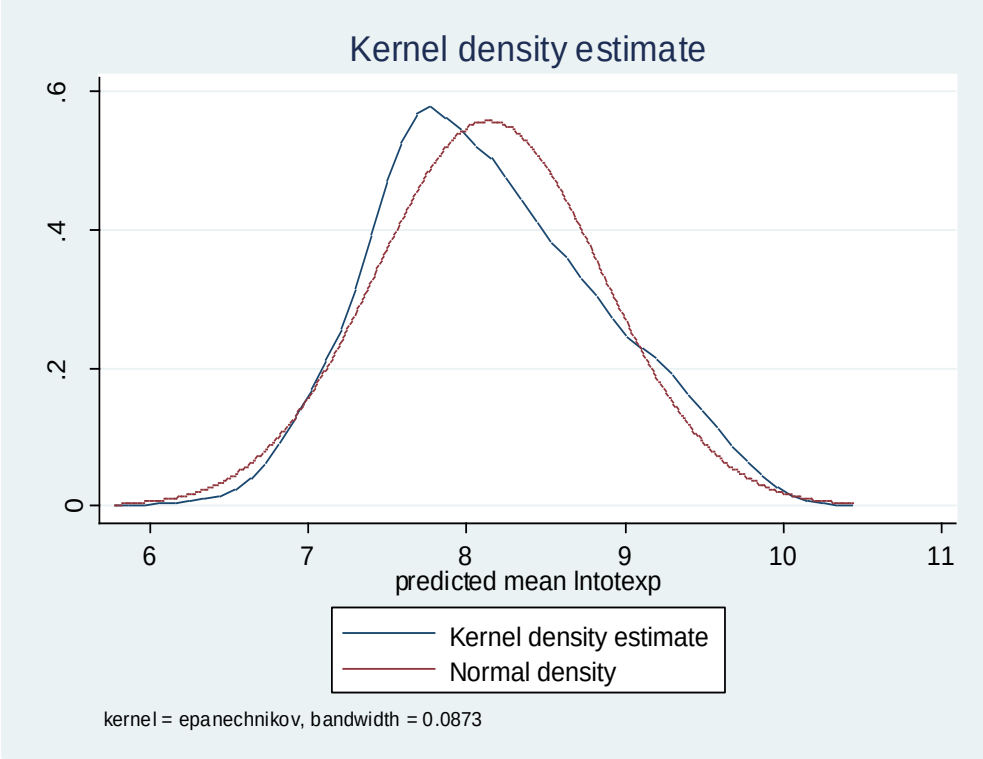


Figure 4-3. Kernel density plot after GLM regression on total expenditure

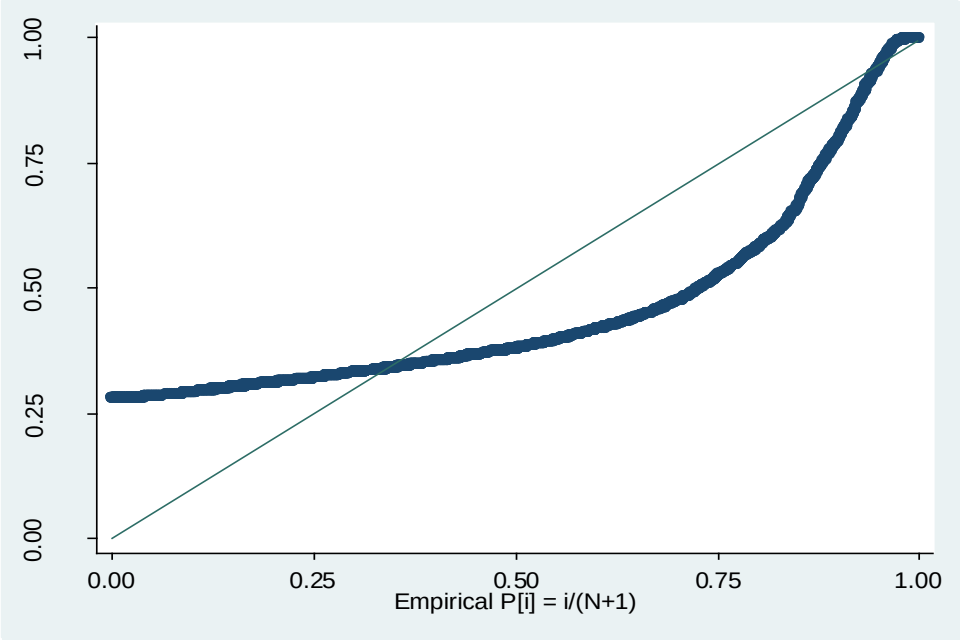


Figure 4-4. Normal plot of total expenditure

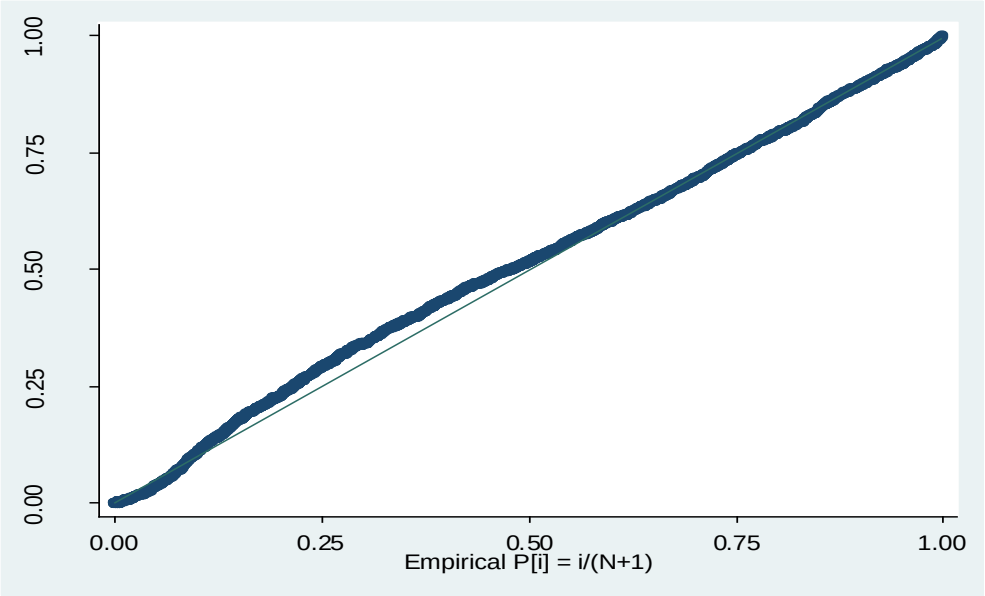


Figure 4-5. Normal plot of log transformation of total expenditure

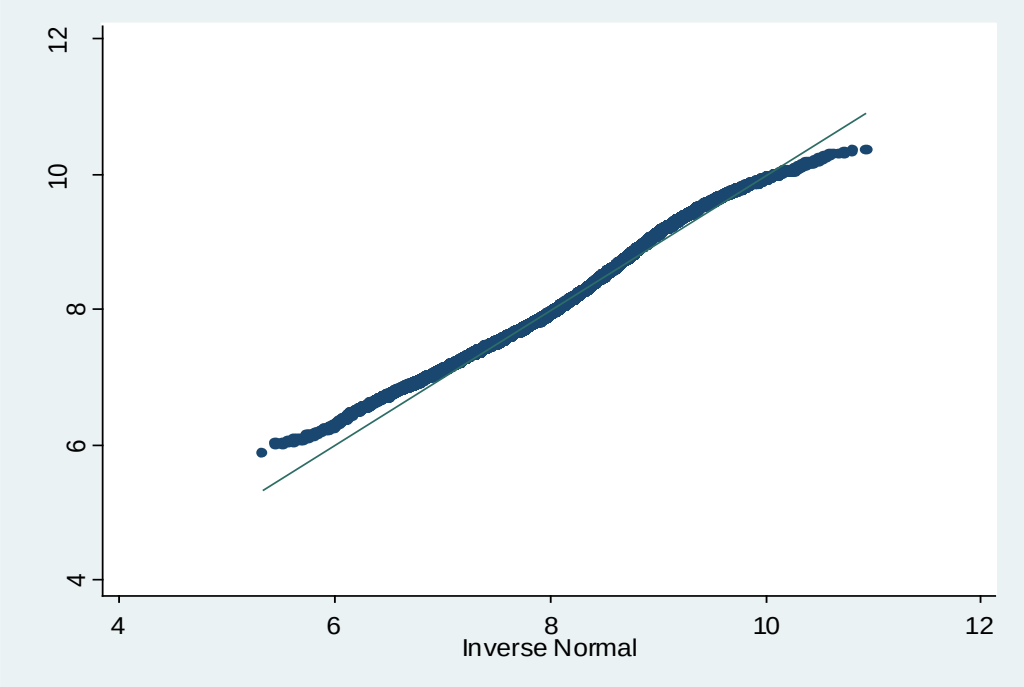


Figure 4-6. Q-Q plot of residual-fitted GLM regression of log transformation of total expenditure

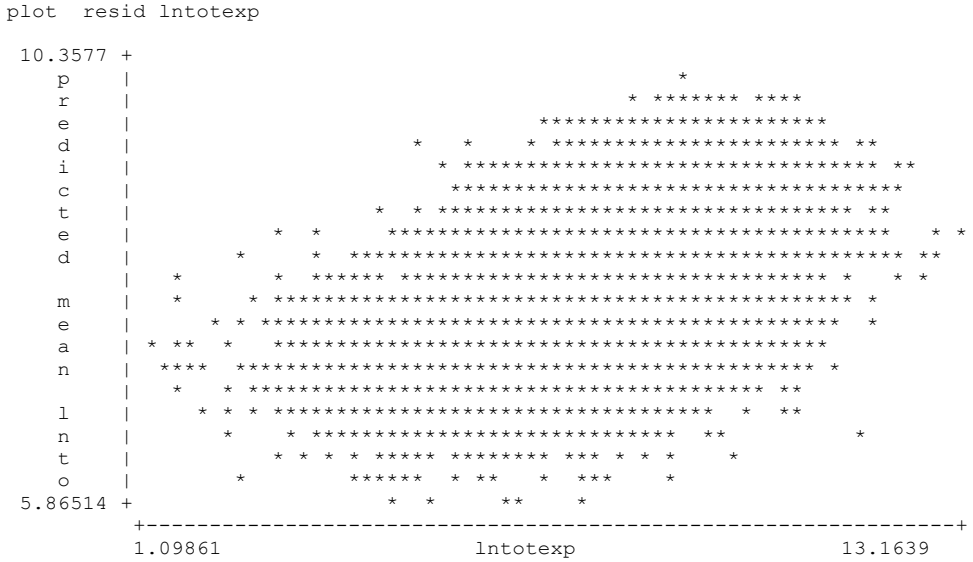


Figure 4-7. Residual-fitted plot after OLS regression for log total expenditures

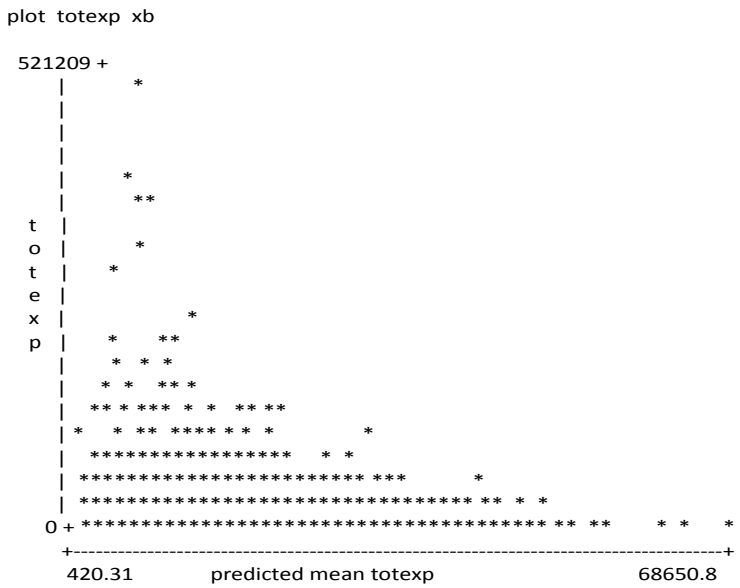


Figure 4-8. Residual-fitted plot after GLM regression for total expenditures

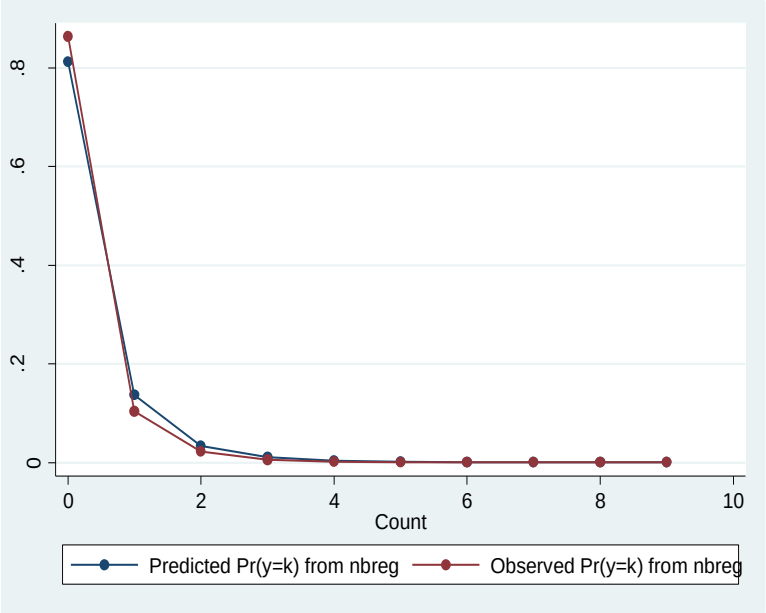


Figure 4-9. Observed versus expected plot after negative binomial regression for ER visits

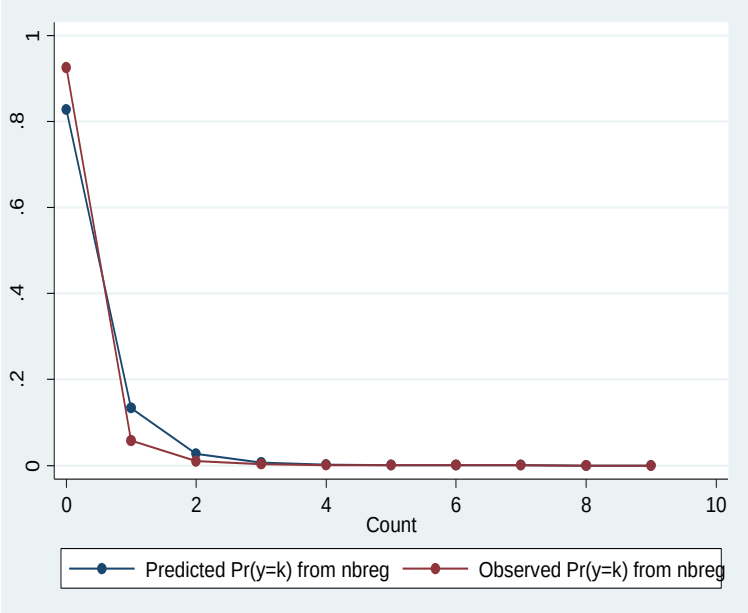


Figure 4-10. Observed versus expected plot after negative binomial regression for length of stay

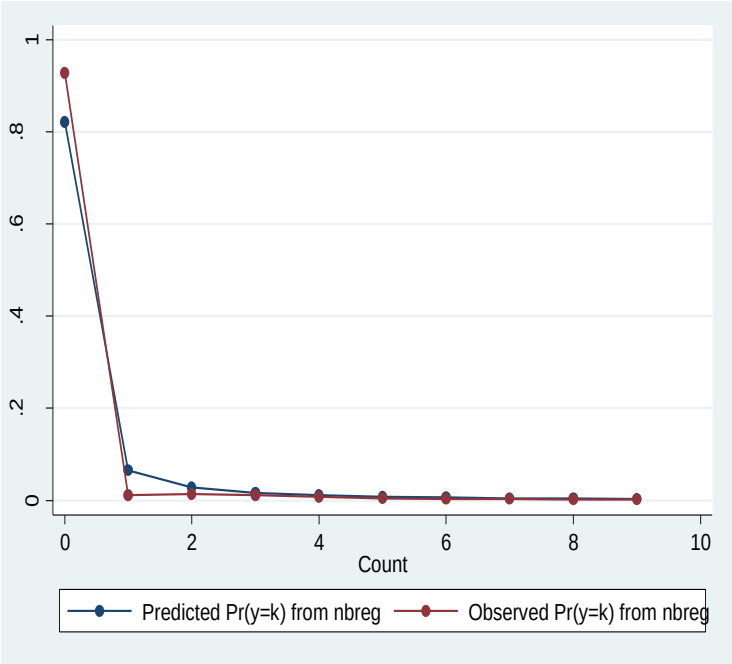


Figure 4-11. Observed versus expected plot after negative binomial regression for inpatient discharges

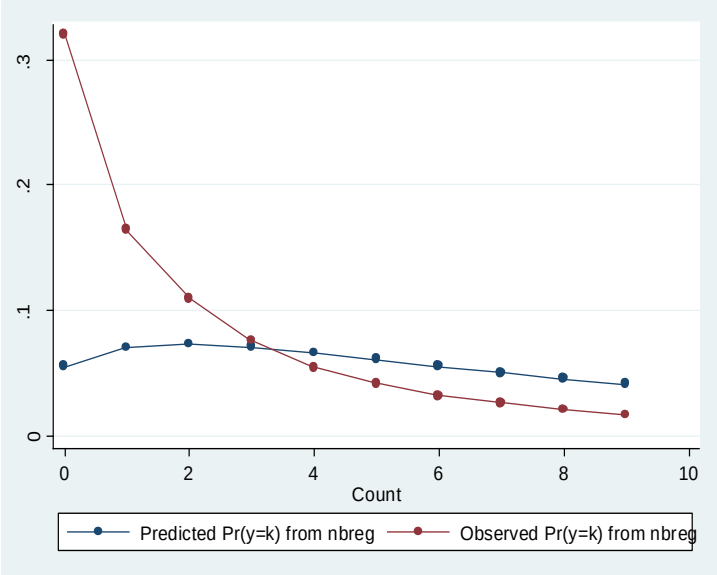
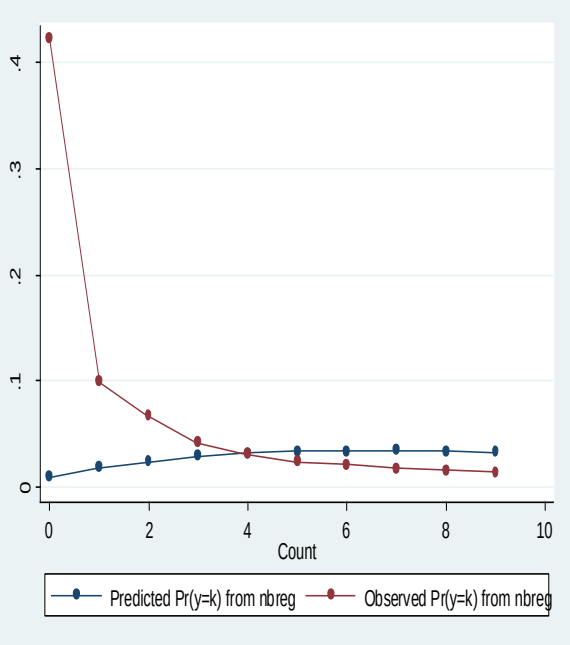
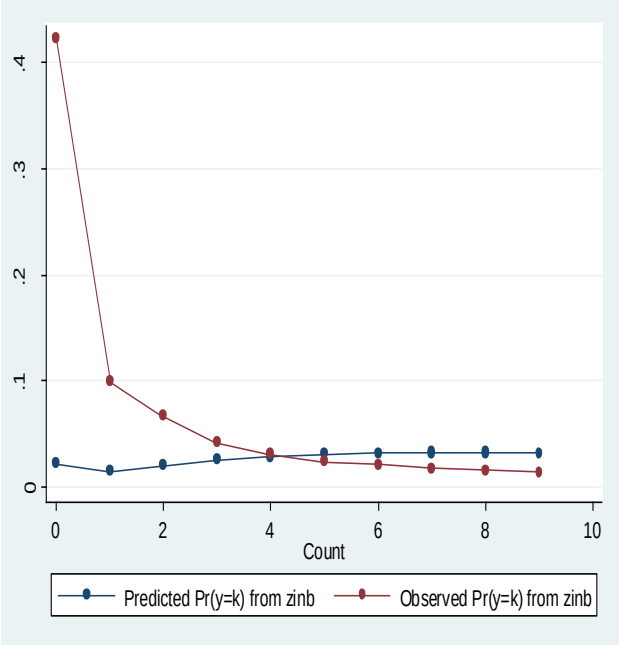


Figure 4-12. Observed versus expected plot after negative binomial regression for all physician visits

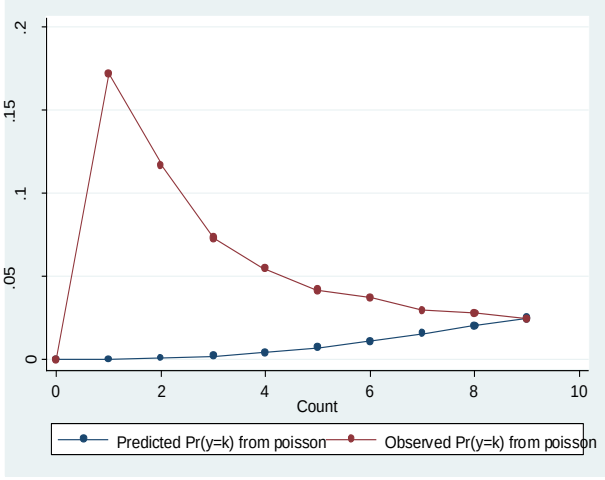
Negative binomial regression



Zero inflated negative binomial



Poisson (conditional on use)



Negative binomial (condition on use)

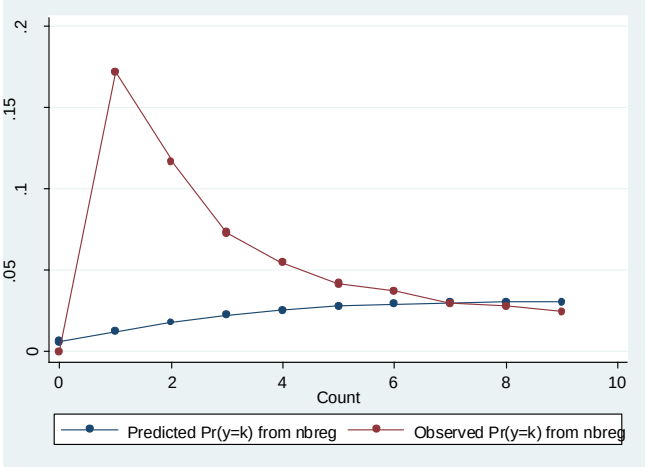


Figure 4-13. Observed versus expected plot after count regression for number of prescriptions

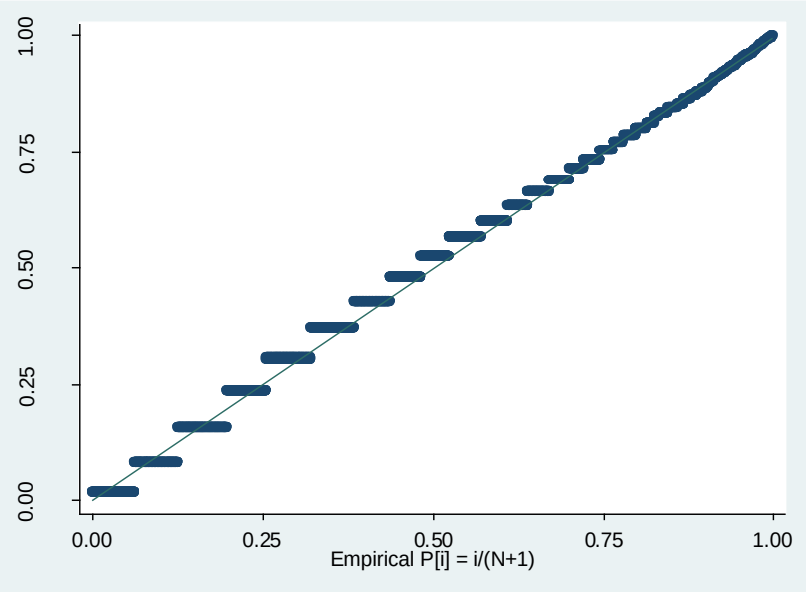


Figure 4-14. Normal plot of log transformation of all physician visits

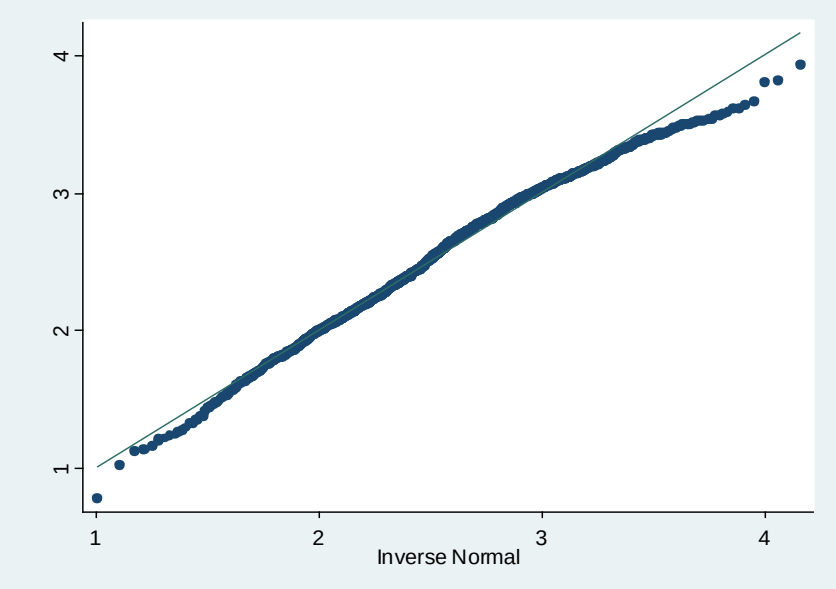


Figure 4-15. Q-Q plot of residual-fitted GLM regression of log transformed all physician visits

CHAPTER 5
DISCUSSION AND CONCLUSIONS

Receiving care from a PCMH had a mixed impact on total health care expenditures and utilization. The unadjusted outcomes were fairly similar. However, adjusted results shows consumers in medical homes on average had significantly lower mean expenditures ($10,007) compared to their counterparts not in medical homes ($10,841). Additionally, despite the fact that the mean physical health functioning score decreased as levels of medical homeness increased, the mean expenditures were lowest for individuals in the highest level of PCMH ($9,781), followed by low level ($9,941), and medium level ($10,968), and was highest for individuals not in a medical home ($11,115). This suggests a high intensity of care at the higher level of PCMH. Further, these results support the argument that moving to a PCMH model could positively impact the health care expenditures and utilization of consumers and potentially achieve significant savings relative to receiving care in non-PCMH practices.

Summary and Interpretation of Factor Analysis

Over the years there have been considerable debates on factor analysis. A few of the concerns that have been raised include the subjective nature in selecting the number and names of factors, and the lack of significance testing. Despite these concerns, it remains a method that provides researchers with an excellent method to best summarize variables.

The results in this research are a heuristic view of patient perspective of PCMH and do not encompass the complete definition of medical homeness. PCMH as defined by the American Academy of Pediatrics (2002) is a comprehensive approach to primary

care where a robust partnership is established between provider and patient. The care provided is characterized as accessible, family centered, coordinated, continuous, culturally competent and compassionate. From this outlook, PCMH is defined by two factors in the MEPS data: interaction with provider and accommodation of USC services. These factors included several theoretical constructs: optimal provider patient communications, shared decision-making, coordinated care, comprehensive care, and enhanced access. There were three items that did not successfully load: care continuity, extended practice hours, and provider asking about other treatments that a consumer received from other providers.

Theoretically speaking it is conceivable that a major construct, such as continuity of care should successfully load, but this was not observed. We can speculate that this weak correlation was a function of the variable being a calculation (number of visits to USC divided by the total number of visits in a given year) as opposed to a self-reported variable by respondents. This may explain the continuity of care variable's modest relationship with the other items.

Who Received Care in Patient-Centered Medical Homes?

There were significant differences in educational attainment for respondents in medical homes when compared to those in non-medical homes ($p < 0.01$). Respondents in medical homes were more likely to be better educated. The proportion of respondents in medical homes with less than a high school diploma was lower than those in a non-medical home (14% vs. 17%, respectively).

Overwhelmingly, the primary drivers of being in a medical home were the need variables (perceived and evaluated need). In all instances, each need variable was

significantly associated with being in a medical home. Thirty-nine percent of respondents in medical homes reported having a self-rated health status as fair or poor compared to 25% of their non-medical home counterparts ($p < 0.01$). Similarly, the average number of chronic conditions of individuals whose care was consistent with medical homeness was 3.0 compared to an average of 2.8 for non-medical home respondents ($p < 0.01$). Further, the average physical functioning score of 38 for individuals in medical homes was lower than the national average of 50 and respondents not in medical homes had an average score of 42 ($p < 0.01$).

Benefits of Being in a Patient-Centered Medical Home

Expenditures

The finding here show health care expenditures of respondents whose care was consistent with domains of medical homes on average were significantly lower ($10,007) compared to their counterparts not in medical homes ($10,841). This differential in expenditures has significant implication for chronic care policy since the CDC (2009) estimates about 75% percent of annual health care dollars are spent on chronic conditions.

There are several possible explanations for the decrease in expenditures. Several characteristics of medical homes are associated with improved health outcomes. For example, having a usual source of care is associated with improved prevention activities (Devoe et al., 2003), reductions in unnecessary ER visits (Ryan et al., 2001), and decreased preventable hospitalizations (Falik et al., 2001). Second, the literature supports the notion that provider patient collaborations and shared decision-

making results in productive information exchanges that could lead to improved self-management activities and treatment adherence (Brown, Stewart, and Ryan, 2003).

Discharges and Length of Stay

The hypothesized relationship that individuals in medical homes would have fewer inpatient discharges was not supported by the analysis. The model was unable to detect a significant difference in the number of discharges. Despite the fact that individuals in medical homes were significantly sicker than their non-medical home counterpart, on average, medical home respondents had fairly similar inpatient discharges (0.3) compared to their counterparts not in a medical home (0.2). While the hypothesized relationship was not supported, it can be speculated that being in a medical home was beneficial because these sicker individuals had similar discharges than their healthier counterparts. This suggests that the activities in medical homes may have resulted in some level of treatment adherences and self-care that mitigated preventable hospitalizations. Further, the improved coordination in medical homes may have resulted in improved quality of care and thereby cost savings as a result of reductions in hospitalizations or readmissions (Barry et al., 2002; Walsh et al., 2002).

Conversely, the hypothesized relationship for being in a medical home (Y/N) was supported. Individuals in medical homes had longer lengths of hospital stays than their counterparts not in a medical home. This result may be explained by significant differences in the number of chronic conditions and lower physical functioning. Levels of medical homes were not significantly associated with length of hospital stays.

Emergency Room Visits

The hypothesized relationship was not supported, which suggests that individuals in medical homes reported more ER visits than their counterparts not in

medical homes. This finding is counter-directional to other studies that observed a reduction in the number of ER visits (Roby et al, 2010). The divergence in findings may be a result of the cross sectional nature of this study, which does not allow observations of respondents over time and hence we would be unable to capture the benefits of being in a medical home. Additionally, the self-reporting nature of the study could also introduce recall bias and this may explain the differences in findings. Other studies have hypothesized that several mechanisms associated with being in a medical homes, such as enhanced access, improved care coordination and optimal communications, led to more self-care that ultimately reduced ER utilizations (Roby et. al, 2010).

Physician Visits

The hypothesized relationship was not supported by this analysis. However, bootstrapped procedures found that respondents in medical homes had on average 15.39 physician visits when compared to their counterparts not in a medical home with 15.00. Likewise, the average number of physician visits varied by level of medical homes: consumers in low level medical homes (13.9 visits), medium medical homes (17.1 visits), and high medical homes (14.3 visits). As level of medical homeness increased, individuals were generally sicker, and had more chronic conditions which likely resulted in additional contact with providers. Noteworthy is the average number of provider visits for individuals in medium level medical homes. While not significant, the average number of chronic conditions for individuals in medium level was higher than their counterparts in low and high levels.

Prescription Drugs

The hypothesized relationship was not supported by this analysis. The mean number of prescriptions filled by individuals in medical homes (40.29) was statistically

greater than their counterparts not in a medical home (35.10). The mean number of prescriptions varied by level of medical homes: consumers in low level medical homes filled on average 39.01 prescriptions, medium medical homeness 43.65, and high medical homeness 39.22 prescriptions.

Policy Implications

There is near consensus that an appropriate reform of our health care system requires a strong primary care system (Landon et al., 2010). The PCMH model is advocated as the model that will reform primary care and there is growing evidence that supports its clinical and economic potential. However, the following barriers have been identified as limiting factors: expensive startup and maintenance cost, physician adoption, health information technology (an essential front-end investment), access to a sufficient supply of primary care providers, appropriate incentives or reimbursement, difference implementation approaches, and lack of agreement on components of a medical home (Keckley, Hoffman, and Underwood, 2010; Landon et al., 2010).

Moreover, given the continued growth of health care expenditures and the increasing prevalence of chronic conditions, it is particularly salient to understand the impact of patient-centered medical homes in this population. Central to the medical homes debate is the ability of this care model to address the needs of the chronically ill. An ongoing collaboration between provider and patient is required to accomplish this task, which could result in continuous, coordinated high quality care. Additionally, such intense education and training should support patient engagement and self-efficacy to better control the chronic conditions. The results here support previous research that states activities in medical homes (e.g. receipt of self-care plan) could result in significant positive impact on health outcomes and expenditures. There are great

societal benefits in the role medical homes could play in constraining health care expenditures.

Furthermore, it is long accepted that understanding consumers' experiences, expectations, and preferences is fundamental in the health care quality debate. Likewise, understanding what consumers consider a medical home is also important. From a consumer's perspective medical homeness encompasses several important theoretical constructs that policy makers, administrators, and planners should be mindful of when converting to the PCMH model. The final factors highlight the fact that consumers place great value in being able to access their providers, and receiving high quality care (optimal communication and shared decision-making), comprehensive, and coordinated care.

In a study by Roby and colleagues (2010), it was concluded that administrative flexibility during the implementation stage of the Medical Services Initiative Program led to variations in care. While this flexibility was for practice level features, it can be speculated that ignoring consumers' perspectives can also lead to further variations in care. The findings here have important implications to public policy and future research because they provide a baseline for understanding the consumers' views on the components of medical homes and their impact on outcomes.

It is well established that the rise in the prevalence of chronic diseases has been driven by an increase in such population risk factors as obesity, smoking, stress, sedentary lifestyles, alcohol abuse, and other modifiable practices (Thorpe, 2005; Mokdad, 2004; McGinnis & Foege, 1993). At the core of this debate is the seemingly minimal commitment to population-wide prevention approaches (McGinnis et al., 2002;

Satcher, 2006). Since much of the prevention activities are done in primary care, any policy that would direct individuals into PCMHs could result in greater prevention. Beal and colleagues (2006) observed significant improvement in preventive screenings as a result of reminders sent or phoned to chronically ill adults in medical homes. They also did not observe any racial disparities in reminders for preventive screenings.

Finally, PCMH policy could bring some degree of resolution to the crisis that primary care is currently facing (Rittenhouse and Shortell, 2009; Berenson et al., 2008; Rubenstein, 2008). It is believed that PMCH can provide some hope to primary care practitioners through advocacy, and as a source of confidence to bring a level of coordination to consumers that is currently lacking. Further, the PCMH model proposes a payment structure that merges FFS, pay-for-performance (P4P), and additional payment for care coordination or integration of services. Our current reimbursement model is biased towards procedures and does not adequately pay for care coordination, care management, and non-traditional medical consultation. PCMH reimbursement reform calls for monetary credit for case mix differences, uptake and utilization of health information systems, and attainment of quality improvement targets.

Future research should look to examine demonstrations that are being done with FQHCs (e.g. Safety Net Medical Homes Initiative). This could have important implications to access to care, as well as elimination of disparities. The findings here suggest that as levels of medical homes increase, the physical function score of respondents decreases, so future research should also focus on the severely chronically ill. Finally, a better understanding of PCMH's impact on process of care (e.g. HbA1c) for the chronically ill is needed.

Limitations

There are several limitations to this study. The key limitation is that a “true medical home practice” was not identified, but the results reflect whether or not an individual’s care (self-reported) provided evidence of a theoretical medical home.

The Medical Expenditure Panel Survey (MEPS) relies on respondents self-reports of medical conditions. Professional coders review these reports and corresponding diagnostic codes are assigned. First, this survey utilizes the International Classification of Diseases (9th revision) Clinical Modification (ICD-9-CM) which is based on the World Health Organization's Ninth Revision, International Classification of Diseases (ICD-9). MEPS records the first three of the five digit ICD-9 codes.

The third limitation is the absence of a health literacy measure in MEPS. Health literacy, according to Healthy People 2010, “is the degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions.” The literature supports that low health literacy is associated worse glycemic control, less knowledge of an individual’s condition, and being more likely to have one of the disease complications (Schillinger et al 2002); higher rates of health service utilization (Baker et al., 1998, 1997); and poorer self-rated health status (Weiss et al., 1992). These individuals are also reported as being less likely to understand written and oral communication given by health care providers, to adhere to necessary instructions and procedures (e.g. taking medications properly and keeping appointments), and to navigate the system and acquire necessary care (Hopper et al., 1998; Baker et al., 1996; Davis et al., 1996).

The fourth limitation of this study involves the use of a point-in-time measure of health insurance status of respondents. The MEPS collects health insurance status several times a year and has the ability to generate a number of estimates of health insurance coverage, including point-in-time, monthly, and annual estimates.

Several models in this research yielded less than perfect fit (e.g. physician visits and prescription drugs). With respect to physician visits, both GLM and negative binomial regression were completed and discussed. Similarly, multiple models were examined for prescription drug model fitness and the negative binomial was selected. The models were not precise and its ability to predict zero or fewer numbers of prescriptions can be challenging. Care should be taken when interpreting because the coefficients may be overestimations of the true effect size.

Since MEPS relies on respondents' self-reports certain challenges, such as recall bias and social desirability, in answering questions may restrict the accuracy of the data. Finally, the cross sectional design of the study does not allow for sufficient time to understand the true benefits if any for chronically ill individuals in medical homes.

Despite these limitations, this study adds to the growing literature that supports the view that the PCMH model is clinically and economically promising. However, this model is unable to transform care across the health care continuum. For that reason, considerations of PCMHs potential must be examined as it relates to the continuum of care. Landon and colleagues (2010) affirm that the PCMH model provides opportunities for improved quality while constraining cost, especially as it relates to over-utilization of specialists, unplanned hospital admissions, and ER visits for non-urgent conditions. Further, the additional development of primary care will result in an increased ability to

attack these cost drivers, as well as place PCP's in opposition to other health care providers. Landon and colleagues (2010) suggest that clearly defined provider roles and appropriate incentives must be outlined to support sustainability and collaboration. The Accountable Care Organizations (ACO's) have been proposed (with a PCMH foundation) to support this mutual commitment to medical and financial outcomes. ACOs are provider-led organizations with a stated mission of managing care across the continuum, while being accountable for both quality and cost (Rittenhouse et al, 2009).

Table 5-1. Summary of the findings

Hypothesis	Hypothesized relationship	Actual relationship
R1: Interpretable Factor structure	+	+
R2: Individual characteristics associated with being in a medical home	+	+*
R3: Impact of being in a medical home		
a. Total expenditures	-	-
b. Outpatient visits	+	+
c. Inpatient		
i. Discharges	-	+
ii. Length of stay	-	+*
d. Emergency room visits	-	+
e. Prescription drugs	-	+
R4: All differences in performance of a given disease		
a. Total expenditures	-	High blood pressure
b. Outpatient visits	-	High blood pressure
c. Inpatient		
i. Discharges	-	-
ii. Length of stay	-	High blood pressure & Diabetes
d. Emergency room visits	-	Diabetes
e. Prescription drugs	-	-

*Significance at 0.05 level

APPENDIX
BACKGROUND TABLES

Table A-1. Eigenvalues of PCMH factor analysis

	Eigenvalue	Difference	Proportion	Cumulative
1	5.708236	2.103260	0.300400	0.300400
2	3.604976	1.756161	0.189700	0.490200
3	1.848815	0.176975	0.097300	0.587500
4	1.671840	0.498188	0.088000	0.675500
5	1.173652	0.165350	0.061800	0.737200
6	1.008302	0.168784	0.053100	0.790300
7	0.839518	0.087367	0.044200	0.834500
8	0.752151	0.219723	0.039600	0.874100
9	0.532429	0.071392	0.028000	0.902100
10	0.461037	0.115624	0.024300	0.926400
11	0.345413	0.089058	0.018200	0.944500
12	0.256355	0.007411	0.013500	0.958000
13	0.248944	0.081790	0.013100	0.971100
14	0.167153	0.020234	0.008800	0.979900
15	0.146919	0.042829	0.007700	0.987700
16	0.104090	0.035618	0.005500	0.993100
17	0.068472	0.023587	0.003600	0.996800
18	0.044886	0.028074	0.002400	0.999810
19	0.016811		0.000900	1.000000

Table A-2. Factor analysis with 2 factors of PCMH variables

Variables	Rotated Factor Patterns	
	One	Two
Doctor listened to you	0.86	
Doctor showed respect	0.86	
Doctor explained so you understood	0.83	
Doctor spent enough time with you	0.82	
Got med appointment when wanted	0.66	
Problem getting specialist referral	0.63	
Unable to get necessary medical care	0.56	
Provider explained options to person	0.55	
How difficult to contact USC by phone?	0.48	
How difficult contact USC after hours?	0.47	
Provider asks person to help decide	0.46	
Unable to get necessary prescription medicine	0.45	
Go to USC for preventive health care		0.95
Go to USC for ongoing health problem		0.95
Go to USC for new health problem		0.94
Go to USC for referrals		0.94
USC has office hours nights/weekends		
Provider ask about other treatments		
Usual Clinician Index		

*Only values over 0.4 are included and represent the initial variables used to define the factor

Table A-3. Moderator regression (GLM) predicting amount of total expenditures and physician visits

Variables	Total expenditures			Physician visits		
	Coefficient	SE	p value	Coefficient	SE	p value
Patient-centered medical homes						
No	Reference					
Yes	-0.63	1.22	0.61	-1.14	1.31	0.39
Predisposing Factors						
Age						
18-24	Reference					
25-44	-0.10	0.34	0.78	0.06	0.28	0.83
45-64	-0.05	0.44	0.92	-0.23	0.38	0.55
65 +	-0.06	0.47	0.90	-0.12	0.43	0.78
Sex						
Female	Reference					
Male	0.04	0.07	0.63	0.01	0.07	0.88
Race						
White	Reference					
African American	0.03	0.11	0.79	0.20	0.12	0.10**
Other	-0.10	0.14	0.49	0.33	0.23	0.15
Hispanic ethnicity						
No	Reference					
Yes	0.10	0.14	0.46	0.05	0.12	0.64
MSA						
Urban	Reference					
Rural	-0.05	0.08	0.54	0.11	0.07	0.12
Region						
Northeast	Reference					
Midwest	0.16	0.10	0.10	-0.01	0.09	0.89
South	0.16	0.12	0.16	0.05	0.11	0.63
West	0.21	0.16	0.19	0.08	0.16	0.60
Marital status						
Married	Reference					
Widowed/Divorced/Separated	0.06	0.08	0.47	-0.06	0.08	0.50
Never married	-0.02	0.16	0.92	0.11	0.16	0.52

(Table A-3. Continued)

Variables	Total expenditures			Physician visits		
Educational attainment						
Graduate school	Reference					
No high school diploma	0.08	0.16	0.63	-0.04	0.17	0.83
Completed high school/GED	-0.03	0.13	0.82	-0.04	0.15	0.79
Completed 4 year degree	0.06	0.12	0.60	-0.15	0.13	0.24
Other	0.24	0.16	0.13	0.08	0.16	0.59
How long since last routine checkup						
Within past year	Reference					
Within past 2 years	-0.52	0.15	0.00*	-0.38	0.14	0.01*
Within past 3-5 years	0.33	0.26	0.21	-0.33	0.22	0.14
Never	0.27	0.36	0.44	0.51	0.50	0.31
How long since last dental checkup						
Twice a year or more	Reference					
Once a year	-0.02	0.13	0.86	-0.24	0.10	0.01*
Less than once a year	-0.03	0.10	0.79	-0.20	0.09	0.03*
Never	-0.07	0.12	0.56	-0.33	0.08	0.00*
Need Factors						
Perceived health status						
Excellent	Reference					
Very good	0.25	0.16	0.13	0.20	0.11	0.06**
Good	0.42	0.18	0.02*	0.35	0.14	0.01*
Fair	0.49	0.24	0.04*	0.32	0.21	0.12
Poor	0.61	0.30	0.04*	0.38	0.25	0.12
Number of chronic condition(s)	0.17	0.03	0.00*	0.18	0.03	0.00*
Physical component (SF-12)	-0.03	0.00	0.00*	-0.02	0.00	0.00*
Enabling						
Income						
>400% FPL	Reference					
<100% FPL	-0.03	0.12	0.78	-0.27	0.09	0.00*
101-200% FPL	-0.05	0.15	0.76	-0.15	0.14	0.29
201-300% FPL	-0.02	0.12	0.88	-0.11	0.10	0.26
301-400% FPL	0.04	0.09	0.68	-0.07	0.07	0.31

(Table A-3. Continued)

Variables	Total expenditures			Physician visits		
Insurance						
Any private	Reference					
Public only	-0.24	0.11	0.04*	0.00	0.09	0.96
Uninsured	-0.56	0.24	0.02*	-0.19	0.29	0.50
Gatekeeper/PCP requirement						
No, private plan with gatekeeper	Reference					
Yes, private plan with gatekeeper	-0.04	0.16	0.79	-0.16	0.13	0.22
Established network						
Private plan without doctor list	Reference					
Private plan with doctor list	-0.03	0.09	0.70	0.06	0.07	0.40
Other						
Primary care provider						
No	Reference					
Yes	-0.20	0.19	0.30	-0.30	0.19	0.12
Time						
2004	Reference					
2005	-0.10	0.12	0.40	-0.04	0.11	0.71
2006	-0.11	0.10	0.25	-0.15	0.08	0.07**
2007	-0.25	0.11	0.03*	-0.30	0.10	0.00*
Diseases						
Diabetes	0.14	0.16	0.40	-0.29	0.19	0.13
High blood pressure	0.27	0.16	0.09**	-0.08	0.19	0.70
Asthma	0.23	0.24	0.35	-0.03	0.23	0.91
COPD	0.27	0.21	0.20	0.09	0.23	0.71
Arthritis	0.14	0.31	0.66	-0.26	0.28	0.36
Depression	0.31	0.17	0.08**	0.20	0.23	0.39
Interaction						
PCMH * Diabetes	-0.05	0.12	0.66	0.05	0.10	0.62
PCMH * High blood pressure	-0.24	0.12	0.05*	-0.23	0.09	0.01*
PCMH * Asthma	-0.35	0.24	0.14	-0.10	0.19	0.60
PCMH * COPD	-0.36	0.24	0.14	-0.38	0.22	0.09**
PCMH * Arthritis	-0.12	0.38	0.76	0.50	0.30	0.10**
PCMH * Depression	-0.08	0.15	0.58	0.16	0.17	0.37

*Significance at 0.05 level
**Significance at 0.01 level

Table A-4. Moderator regression (NB) predicting emergency room visits and prescription drugs

Variables	Emergency room visits			Prescription drugs		
	Rate Ratio	SE	p value	Rate Ratio	SE	p value
Patient-centered medical homes						
No	Reference					
Yes	1.39	2.71	0.87	0.28	0.27	0.19
Predisposing Factors						
Age						
18-24	Reference					
25-44	0.47	0.23	0.13	1.37	0.31	0.17
45-64	0.42	0.25	0.15	1.39	0.39	0.24
65 +	0.43	0.30	0.22	1.26	0.40	0.46
Sex						
Female	Reference					
Male	0.89	0.12	0.36	1.03	0.05	0.51
Race						
White	Reference					
African American	1.09	0.20	0.64	1.06	0.08	0.42
Other	1.01	0.27	0.97	0.95	0.10	0.64
Hispanic ethnicity						
No	Reference					
Yes	0.82	0.16	0.31	0.94	0.09	0.49
MSA						
Urban	Reference					
Rural	0.80	0.14	0.20	0.94	0.06	0.28
Region						
Northeast	Reference					
Midwest	1.19	0.28	0.47	1.15	0.10	0.09**
South	1.15	0.23	0.49	1.17	0.10	0.07**
West	1.03	0.28	0.91	1.21	0.16	0.14
Marital status						
Married	Reference					
Widowed/Divorced/Separated	1.23	0.19	0.18	1.04	0.06	0.47
Never married	1.03	0.29	0.92	0.97	0.11	0.78

(Table A-4. Continued)

Variables	Emergency room visits			Prescription drugs		
Educational attainment						
Graduate school	Reference					
No high school diploma	1.32	0.48	0.44	1.24	0.15	0.07**
Completed high school/GED	1.51	0.50	0.22	1.17	0.11	0.09**
Completed 4 year degree	1.28	0.40	0.44	1.10	0.09	0.25
Other	1.21	0.46	0.61	0.97	0.11	0.79
How long since last routine checkup						
Within past year	Reference					
Within past 2 years	0.93	0.31	0.83	0.91	0.11	0.44
Within past 3-5 years	0.58	0.32	0.33	1.04	0.22	0.86
Never	0.92	0.63	0.91	1.13	0.32	0.67
How long since last dental checkup						
Twice a year or more	Reference					
Once a year	1.11	0.20	0.58	0.95	0.08	0.52
Less than once a year	1.45	0.26	0.04*	1.03	0.07	0.66
Never	1.27	0.21	0.15	1.08	0.08	0.31
Need Factors						
Perceived health status						
Excellent	Reference					
Very good	1.12	0.37	0.73	1.22	0.13	0.07**
Good	1.39	0.47	0.33	1.45	0.18	0.00*
Fair	1.92	0.76	0.10	1.72	0.29	0.00*
Poor	1.85	0.84	0.18	1.94	0.41	0.00*
Number of chronic condition(s)	1.06	0.05	0.26	1.26	0.03	0.00*
Physical component (SF-12)	0.98	0.01	0.00*	0.99	0.00	0.00*
Enabling						
Income						
>400% FPL	Reference					
<100% FPL	0.97	0.21	0.90	1.20	0.11	0.05*
101-200% FPL	0.65	0.17	0.11	1.11	0.12	0.35
201-300% FPL	0.93	0.20	0.73	1.15	0.10	0.10**
301-400% FPL	0.96	0.16	0.82	1.03	0.06	0.61

(Table A-4. Continued)

Variables	Emergency room visits			Prescription drugs		
Insurance						
Any private	Reference					
Public only	1.14	0.24	0.54	1.22	0.08	0.00*
Uninsured	1.07	0.52	0.89	1.03	0.22	0.90
Gatekeeper/PCP requirement						
No, private plan with gatekeeper	Reference					
Yes, private plan with gatekeeper	0.68	0.24	0.27	1.13	0.12	0.23
Established network						
Private plan without doctor list	Reference					
Private plan with doctor list	0.89	0.15	0.48	1.25	0.07	0.00*
Other						
Primary care provider						
No	Reference					
Yes	0.95	0.25	0.84	1.02	0.12	0.84
Time						
2004	Reference					
2005	0.92	0.19	0.70	1.01	0.08	0.92
2006	0.88	0.15	0.45	1.03	0.06	0.59
2007	0.45	0.11	0.00*	0.95	0.07	0.47
Diseases						
Diabetes	0.92	0.35	0.83	1.39	0.14	0.00*
High blood pressure	1.41	0.55	0.38	1.06	0.09	0.54
Asthma	1.64	0.75	0.28	0.86	0.13	0.31
COPD	3.58	1.49	0.00*	0.86	0.13	0.32
Arthritis	1.14	0.61	0.81	0.94	0.21	0.77
Depression	2.33	0.89	0.03*	1.07	0.13	0.56
Interaction						
PCMH * Diabetes	2.17	0.60	0.01*	0.89	0.07	0.16
PCMH * High blood pressure	0.81	0.21	0.42	0.97	0.07	0.69
PCMH * Asthma	1.25	0.53	0.60	1.18	0.20	0.35
PCMH * COPD	0.57	0.17	0.07*	1.19	0.21	0.33
PCMH * Arthritis	0.73	0.42	0.59	0.70	0.19	0.18
PCMH * Depression	0.76	0.23	0.35	1.01	0.12	0.95

*Significance at 0.05 level
**Significance at 0.01 level

Table A-5. Moderator regression (NB) predicting hospital utilization (discharges and length of stay)

Variables	Nights in hospital			Discharges		
	Rate Ratio	SE	p value	Rate Ratio	SE	p value
Patient-centered medical homes						
No	Reference					
Yes	6097.03	18140.71	0.00*	4.10	8.16	0.48
Predisposing Factors						
Age						
18-24	Reference					
25-44	1.58	1.11	0.52	1.27	0.93	0.74
45-64	4.45	3.92	0.09	1.14	0.85	0.87
65 +	8.19	8.40	0.04*	1.67	1.30	0.51
Sex						
Female	Reference					
Male	1.41	0.28	0.08**	1.12	0.14	0.36
Race						
White	Reference					
African American	1.13	0.32	0.66	1.01	0.19	0.95
Other	0.52	0.19	0.08**	0.97	0.27	0.91
Hispanic ethnicity						
No	Reference					
Yes	0.58	0.20	0.12	0.96	0.20	0.85
MSA						
Urban	Reference					
Rural	0.60	0.14	0.03*	0.77	0.11	0.07**
Region						
Northeast	Reference					
Midwest	0.52	0.14	0.02*	0.84	0.16	0.35
South	0.68	0.22	0.22	1.17	0.26	0.49
West	0.44	0.18	0.05*	0.77	0.21	0.34
Marital status						
Married	Reference					
Widowed/Divorced/Separated	1.52	0.35	0.07**	1.14	0.17	0.38
Never married	1.52	0.57	0.27	1.06	0.28	0.82

(Table A-5. Continued)

Variables	Nights in hospital			Discharges		
Educational attainment						
Graduate school	Reference					
No high school diploma	1.66	0.79	0.28	1.37	0.51	0.39
Completed high school/GED	1.23	0.51	0.62	1.14	0.38	0.70
Completed 4 year degree	1.19	0.44	0.63	1.29	0.38	0.38
Other	1.83	0.82	0.18	1.58	0.59	0.23
How long since last routine checkup						
Within past year	Reference					
Within past 2 years	0.26	0.10	0.00*	0.62	0.18	0.10
Within past 3-5 years	4.75	3.49	0.03*	1.48	0.68	0.39
Never	0.47	0.34	0.29	1.07	0.69	0.92
How long since last dental checkup						
Twice a year or more	Reference					
Once a year	1.22	0.39	0.54	1.22	0.27	0.37
Less than once a year	0.74	0.19	0.26	1.13	0.20	0.50
Never	0.67	0.20	0.17	0.94	0.20	0.78
Need Factors						
Perceived health status						
Excellent	Reference					
Very good	0.94	0.42	0.89	0.94	0.38	0.87
Good	0.93	0.44	0.88	0.99	0.36	0.98
Fair	0.79	0.43	0.67	1.32	0.56	0.52
Poor	0.57	0.39	0.41	1.08	0.53	0.87
Number of chronic condition(s)	0.88	0.07	0.11	0.99	0.05	0.81
Physical component (SF-12)	0.96	0.01	0.00*	0.96	0.01	0.00*
Enabling						
Income						
>400% FPL	Reference					
<100% FPL	2.01	0.60	0.02*	1.41	0.32	0.14
101-200% FPL	0.94	0.43	0.89	1.09	0.30	0.75
201-300% FPL	1.38	0.48	0.35	1.42	0.31	0.11
301-400% FPL	1.40	0.36	0.19	0.98	0.16	0.89

(Table A-5. Continued)

Variables	Nights in hospital			Discharges		
Insurance						
Any private	Reference					
Public only	0.43	0.12	0.00*	0.76	0.14	0.13
Uninsured	0.05	0.04	0.00*	0.57	0.31	0.30
Gatekeeper/PCP requirement						
No, private plan with gatekeeper	Reference					
Yes, private plan with gatekeeper	0.38	0.14	0.01*	0.88	0.26	0.68
Established network						
Private plan without doctor list	Reference					
Private plan with doctor list	0.78	0.18	0.29	1.03	0.21	0.88
Other						
Primary care provider						
No	Reference					
Yes	0.73	0.28	0.41	0.73	0.18	0.19
Time						
2004	Reference					
2005	1.31	0.42	0.40	0.80	0.18	0.33
2006	1.02	0.26	0.95	0.86	0.14	0.38
2007	0.51	0.15	0.02*	0.74	0.15	0.14
Diseases						
Diabetes	0.72	0.33	0.48	0.87	0.30	0.68
High blood pressure	2.60	1.06	0.02*	1.71	0.60	0.13
Asthma	2.02	1.20	0.15	1.88	0.83	0.15
COPD	4.06	2.26	0.01*	2.19	0.87	0.05*
Arthritis	0.36	0.21	0.07**	0.70	0.39	0.51
Depression	4.12	2.05	0.01*	2.07	0.79	0.06**
Interaction						
PCMH * Diabetes	2.26	0.94	0.05*	1.34	0.35	0.25
PCMH * High blood pressure	0.50	0.14	0.01*	0.77	0.14	0.16
PCMH * Asthma	0.76	0.48	0.66	0.73	0.33	0.49
PCMH * COPD	0.61	0.35	0.39	0.85	0.28	0.64
PCMH * Arthritis	0.41	0.27	0.18	0.52	0.37	0.36
PCMH * Depression	0.62	0.29	0.31	0.86	0.27	0.63

*Significance at 0.05 level
**Significance at 0.01 level

LIST OF REFERENCES

Adams EK, Johnson V. 2000. An Elementary School-Based Health Clinic: Can It Reduce Medicaid Costs? *Pediatrics* 105: 780–788

Adams RJ, Fuhlbrigge A, Guilbert T, Lozano, P. and Martinez, F. 2002. Inadequate Use Of Asthma Medication In The United States: Results Of The Asthma In America National Population Survey. *Journal of Allergy and Clinical Immunology* 110: 58–64.

Agency for Health care Research and Quality. 2001. Reasons for Lacking a Usual Source of Care: 2001 Estimates for the U. S. Civilian Non-institutionalized Population. Available at: http://www.meps.ahcpr.gov/mepsweb//data_files/publications/st32/stat32.pdf . Retrieved February 10th, 2009.

AHRQ. 2002. "National Health care Disparities Report." Rockville, MD: Agency for Health care Research and Quality.

American Academy of Family Physicians, American Academy of Pediatrics, American College of Physicians, and American Osteopathic Association. 2007. Joint Principles Of The Patient-Centered Medical Home. Available at: http://www.acponline.org/advocacy/where_we_stand/medical_home/approve_jp.pdf. Retrieved January 23rd, 2009

American Academy of Pediatrics, Council on Pediatric Practice. 1967. Pediatric Records And A "Medical Home." In: *Standards of Child Care.* Evanston, IL: American Academy of Pediatrics, 77–79.

American Academy of Pediatrics, Committee on Standards of Child Health Care. 1977. *Standards of Child Health Care*. 3rd ed. Evanston, IL: American Academy of Pediatrics.

Andersen, GR. and Knickman, J.R. 2001. Changing the Chronic Care System to Meet People's Needs. *Health Affairs*, 206: 146-160.

Anderson RM. 1985. Is The Problem Of Compliance All In Our Heads? *Diabetes Educator*, 11: 31–34.

Anderson-Rothman, A. and Wagner, EH. 2003. Chronic Illness Management: What is the Role of Primary Care? Annals of Internal Medicine, 138: 256-261.

Anderson, GF., Frogner, BK., Johns, RA. and Reinhardt, UE. 2006. Health Care Spending And Use of Information Technology In OECD Countries. *Health Affairs,* 253: 819–831.

Angrist, JD. and Krueger, AB. 2001. Instrumental variables and the search for identification: from supply and demand to natural experiments. *The Journal of Economic Perspectives,* 15 4: 69-85.

American Diabetes Association. 2001. Standards of Medical Care For Patients With Diabetes Mellitus. *Diabetes Care,* 24: S33–S43.

American Academy of Pediatrics. 2002. The Medical Home: Medical Home Initiatives For Children With Special Needs Project Advisory Committee. *Pediatrics*, 1101: 184-186.

Arora, NK. and McHorney, CA. 2000. Patient Preference For Treatment Approaches In Medical Decision-making. Who Really Wants To Participate? *Medical Care,*38: 335-341.

Ashcroft, R., Hope, T. and Parker, M. 2001. Ethical Issues And Evidence Based Patient Choice. In: Edwards A, Elwyn G. Eds., Evidence Based Patient Choice—Inevitable Or Impossible? pp. 53–65. Oxford: Oxford University Press.

Ashton, CM., Haidet, P., Paterniti, DA., Collins, TC., Gordon, HS., O'Malley, K., Pertersen, LA, Sharf, BF, Suarez-Almazor, ME., Wray, NP. and Street, R.L. 2003. Racial And Ethnic Disparities In The Use Of Health Services, Bias, Preferences Or Poor Communication? *Journal of General Internal Medicine*, 18: 146-152.

Backer, LA. 2007. The Medical Home: An Idea Whose Times Has Come…. Again. *Family Practice Management,* 148: 38-41.

Baker DW, Parker RM, Williams MV, Clark WS. 1998. Health Literacy and The Risk of Hospital Admission. *Journal of General Internal Medicine,* 13:791-798.

Baker DW, Parker RM, Williams MV, Clark WS, Nurss J. 1997. The Relationship of Patient Reading Ability to Self-Reported Health and Use of Health Services. *American Journal of Public Health.* 87, 1027-1030.

Barr, MS. 2008. The Need to Test the Patient-Centered Medical Homes. *JAMA,* 3007, 834-835.

Barr M. 2006. The Advanced Medical Home: A Patient-centered, Physician-Guided Model Of Health Care. Philadelphia PA: American College of Physicians.

Barr, DA. 1995. The Effects Of Organizational Structure On Primary Care Outcomes Under Managed Care. *Annals of Internal Medicine*, 122: 353-359.

Barry TL, Davis DJ, Meara JG, Halvorson M. 2002. Case Management: An Evaluation at Childrens Hospital Los Angeles. *Nursing Economics,* 20: 22–27.

Bascle G. 2008. Controlling for Endogeneity with Instrumental Variables in Strategic Management Research. *Strategic Organization*, 6(3): 285–327.

Beal, AC., Doty, MM., Hernandez, SE., Shea, KK. and Davis, K. 2007. Closing the Divide: How Medical Homes Promote Equity in Health Care: Results From The Commonwealth Fund 2006 Health Care Quality Survey, The Commonwealth Fund.

Berenson, RA., Hammons, T., Gans, DN., Zuckerman, S., Merrell, K., Underwood, WA. and Williams, AF. 2008. A House Is Not A Home: Keeping Patients at the Center of Practice Redesign. *Health Affairs*, 275: 1219–1230.

Berg, GD. and Mansley, EC. 2004. Endogeneity Bias in the Absence of Unobserved Heterogeneity. *Annals of Epidemiology*, 14: 561 – 565.

Bergeson, SC. and Dean, JD. 2006. A Systems Approach to Patient-Centered Care. *JAMA*, 29623: 2848-2851.

Berk, ML. and Monheit. AC. 2001. The Concentration of Health Care Expenditures, Revisited. *Health Affairs,* 20 2: 9-18.

Berry, D. 2007. *Health Communication Theory and Practice*. Berkshire, England: Open University Press.

Bethell, CD., Read, D. and Brockwood, K. 2004. Using Existing Population-Based Data Sets To Measure The American Academy Of Pediatrics Definition Of Medical Home For All Children And Children With Special Health Care Needs. *Pediatrics,* 1135: 1529-1537.

Blewett, LA., Johnson, PJ., Lee, B. and Scal, PB. 2008. When A Usual Source Of Care And Usual Provider Matter: Adult Prevention And Screening. *Journal of General Internal Medical*, 239: 1354-1360.

Block, DJ. 2006. *Health care Outcomes Management: Strategies for Planning and Evaluation*. Sudbury, Massachusetts: Jones and Bartlett Publishers.

Bodenheimer, T. 2008. Coordinating Care – A Perilous Journey through the Health Care System. New England Journal of Medicine, 35810: 1064-1071.

Bodenheimer T, Wagner EH, Grumbach K. 2002a. Improving Primary Care For Patients With Chronic Illness. *JAMA*, 288: 1775-1779.

Bodenheimer T, Wagner EH, Grumbach K. 2002b. Improving Primary Care For Patients With Chronic Illness: The Chronic Care Model, Part 2. *JAMA*, 288: 1909 - 14.

Bodenheimer ,T., Lorig, K., Holman, H., and Grumbach, K. 2002. Patient Self-Management Of Chronic Disease In Primary Care. *JAMA*, 288: 2469–2475.

Bodenheimer, T., Berenson, RA. and Rudolf, P. 2007. The Primary Care –Specialty Income Gap: Why Its Matters. *Annals of Internal Medicine*, 1464: 301-306.

Bodenheimer, T. and Grumbach, K. 2007. Improving Primary Care: Strategies and Tools For a Better Practice. New York City, NY: Lange Medical Books / McGraw-Hill.

Bodenheimer,T., Chen, E. and Bennett, HD. 2009 Confronting The Growing Burden Of Chronic Disease: Can The U.S. Health Care Workforce Do The Job? Health Affairs, 28: 64-74.

Bohmer, RMJ. 2010. Managing The New Primary Care: The New Skills That Will Be Needed. *Health Affair*, 29(5): 1010 - 1014.

Bordowitz, R., Morland, K. and Reich, D. 2007. The Use Of An Electronic Medical Records To Improve Documentation And Treatment Of Obesity. *Family Medicine*, 394: 274-279.

Braddock CH III, Fihn SD, Levinson W, Jonsen, AR, Pearlman RA. 1997. How Doctors And Patients Discuss Routine Clinical Decisions: Informed Decision-making In The Outpatient Setting. *Journal of General Internal Medicine,* 126: 339-345.

Braddock CH III, Edwards KA, Hasenberg NM, Laidley TL, Levinson W. 1999. Informed Decision-making In Outpatient Practice: Time To Get Back To Basics. *JAMA*, 28224: 2313-2320.

Brown, L. 1998. The Evolution of Managed Care in the US. *Pharmacoeconomics*, 14supp 1: 37-43.

Brown, J.B., Stewart, M., and Ryan, B.L. 2003. Outcomes Of Patient-Provider Interaction. In Thompson, T.L., Dorsey, A.M., Miller, K.I., and Parrot, R. Eds, Handbook of Health Communication pp. 141- 162. Mahwah, New Jersey: Lawrence Erlbarum Associates, Publishers.

Carrier, E., Gourevitch, MN. and Shah, NR. 2009. Medical Homes: Challenges in Translating Theory into Practice. *Medical Care*, 47(7): 714 - 722.

Cebul, RD, Rebitzer, JB., Taylor, LJ. and Votruba, ME. 2008. Organizational Fragmentation and Care Quality in the U.S. Health care System. *Journal of Economic Perspective,* 224: 93–113.

Centers for Disease Control and Prevention. 2009. Inactive Influenza Vaccine: What You Need To Know, 2008-09. Available at:

http://www.cdc.gov/vaccines/pubs/vis/downloads/vis-flu.pdf. Retrieved May 1st 2009.

Centers for Disease Control and Prevention. 2009. Chronic Disease Overview. Available at: http://www.cdc.gov/NCCdphp/overview.htm. Retrieved Jan 1st, 2009.

Center for Medical Home Improvement. 2006. The Medical Home Index—Short Version: measuring the organization and delivery of primary care for children with special health care needs. Available at: http://www.medicalhomeimprovement.org/pdf/CMHI-MHI-Pediatric_Full-Version.pdf. Retrieved October 2nd, 2009.

Chobanian, AV., Bakris, GL., Black, HR., Cushman, WH., Green, LA., Izzo, JL., Jones, DW., Materson, BJ., Oparil, S., Wright, JT., Roccella, EJ., and the National High Blood Pressure Education Program Coordinating Committee. 2003a. Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Hypertension,* 42: 1206-1252

Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL, et al. 2003b. The Seventh Report Of The Joint National Committee On Prevention, Detection, Evaluation, And Treatment Of High Blood Pressure: The JNC 7 Report. *JAMA*, 289: 2560–2572.

Clemens-Cope, L. and Kenney, G. 2007. Low Income Parents' Report Of Communication Problems With Health Care Providers: Effects Of Language And Insurance. *Public Health Report,*122: 206-216.

Clever, SL, Jin, L., Levinson, W. and Meltzer, DO. 2008. Does The Doctor-Patient Communication Affect Patient Satisfaction With Hospital Care? Results of an Analysis With A Novel Instrumental Variable. *Health Services Research*, 435: 1504-1519.

Cohen, S.B., DiGaetano, R. and Goksel. H. 1999. Methodology Report #5: Estimation Procedures in the 1996 Medical Expenditure Panel Survey Household Component. Rockville, MD: Agency for Health care Research and Quality.

Cohen, SB. 2002. The Medical Expenditure Panel Survey: Overview. *Effective Clinical Practice*, May/June 2002. 5:E1.

Cohen, SB. 2003. Design Strategies And Innovations In Medical Expenditure Panel Survey. *Medical Care*, 417: II-5 – III-12.

Cohen, SG. and Bailey, DE. 1997. What Makes Teams Work: Group Effectiveness Research From Shop Floor To Executive Suite. *Journal of Management*, 23: 239-290.

Cohen, SB. and Wun, LM. 2005. A Comparison Of Household And Medical Provider Reported Health Care Utilization And An Estimation Strategy To Correct For Response Error. *Journal of Economic and Social Measurement,* 30: 115-126.

Cohen, SB., Makuc, DM. and Ezzati-Rice, T. 2007. Health Insurance Coverage During 24-Month Period: A Comparison Of Estimates From Two National Health Survey. *Health Services Outcomes Research Methodology*, 7: 125-144.

Coleman, K. and Phillips, K. (2010). Providing Underserved Patients with Medical Homes: Assessing the Readiness of Safety-Net Health Centers, The Commonwealth Fund

Commonwealth Fund. 2008a. Commonwealth Fund Commission on a High Performance Health System, Why Not the Best? Results from the National Scorecard on U.S. Health System Performance. Available at: http://www.commonwealthfund.org/usr_doc/Why_Not_the_Best_national_scorecard_2008.pdf?section=4039. Retrieved October 12th, 2008.

Commonwealth Fund. 2008b. In Focus: Are Medical Homes Primary Answer? Available at: http://www.commonwealthfund.org/usr_doc/2008_01_02_QM.pdf?section=4039. Retrieved October 17th, 2008.

Cook, T. and D. Campbell. 1979. *Quasi Experimentation: Design and Analysis Issues for Field Settings*. Chicago, IL: Rand McNally.

Cooley, W.C., McAllister, J.W., Sherrieb, K. and Clark, R. 2009. Improved Outcomes Associated With Medical Home Implementation In Pediatric Primary Care. *Pediatrics*, 124: 358-364.

Cooley, WC. 2004. Redefining Primary Pediatric Care For Children With Special Health Care Needs: The Primary Care Medical Home. *Current Opinion Pediatrics,* 166: 689–692.

Cooley, W.C., McAllister, J.W., Sherrieb, K. and Clark, R. 2003. The Medical Home Index: Development and Validation Of A New Practice-Level Measure Of Implementation Of The Medical Home Model. *Ambulatory Pediatrics*, 3: 173-180.

Coombs, JG. 2005. *The Rise and Fall of HMOs: An American Health Care Revolution*. Madison, WI: University of Wisconsin Press.

Coulter A. 1997. Partnerships With Patients: The Pros And Cons Of Shared Clinical Decision-making. *Journal of Health Service Research Policy*, 2: 112–21.

Cronbach, LJ. 1951. Coefficient Alpha And The Internal Structure Of Test. *Psychometrika*, 16: 297-334.

Cronbach, L. J., and Meehl, P. E. 1955. Construct validity in psychological tests. *Psychological Bulletin, 52*: 281-302.

Cunningham, PJ., Clancy, CM., Cohen, JW. and Wilets, M. 1995. The Use of Hospital Emergency Departments for Non-urgent Health Problems: A National Perspective. Medical Care Research and Review, 524: 453 - 474.

Curtin, M. and Lubkin, I. 1995. What Is Chronicity? In I. Lubkin Ed., *Chronic Illness: Impact and Interventions* 3rd edition, pp. 3-25. Sudbury, MA: Jones and Barlette.

Davis TC, Arnold C, Berkel HJ, Nandy, I., Jackson, RH. and Glass, J. 1996; Knowledge And Attitude On Screening Mammography Among Low-Literate, Low-Income Women. *Cancer,* 789: 912-20.

De Boer, AGEM., Wijker, W. and De Haes, HCJM. 1997. Predictors of Health Care Utilization in the Chronically Ill: A Review of the Literature. *Health Policy,* 42: 101-115.

DeVellis, R. F. 2003. *Scale development: Theory and applications* 2nd ed. London: Sage.

Devoe JE, Baez A, Angier H, Krois L, Edlund C, Carney PA. 2007. Insurance + Access Not Equal To Health Care: Typology Of Barriers To Health Care Access For Low-Income Families. *Annals of Family Medicine,* 56: 511-518.

DeVoe J. 2008. The Unsustainable US Health Care System: A Blueprint For Change. *Annals of Family Medicine,* 63: 263-266.

DeVol, R. and Bedroussian, A. 2007. An Unhealthy America: The Economic Burden of Chronic Disease. Available at: http://www.milkeninstitute.org/pdf/chronic_disease_report.pdf. Retrieved March 3rd 2009. Santa Monica, California: The Milken Institute 2007

DiMatteo MR, Sherbourne CD, Hays RD, et al. 1993. Physicians' Characteristics Influence Patients' Adherence to Medical Treatment: Results from the Medical Outcomes Study. *Health Psychology*, 12: 93–102.

Dodd, S., A. Bassi, K. Bodger, and P. Williamson. 2006. "A Comparison of Multivariable Regression Models to Analyze Cost Data." *Journal of Evaluation in Clinical Practice,* 12 (1): 76-86.

Donalson, MS. 2001. Continuity of Care: A Re-conceptualization. Medical Care Research and Review, 583: 255-290.

Donaldson, M.S., Yordy, K.D., Lohr, K.N. and Vaneslow. N.A. 1996 Primary Care: America's Health in a New Era. Washington DC. National Academy Press

Duan, N. 1983. Smearing Estimate: A Nonparametric Retransformation Method. *Journal of the American Statistical Association,* 78 383: 605-610.

Duan, N., Manning, WG, Morris, CN. and Newhouse, JP. 1984. Choosing Between the Sample-Selection Model and the Multi-Part Model. *Journal of Business and Economic Statistics,* 2 3: 283-289.

Dubard, CA. 2009. Moving Forward With The Medical Home: Evidence, Expectations And Insights Into CCNC. *North Carolina Medical Journal*, 703: 225-230.

Edwards, M., Davies, M. and Edwards, A. 2009. What Are The External Influences On Information Exchange And Shared Decision-Making In Health care Consultations: A Meta-Synthesis Of The Literature. *Patient Education and Counseling,* 75: 37–52.

Ellwood, PM., Anderson, NN., Billings, JE., Carlson, RJ., Hoagberg, EJ. and McClure, W. 1971. Health Maintenance Strategy. *Medical Care*, IX3: 291-298.

Enthoven, AC, Crosson, FJ, and Shortell, SM. 2007. Redefining Health Care: Medical Homes Or Archipelagos To Navigate? *Health Affairs*, 26: 1366 –1372.

Epstein RM., Alsper, BS. and Quill, TE. 2004. Communicating Evidence for Participatory Decision-making. JAMA, 29119: 2359-2366.

Ettner, SL. 2004. Methods for Addressing Selection Bias in Observational Studies. Text Version of a Slide Presentation at a National Research Service Award NRSA Trainees Research Conference. Agency for Health care Research and Quality, Rockville, MD. Available at http://www.ahrq.gov/fund/training/ettnertxt.htm. Retrieved July 1st 2009.

Fahrmeir, L. and Tutz, G. 2001. *Multivariate Statistical Modeling Based on Generalized Linear Models.* Second Edition: Springer.

Finney-Rutten, LJ., Auguston, E. and Wanke, K. 2006. Factors Associated With Patients' Perception Of Health Providers' Communication Behavior. *Journal of Health Communication*, 11: 135-146.

Fiscella, K., Franks, P., Gold, MR., Clancy, CM. 2000. Inequality In Quality: Addressing Socioeconomic, Racial, And Ethnic Disparities In Health Care. *JAMA*, 28319: 2579-2584.

Fiscella, K. and Epstein, RM. 2008. So Much To Do, So Little Time: Care For The Socially Disadvantaged And The 15 Minute Visit. *Archives of Internal Medicine*, 16817: 1843-1852.

Fisher, E., Wennberg, D., Stukel, T., Gottlieb, DJ., Lucas, FL. and Pinder, EL. 2003a. The Implications of Regional Variations in Medicare Spending. Part 1: The Content, Quality, and Accessibility of Care. *Annals of Internal Medicine,* 1384: 273–287.

Fisher, E., Wennberg, D., Stukel, T., Gottlieb, DJ., Lucas, FL. and Pinder, EL. 2003b. The Implications of Regional Variations in Medicare Spending. Part 2: Health Outcomes and Satisfaction with Care. *Annals of Internal Medicine,* 1384: 288–298.

Flynn SP. 1985. Continuity Of Care During Pregnancy: The Effect Of Provider Continuity On Outcome. *Journal of Family Practice,* 21: 375-380.

Frewer, LJ., Salter, B. and Lambert, N. 2001. Understanding Patients' Preferences For Treatment: The Need For Innovative Methodologies. *Qualitative Health Care,*10: i50-54.

Friedberg, MW., Safran, DG., Coltin, KL., Dresser, M. and Schneider, EC. 2009. Readiness for Patient-Centered Medical Homes: Structural Capabilities of Massachusetts Primary Care Practices. *Journal of General Internal Medicine*, 242: 162-169.

Fryer GE, Jr., Consoli R, Miyoshi TJ, Dovey SM, Phillips RL Jr, Green LA. 2004. Specialist Physicians Providing Primary Care Services In Colorado. *Journal of American Board of Family Practice*, 17: 81–90.

Forrest, C.B., Glade, G.B., Baker, A.E., Bocian, A., Von Schrader, S., Starfield, B. 2000. Coordination Or Specialty Referral And Physician Satisfaction With Referral Care. *Archives of Pediatric Adolescent Medicine*. 154: 499-506.

Fortin M, Bravo G, Hudon C, Vanasse A, Lapointe, L. 2005. Prevalence Of Multi-morbidity Among Adults Seen In Family Practice. *Annals of Family Medicine*, 3: 223–228.

Furr, RM. and Bacharach, VR. 2007. *Psychometrics: An Introduction*. London: Sage.

Future of Family Medicine Project Leadership Committee. 2004. The Future Of Family Medicine. *Annals of Family Medicine*, 2suppl. 1: S3-S32.

Gadomski, A., Jenkins, P. and Nichols, M. 1998 "Impact of a Medicaid Primary Care Provider and Preventive Care on Pediatric Hospitalization." *Pediatrics*. 1013: E1.

Gallagher TC, Geling O, Comite F. 2001. Use Of Multiple Providers For Regular Care And Women's Receipt Of Hormone Replacement Therapy Counseling. *Medical Care,*39: 1086-1096.

Garrity TF, Haynes RB, Mattson ME, Engebretson Jr TO. 1998. Medical Compliance And The Clinical-Patient Relationship: A Review. Washington DC: National Institutes of Health;

Garibaldi, RA., Popkave, C. and Bylsma, W. 2005. Career Plans for Trainees in Internal Medicine. *Academic Medicine*, 805: 507-512.

Garg, AX., Adhikari, NK., McDonald, H. Rosas-Arellano, R., Devereaux, PJ., Beyene, J., Sam, J. and Haynes, RB 2005. Effects Of Computerized Clinical Decision Support Systems On Practitioner Performance And Patient Outcomes. *JAMA*, 29310: 1223-1238.

Gibson, TB., Mark, TL., Axelsen, K., Basur, O., Rublee, DA. and McGuigan, KA. 2006. Impact of Statin Copayments on Adherence and Medical Care Utilization and Expenditures. *American Journal of Managed Care*, 12: SP11–19.

Gill JM and Mainous AG. 1998. The Role Of Provider Continuity In Preventing Hospitalizations. *Archives of Family Medicine,* 74: 352-357.

Gill JM and Mainous AG III, Nsereko M. 2000. The Effect Of Continuity Of Care On Emergency Department Use. *Archives of Family Medicine,* 94: 333-338.

Ginnsburg, JA., Doherty, RB., Ralston, JF., et al. 2008. Achieving A High Performance Health Care System With Universal Access: What Can the Unites States Learn From Other Countries. *Annals of Internal Medicine*, 1481: 55-75.

Gittell, JH., Fairfield, KM., Berbaum, B., Head, W., Jackson, R., Kelly, M. Laskin, R., Lipson, S., Siliski, J., Thornhill, T. and Zuckerman, J. 2000. Impact Of Relational Coordination On Quality Of Care, Postoperative Pain And Functioning, And Length Of Stay: Nine Hospital Study Of Surgical Patients. *Medical Care*, 38: 807-819.

Goldberg, DG. & Kuzel, AJ. 2009. Elements of the patient-centered medical home in family practices in Virginia. *Annals of Family Medicine, 7*(4), 301-308.

Golin, C., DiMatteo, MR., Duan, N and Leake, B. 2002. Impoverished Diabetic Patients Whose Doctors Facilitate Their Participation In Medical Decision-making Are More Satisfies With Their Care. *Journal of General Internal Medicine,* 17: 866-875.

Goodman, DC. and Fisher, ES. 2008. Physician Workforce Crisis? Wrong Diagnosis, Wrong Prescription. *New England Journal of Medicine*, 35816: 1658-1661.

Gordon, J.B., Colby, H.H., Bartelt, T., Jablonski, D., Krauthofer, M.L. and Havens, P. 2007 “A Tertiary Care-Primary Care Partnership Model For Medically Complex

And Fragile Children And Youth With Special Health Care Needs." *Archives of Pediatric Adolescent Medicine.* 16110: 937-944.

Goroll, AH., Berenson, RA., Schoenbaum, SC. and Gardner, LB. 2007. Fundamental Reform of Payment for Adult Primary Care: Comprehensive Payment for Comprehensive Care. *Journal of General Internal Medicine,* 223: 410–415.

Government Accounting Office. 2008. Primary Care Professionals: Recent Supply Trends, Projections and Valuation of Services. Available at: http://www.gao.gov/new.items/d08472t.pdf. Retrieved on March 3rd, 2009.

Green, LA., Fryer, GE., Yawn, BP., Lanier, D. and Dovey, SM. 2001. The Ecology of Medical Care Revisited . *New England Journal of Medicine,* 34426: 2021-2025.

Greene W. 2003. *Econometric analysis* 5th ed. Upper Saddle River, NJ: Pearson Education Inc.

Greenfield, S., Kaplan, SH., Ware, JE., Yano, EM. and Frank, HJ. 1988. Patients' Participation In Medical Care: Effects On Blood Sugar Control And Quality Of Life In Diabetes. *Journal of General Internal Medicine,* 3: 448-457.

Greenfield S, Kaplan S, and Ware J. 1985. Expanding Patient Involvement In Care: Effects On Patient Outcomes. *Annals of Internal Medicine*, 102: 520–528.

Griswold KS, Servoss TJ, Leonard KE, et al. 2005. Connections to Primary Medical Care After Psychiatric Crisis. *Journal of American Board of Family Practice*,18: 166 –72.

Griswold KS, Greene B, Smith SJ, Behrens T, Blondell RD. 2007. Linkage To Primary Medical Care Following Inpatient Detoxification. *American Journal of Addiction*, 16: 183– 6.

Grumbach, K., Selby, J.V., Damberg, C., Bindman, A.B., Quesenberry, C., Truman, A. and Uratsu, C. 1999 "Resolving the Gatekeeper Conundrum: What Patients Value in Primary Care and Referrals to Specialists." *JAMA*, 2813: 261-266.

Grumbach, K, and Bodenheimer, T. 2002. A Primary Care Home For Americans: Putting The House In Order. *JAMA*: 288, 889 –893.

Guthrie B, and Wyke S. 2000. Does Continuity In General Practice Really Matter? *BMJ,*321: 734-736.

Hardin, JW. and Hilbe, JM. 2007. *Generalized Linear Models and Extensions* 2nd. Ed. College Park, TX: STATA Press.

Harkinson, MT., Blumenfrucht, FD. 2006. Sustained Improvement For Specialty Clinic Access. *Joint Commission Journal on Quality and Patient Safety*, 32(3):142–151.

Hatcher, L. 1994. *A Step-by-Step Approach to Using SAS for Factor Analysis and Structure Equation Modeling*. Cary, NC: SAS Institute Inc.

Heckman J. 1976. The Common Structure Of Statistical Models Of Truncation, Sample Selection, And Limited Dependent Variables And A Simple Estimator For Such Models. *Annals of Economic Social Measurement*, 5: 475–492.

Heckman J. 1979. Sample Selection Bias As A Specification Error. *Econometrica,* 47: 153–161.

Heisler, M., Cole, I., Weir, D., Kerr, EA. and Hayward, RA. 2007. Does Physician Communication Influence Older Patients' Diabetes Self-Management And Glycemic Results From The Health And Retirement Study HRS? *Journal of Gerontology,* 62A12: 1435-1442.

Henson, RK. 2001. Understanding Internal Consistency Reliability Estimates: A Conceptual Primer on Coefficient Alpha. *Measurement and Evaluation in Counseling and Development*, 34: 177-189.

Hildebrand, D.K., J.D. Laing, and H. Rosenthal. 1977. *Prediction Analysis of Cross Classifications*. New York: John Wiley and Sons, Inc.

Hoffman, C., Rice, D. and Sung, HY. 1996. Persons with Chronic Conditions: Their Prevalence and Costs. *JAMA,*276: 1473-1479.

Hopper, KD., Ten-Have, TR., Tully, DA., Hall, TE. 1998. The Readability of Currently Used Surgical/Procedure Consent Forms In The United States. *Surgery*, 1235: 496-503.

Hung, DY., Rundall, TG., Tallia, AF., Cohen, DJ., Halpin, HA. and Crabtree, BJ. 2007. Rethinking Prevention In Primary Care: Applying The Chronic Care Model To Address Health Risk Behaviors. *Milbank Quarterly*, 851: 69-91.

Hurd, S. 2008. The Right Care, At The Right Place, At The Right Time. Available at: http://marillacclinic.org/about/directors-corner/2009-06-09_Integrated-Care-at-Medical-Home.ppt. Retrieved August 3rd, 2009.

Institute of Medicine. 1996. Division of Health Care Services. Committee on the Future of Primary Care., Donaldson MS. Primary care: America's health in a new era. Washington, D.C.: National Academy Press.

Institute of Medicine. 2001a. *Crossing the Quality Chasm: A New Health System for the 21st Century.* Washington, D.C: National Academy Press.

Institute of Medicine. 2001b. Envisioning a National Health care Quality Report. Washington, D.C: National Academy Press.

Institute of Medicine. 2003. Unequal Treatment: Confronting Racial and Ethnic Disparities in Health care. Edited by B. Smedley et al. Washington, D.C: National Academy Press

Isaac, SL. and Knickman, JR.Eds.. 2004. Generalist Medicine and the US Health System. Princeton, New Jersey: Jossey-Bass.

Jee SH and Cabana MD. 2006. Indices For Continuity Of Care: A Systematic Review Of The Literature. *Medical Care Research Review*, 632; 158–188.

Jolliffe, IT. 2002. *Principal Component Analysis* 2nd. Ed. New York: Springer.

Kaiser Family Foundation. 2002. National Survey of Physicians: Part III. Available at: http://www.kff.org/kaiserpolls/upload/Highlights-and-Chart-Pack-2.pdf. Retrieved on March 3rd, 2009.

Keckley, PH. and Underwood, HR. 2008. The Medical Home: Disruptive Innovation for a New Primary Care Model. Available at: http://www.deloitte.com/assets/Dcom-UnitedStates/Local%20Assets/Documents/us_chs_MedicalHome_w.pdf. Retrieved March 1st, 2009.

Keckley, PH. Hoffman, M. and Underwood, HR. 2010. Medical Home 2.0: The Present, the Future. Available at: http://www.deloitte.com/assets/Dcom-UnitedStates/Local%20Assets/Documents/US_CHS_MedicalHome2_092210.pdf . Retrieved February 20th, 2010.

Kennedy, P. 2008. Guide to Econometrics 6th Ed. Malden, MA: Blackwell Publishing.

Kerr EA, McGlynn EA, Adams J, Keesey J, and Asch SM, 2004. Profiling the Quality of Care in Communities: Results from the Community Quality Index Study. *Health Affairs*, 233: 247–256.

Kessler, RC., Demler, O., Frank, RG., Olfson, M., Pincus, HA., Walters, EE., Wang, P., Wells, KB. and Zaslavsky, AM. 2005. Prevalence and Treatment of Mental Disorders, 1990 to 2003. *New England Journal of Medicine,* 352: 2515-2523.

Kieckhefer, GM., Greek, AA., Joesch, JM., Kim, H. and Baydar, N. 2005. Presence And Characteristics Of Medical Homes And Health Services Utilization Among Children With Asthma. *Journal of Pediatric Health Care,* 19: 285 – 292.

Kongstvedt, PR. 2007. *Essentials of Managed Health Care* 5th Ed. Sudsbury, MA: Jones and Bartlett Publishers.

Koop, E. 1996. Health Promotion And Disease In Clinical Practice. In RS Lawrence, SH Woolf and S. Jonas Eds., *Health Promotion and Disease Prevention in Clinical Practice*, pp. vii-ix. Baltimore, MD: Williams and Wilkins.

Kottke, TE., Solberg, LI., Brekke, ML., Caberra, A. and Marquez, MA. 1997. Delivery Rates For Preventive Services In 44 Midwestern Clinics. *Mayo Clinic Proceedings,* 726: 515-523.

Lafata JE, Martin S, Morlock R, Divine G, Xi H. 2001. Provider Type And The Receipt Of General And Diabetes-Related Preventive Health Services Among Patients With Diabetes. *Medical Care*, 39: 491-499.

Lambrew, JM., DeFriese, GH., Carey, TS., Ricketts, TC. and Biddle. AK. 1996. ''The Effects of Having a Regular Doctor on Access to Primary Care.'' *Medical Care*, 34 2: 138–51.

Landon, BE., Reschovsky, J. and Blumenthal, D. 2003. Changes In Career Satisfaction Among Primary Care And Specialist Physicians, 1997-2001. *JAMA*, 289: 442-449.

Landon, BE., Gill, JM., Antonelli, RC. & Rich, EC. 2010. Prospects For Rebuilding Primary Care Using The Patient-Centered Medical Homes. *Health Affair*, 29(5): 827-834.

Lantz, PM., Lichtenstein, RL., and Pollack HA. 2007. Health Policy Approaches To Population Health: The Limits Of Medicalization. *Health Affairs*, 26: 1253–1257.

Legorreta, AP., Liu, X., Zaher, CA. and Jatulis, DE. 2000. Variation In Managing Asthma Experience At The Medical Group Level In California. *Ambulatory Journal of Managed Care,* 6: 445-453.

Levinson, W., Kao, A., Kuby, A. and Thisted, RA. 2005. Not All Patients Wants To Participate In Decision-making: A National Study Of Public Preferences. *Journal of General Internal Medicine,* 20: 531-535.

Liptak GS, Burns CM, Davidson PW, McAnarney ER. 1998. Effects Of Providing Comprehensive Ambulatory Services To Children With Chronic Conditions. *Archive of Pediatric and Adolescent Medicine,* 152: 1003–1008

Lorig, KR., Sobel, DS., Ritter, PL., Laurent, D. and Hobbs, M. 2001. Effective of a Self-Management Program on Patients with Chronic Disease. *Effective Clinical Practice*, 4(6): 256 -262.

Lubkin, I. and Larsen, PD. Ed. 2006. Chronic Illness: Impact and Interventions 6th edition. Sudbury, MA: Jones and Barlette.

Lubkin, I. 1995. Chronic Illness: Impact and Interventions 3rd edition. Sudbury, MA: Jones and Barlette.

Machlin, S. R. and Dougherty, D. D. *Overview of Methodology for Imputing Missing Expenditure Data in the Medical Expenditure Panel Survey.* Method-ology Report No. 19. March 2007. Agency for Health care Research and Quality, Rockville, Md. http://www.meps.ahrq.gov/mepsweb/data_files/publications/ mr19/mr19.pdf

MacLean CH, Louie R, Leake B, McCaffrey DF, Paulus HE, Brook RH. 2000. Quality of Care For Patients With Rheumatoid Arthritis. *JAMA*: 284, 984-992.

Mainous, AG., Koopman, RJ., Baker, R. and Pearson, WS. 2004. Relationship Between Continuity Of Care And Diabetes Control: Evidence From The Third National Health And Nutrition Examination Survey. *American Journal of Public Health,* 941: 66-70.

Mancur, O. 1965. *The Logic of Collective Action*. Cambridge, MA: Harvard University Press.

Manning, WG., Basu, A. and Mullahy, J. 2005. Generalized Modeling Approaches To Risk Adjustment Of Skewed Outcomes Data. *Journal of Health Economics,* 24 (3): 465-488.

Manning W. G. and Mullahy J. 2001. Estimating Log Models : To Transform or Not To Transform ? *Journal of Health Economics*, 20:461-494.

Manning, WG., Newhouse, JP., Duan, N., Keeler, EB., Leibowitz, A. and Marquis, MS. 1987. Health Insurance and the Demand For Medical Care: Evidence From A Randomized Experiment. *American Economic Review,* 773: 251-277.

Masoudi FA, Havranek EP, Krumholz HM. 2002. The Burden Of Chronic Congestive Heart Failure In Older Persons: Magnitude And Implications For Policy And Research. *Heart Failure Rev*iew: 7, 9 –16.

Matchar, DB, Samsa, GP, Cohen, SJ, Oddone, EZ. 2000. Community Impact of Anticoagulation Services: Rationale and Design of the Managed Care Anticoagulation Services Trial MAST. *Journal of Thrombosis and Thrombolysis*, 9: S7- S11.

McAlister FA, Lawson FM, Teo KK, Armstrong PW. 2001. A Systematic Review of Randomized Trials Of Disease Management Programs In Heart Failure. *American Journal of Medicine*, 110: 378-84.

McCarthy, D., Nuzum, R., Mika, S., Wrenn, J. and Wakefield, M. 2008. The North Dakota Experience: Achieving High-Performance Health Care through Rural Innovation and Cooperation, the Commonwealth Fund

McDonald KM, Sundaram V, Bravata DM, Lewis R, Lin N, Kraft S, McKinnon M, Paguntalan, H, Owens DK. 2007. Care Coordination. Vol. 7 of: Shojania KG,

McDonald KM, Wachter RM, Owens DK, editors. Closing the Quality Gap: A Critical Analysis of Quality Improvement Strategies. Technical Review 9.

McGinnis, J.M. and Foege, W.H. 1993. Actual Cause Of Death In The United States. *Journal of the American Medical Association*, 27018: 2207-12.

McGlynn, EA., Asch, SM., Adams, J. et al. 2003. The Quality of Health Care Delivered to Adults in the United States. *New England Journal of Medicine,* 348: 2635-2645.

McGlynn EA, Asch SM, Adams J, Keesey J, Hicks, J, DeCristofaro A, and Kerr EA. 2003. The Quality of Health Care Delivered to Adults in the United States. *New England Journal of Medicine*, 34826: 2635–2645.

Miller, RH., West, C., Brown, TM, … 2005. The Value Of Electronic Medical Records In Solo Or Small Practices. *Health Affairs*, 245: 1127-1137.

Mokdad, AH., Marks, JS., Stroup, DF. and Gerberding, JL. 2004. Actual Causes Of Death In The United States, 2000. *Journal of the American Medical Association*, 2910: 1238-45.

Moore, G. and Showstack, J. 2003. Primary Care Medicine in Crisis: Toward Reconstruction And Renewal. *Annals of Internal Medicine*, 138: 224-247.

Murray, M., Bodenheimer, T., Rittenhouse, D. and Grumbach, K. 2003. Improving Timely Access to Primary Care: Case Studies of the Advanced Access Model. JAMA, 2898: 1042-1046.

National Chronic Care Consortium. 2003. *The Prevalence and Cost of Chronic Conditions*. Available at: http://www.nccconline.org/pdf/PrevalenceandCostFacts.pdf Retrieved Jan 1st, 2009.

National Diabetes Data Group. 1995. *Diabetes in America* Chapter 10, pp. 221-232, NIH.

National Center for Chronic Disease Prevention and Health Promotion. Chronic disease overview. Available at: www.cdc.gov/nccdphp/overview.htm. Retrieved January 10th 2009.

NCQA. 2008. Standards And Guidelines For Physician Practice Connections—Patient-centered Medical Home PPC-PCMH. Available at: http://www.ncqa.org/tabid/631/Default.aspx. Retrieved October 2nd, 2009.

Nelson, EC., McHorney, CA., Manning, Jr, WG., Rogers, WH., Zubkoff, M., Greenfield, S., Ware, JE. and Tarlov. AR 1998. A Longitudinal Study Of Hospitalization

Rates For Patients With Chronic Disease: Results From The Medical Outcomes Study. *Health Services Research*, 326: 759–774.

Newhouse, JP. and McClellan, M. 1998. Econometrics In Outcomes Research: The Use Of Instrumental Variables. *Annual Review of Public Health,* 19: 17 – 34.

Ni, H., Nauman, DJ., Hershberger, RE. 1998. Managed Care And Outcomes Of Hospitalization Among Elderly Patients With Congestive Heart Failure. *Archives of Internal Medicine*, 158: 1231-1236.

Norris SL, Nichols PJ, Caspersen CJ, Glasgow RE, Engelgau MM, Jack L. 2002. The Effectiveness Of Disease And Case Management For People With Diabetes: A Systematic Review. American Journal of Preventive Medicine, 22: 15-38

Northouse, LL. and Northouse, PG. 1998. *Health Communications: Strategies of Health Professional*. London: Pearson Education.

Norton, EC., Dow, WH. and Do, YK. 2008. Specification Test For The Sample Selection And Two-Part Models. *Health Service Outcomes Research Method*, 2: 201-208.

Nunnally, JC. 1978. *Psychometric Theory* 2nd. ed. New York: McGraw-Hill Book Company.

Nunnally, J. C, and Bernstein, I. H. 1994. *Psychometric Theory* 3rd ed. New York, NY: McGraw-Hill, Inc.

Nutting, PA., Miller, WL., Crabtress, BF., Jaen, CR., Stewart, EE. and Stange, KC. 2009. Initial Lessons From The First National Demonstration Project On Practice Transformation To Patient-centered Medical Homes. *Annals of Family Medicine*, 7: 254-260.

Nutting PA, Goodwin MA, Flocke SA, Zyzanski SJ, Stange KC. 2003. Continuity Of Primary Care: To Whom Does It Matter An When? *Annals of Family Medicine*, 1: 149–155.

O'Malley, AS., Mandelbatt, J., Gold, K. Cagney, KA. and Kerner, J. 1997 Continuity of Care and the use of breast and cervical cancer screening services in a multiethnic community. Archive of Internal Medicine, 157: 1462-1470.

Ong, L. M., de Haes, J. C., Hoos, A. M., and Lammes, F. B. 1995. Doctor-Patient Communication: A Review of the Literature. *Social Science and Medicine*, 407: 903-18.

Ortega AN, Stewart DC, Dowshen SA. and Katz SH. 2000. The Impact of A Pediatric Medical Home On Immunization Coverage. *Clinical Pediatrics,* 39: 89–96

Ostbyte, T., Yarnall, KS., Krause, KM., Pollak, KI., Gradison, M. and Michener, JL. 2005. Is There Time For Management Of Patients With Chronic Diseases In Primary Care? *Annals of Family Medicine*, 33: 209-214.

Overland J, Yue DK, Mira M. 2001. Continuity Of Care In Diabetes: To Whom Does It Matter? *Diabetes Research and Clinical Practice,* 52: 55-61.

Partnership for Solution. 2002. Multiple Chronic Conditions: Complications in Care and Treatment. Available at: http://www.partnershipforsolutions.org/DMS/files/polling_final.pdf. Retrieved Jan 10th, 2009.

Partnership for Solution 2004. Chronic Conditions: Making the Case for Ongoing Care. Available at: http://www.rwjf.org/pr/product.jsp?id=14685. Retrieved Jan 10th, 2009.

Patel, P., Welsh, C., and Foggs, MB. 2004. Improved Asthma Outcomes Using a Coordinated Care Approach in a Large Medical Group. *Disease Management,* 7: 102–111.

Paulus, RA., Davis, K. and Steele, GD. 2008. Continuous Innovation in Health Care: Implications of the Geisinger Experience. *Health Affairs*, 275: 1235-1245.

Pham, HH., Schrag, D., O'Malley, AS., Wu, B. and Bach, PB. 2007. Care Patterns in Medicare and Their Implications for Pay for Performance. *New England Journal of Medicine*, 35611: 1130–39.

Phillips, KA., Haas, JS., Liang, SY., Baker, LC., Tye, S., Kerlikowske, K., Sakowski, J. and Spetz, J. 2004. Are Gatekeeper Requirements Associated With Cancer Screening Utilization? *Health Services Research,* 391: 153-178.

Portney, LG. and Watkins, MP. 2000. *Foundations of Clinical Research: Applications to Practice* 2nd ed. Upper Saddle River, NJ: Prentice Hall Health.

Pugno, PA., Schmittling, GT., Fetter, GT. and Kahn, NB. 2005. Results Of The 2005 National Resident Matching Program: Family Medicine. *Family Medicine*, 37: 555-564.

Reid, RJ., Fishman, PA., Yu, O., Ross, TR., Tufano, JT., Soman, MP. and Larson, EB. 2009. Patient-Centered Medical Homes Demonstration: A Prospective, Quasi-Experimental, Before and After Evaluation. *American Journal of Managed Care*, 159: e71 – e87.

Rittenhouse, DR., Casalini, LP., Gillies, RR., Shortell, SM. and Lau, B. 2008. Measuring the Medical Home Infrastructure In Large Medical Groups. *Health Affairs*, 275: 1246-1258.

Rittenhouse, DR. and Shortell, SM. 2009. The Patient-Centered Medical Home: Will It Stand the Test of Health Reform? *JAMA*, 30119: 2038-2040.

Roby, DH., Pourat, N., Pirritano, MJ., Vrungos, SM., Dajee, H., Castillo, D. and Kominski, GF. 2010. Impact of Patient-centered Medical Home Assignment on Emergency Room Visits Among Uninsured Patients in a Count Health System. *Medical Care Research and Review*, 67(4): 412-430.

Rodriguez, HP., Rogers, WH., Marshall, RE. and Safran, DG. 2007. The Effects of Primary Care Physician Visit Continuity on Patients' Experiences with Care. *Journal of General Internal Medicine*, 22: 787–793.

Rosenblatt RA, Hart LG, Baldwin LM, Chan L, Schneeweiss R. 1998. The Generalist Role Of Specialty Physicians: Is There A Hidden System Of Primary Care? *JAMA*, 279: 1364-1370.

Rosenthal, TC. 2007. Advancing Medical Homes: Evidence-Based Literature Review To Inform Health Policy. Available at: http://www.ahec.buffalo.edu/Reports/Medical%20Home%20Evidence%20Review%2012-05-07.pdf. Retrieved on August 3rd, 2009.

Roos LL, Roos NP, Gilbert P, Nicol JP. 1980. Continuity of Care: Does It Contribute To Quality Of Care? *Medical Care,* 18: 174-184.

Rubenstein, HG. 2008. Medical Homes: The Prescription to Save Primary Care? Available at: http://www.ahip.org/content/default.aspx?bc=31%7C130%7C136%7C22187%7C22216. Retrieved July 28th, 2009.

Russell, LB. 2009. Preventing Chronic Disease: An Important Investment, But Don't Count On Cost Savings. *Health Affairs*, 281: 42-45.

Rutten LJ, Augustson E, Wanke K. 2006. Factors Associated With Patients' Perceptions Of Health Care Providers' Communication Behavior. *Journal of Health Communications*, 11Suppl 1: 35– 46.

Ryan, S., Riley, A., Kang, M. and Starfield. B. 2001. The Effects of Regular Source of Care and Health Need on Medical Care Use among Rural Adolescents. *Archives of Pediatric and Adolescent Medicine*, 155: 184–90.

Saadine JB, Englegau MM, Beckles GL, Gregg, EW, Thompson TJ, Narayan KMV. 2002. A Diabetes Report Card For The United States: Quality Of Care In The 1990s. *Annals Internal Medicine,* 136: 565–574

Samsa, GP., Matchar, DB., Goldstein, LB., Bonito, AJ., Lux, LJ., Witter, DM. and Bian, J. 2000. Quality Of Anticoagulation Management Among Patients With Atrial Fibrillation . *Archives of Internal Medicine*, 160: 967-973.

Saultz JW. 2003. Defining And Measuring Interpersonal Continuity Of Care. *Annals of Family Medicine,* 1: 134-143.

Saultz JW, Albedaiwi W. 2004. Interpersonal Continuity of Care and Patient Satisfaction: A Critical Review. *Annals of Family Medicine*, 2: 445–51.

Saultz, JW. and Lochner, J. 2005. Interpersonal Continuity of Care and Care Outcomes: A Critical Review. *Annals of Family Medicine*, 3: 159-166.

Saydah, SH., Fradkin, J. and Cowie. 2004. Poor Control of Risk Factors For Vascular Disease Among Young Adults With Previously Diagnosed Diabetes. *JAMA,* 291: 335-342.

Schall, MW., Duffy, T, Krishnamurthy, A., Levesqu,e O., Mehta, P., Murray, M., Parlier R., Petzel R., Sanderson J. 2004. Improving Patient Access to the Veterans Health Administration's Primary and Specialty Care. *Joint Commission Journal on Quality and Patient Safety*, 30 (8):415–423.

Schillinger D, Grumbach K, Piette J, Wang, F., Osmond, D., Daher, C., Palacios, J., Diaz-Sullivan, G. and Bindman, AB. 2002. Association of Health Literacy With Diabetes Outcomes. *JAMA*, 288: 475-482.

Schillinger D, Piette J, Grumbach K., Wang, F., Wilson, C., Daher, C., Leong-Grotz, K., Castro, C. and Bindman, AB. 2003. Closing The Loop: Physician Communication With Diabetic Patients Who Have Low Health Literacy. *Archives of Internal Medicine,*1631: 83-90.

Schoen, C., Osborn, R., Doty, MM., Bishop, M., Peugh, J. and Murukutla, N. 2007. Toward Higher-Performance Health Systems: Adults' Health Care Experiences in Seven Countries, 2007, *Health Affairs*, Web Exclusive October 31, 2007 266: w717–w734

Selden, TM. And Hudson, JL. 2006. Access to Care and Utilization among Children: Estimating the Effect of Public and Private Coverage. *Medical Care,* 44(5): I-19-I-26.

Shih, A., Davis, K., Schoenbaum, S., Gauthier, A., Nuzum, R. and McCarthy, D. 2008. *Organizing the U.S. Health Care Delivery System for High Performance*, The Commonwealth Fund.

Shortell, SM., Jones, RH., Radmaker, AW., Gilles, RR., Dranove, DS., Hughes, EF., Budetti, P., Reynolds, KSE. and Huang, CF. 2000. Assessing the Impact Of

Total Quality Improvement And Organizational Culture On Multiple Outcomes Of Care For Coronary Artery Bypass Graft Surgery Patients. *Medical Care*, 38: 207-217.

Shortell, SM., Martstellar, JA., Lin, M., Pearson, ML., Wu, SY., Mendel, P., Cretin, S. and Rosen, M. 2004. The Role Of Perceived Team Effectiveness In Improving Chronic Illness Care. *Medical Care*, 4211: 1040-1048.

Shortell, SM and Schmittdiel, J. 2004. Prepaid Groups and Organized Delivery Systems: Promise, Performance and Potential. In Enthoven and Tollen Ed, *Towards A 21st Century Health System: The Contributions And Promise Of Prepaid Group Practice pp. 1-21*. San Francisco, CA: Jossey-Bass.

Skinner, JS., Staiger, DO. and Fisher, ES. 2006. Is Technological Change in Medicine Always Worth It? The Case of Acute Myocardial Infarction. *Health Affairs*, 252: w34–w47.

Sia, C., Tonniges, TF., Osterhus, E. and Taba, S. 2004. History of Medical Home Concept. *Pediatrics*, 1135, 1473-1478.

Simon, G., Lin, EHB., Katon, W., Saunders, K., VonKorff, M., Walker E, Bush, T. and Robinson, P. 1995. Outcomes Of "Inadequate" Antidepressant Treatment In Primary Care. *Journal of General Internal Medicine*, 10: 663-670.

Smetana, GW., Landon, BE., Bindman, AB., Burstin, H., Davis, RB., Tjia, J., and Rich, EC. 2007. A Comparison Of Outcomes Resulting From Generalist Vs. Specialist Care For A Single Discrete Medical Condition: A Systematic Review And Methodological Critique. *Archives of Internal Medicine.* Jan 8;1671: 10-20

Sochalski, J., Jaarsma, T., Krumholz, HM., Laramee, A., McMurray, JJV., Naylor, MD., Rich, MV., Riegel, B. and Stewart, S. 2009. What Works in Chronic Care Management: The Case of Heart Failure. *Health Affairs,* 281: 179–189.

Sofaer, S. 2009. Navigating Poorly Chartered Territory: Patient Dilemmas in Health Care "Nonsystems". *Medical Care Research and Review*, 661: 75S-93S.

Stanford University-UCSF Evidence-based Practice Center under contract 290-02-0017. AHRQ Publication No. 0407-0051-7. Rockville, MD: Agency for Health care Research and Quality.

Stange, KC. 2009. The Problem of Fragmentation and the Need for Integrative Solutions. *Annals of Family Medicine*, 7: 100-1003.

Starfield, B. 1992 "Primary Care – Concept, Evaluation and Policy." Oxford University Press. New York City, NY.

Starfield, B. 1994 "Is Primary Care Essential?" *The Lancet*, 344Oct 22: 1129-1133.

Starfield B. and Shi, L. 2002. Policy Relevant Determinants of Health: An International Perspective. *Health Policy*, 603: 201-218.

Starfield, B., Shi, L. and Macinko, J. 2005. Contribution of Primary Care to Health Systems and Health. *Milbank Quarterly*, 833: 457-502.

Starr, P. 1982. *The Social Transformation of American Medicine: The Rise of a Sovereign Profession and the Making of a Vast Industry*. New York: Basic Books.

Stewart, JA. 2004. The Origins of Prepaid Group Practice in the United States. In Enthoven and Tollen Ed, *Towards A 21st Century Health System: The Contributions And Promise Of Prepaid Group Practice pp. 265-274*. San Francisco, CA: Jossey-Bass.

Stewart, M., Brown, JB., Donner, A., McWhinney, IR., Oates, J., Weston, WW. and Jordan, J. 2000. The Impact Of Patient-Centered Care On Outcomes. *Journal of Family Practice,* 49: 796-804.

Stewart, M., Brown, JB., Donner, A., McWhinney, R., Oates, J., Weston, W. and Jordan, J. 2000. The Impact Of Patient-Centered Care On Outcomes. *Journal of Family Practice*, 499: 796-804.

Stewart, M., Brown, JB., Boon, H., Galajad, J., Meredith, L. and Sangster, M. 1999. Evidence on Patient-Doctor Communication. *Cancer Prevention and Control*, 3: 25-30.

Stock, JH. and Watson, MW. 2003. *Introduction to Econometrics*, Boston, MA: Addison Wesley.

Stock, JH. and Yogo, M. 2004. Testing for Weak Instruments in Linear IV Regression, Working Paper, Department of Economics, Harvard University, Cambridge, MA.

Streiner, DL. and Norman, GR. 2003. Health Measurement Scales: *A Practical Guide To Their Development And Use* 3rd. ed. New York: Oxford University Press.

Stukel, TA., Fisher, ES., Wennberg, DA., Alter, DA., Gottlieb, DJ. and Vermeulen, MJ. 2007. Analysis Of Observational Studies In The Presence Of Treatment Selection Bias. JAMA, 297 3: 278-285.

Strunk, BC. and Cunningham, PJ. 2002. *Treading Water: American's Access to Needed Medical Care, 1997- 2001*. Washington DC, Center for Studying Health System Change.

Sullivan, M. 2003. The New Subjective Medicine: Taking The Patient's Point Of View On Health Care And Health. *Social Science and Medicine*, 56: 1595-1604.

Susman J, Zervanos NJ, Byerly B. 1989. Continuity Of Care And Outcome In Nursing Home Patients Transferred To A Community Hospital. *Fam*ily *Medicine,* 21: 118-121.

Tarn DM, Heritage J, Paterniti DA, Hays RD, Kravitz, RL, Wenger NS. 2006. Physician Communication When Prescribing New Medications. *Archive of Internal Medicine*, 16617: 1855-1862.

Tarn DM, Paterniti DA, Heritage J, Hays RD, Kravitz, RL, Wenger NS. 2006. Physician Communication About The Cost And Acquisition Of Newly Prescribed Medications. *Ambulatory Journal of Managed Care*. 1211: 657-664.

Terza, JV., Bradford, WD. and Dismuke, CE. 2008. The Use Of Linear Instrumental Variables Methods In Health Services Research And Health Economics: A Cautionary Note. *Health Services Research,* 433: 1102 – 1120.

Terza, JV. 1998. Estimating Count Data Models with Endogenous Switching: Sample Selection and Endogenous Treatment Effects. *Journal of Econometrics*, 84: 129–54.

Thrall, J.H. 2005. Prevalence and Cost of Chronic Disease in a Health Care System Structures for Acute Illness. *Radiology,* 235: 9-12.

Thorpe, KE., Florence, CS. and Joski, P. 2004. Which Medical Conditions Account for the Rise in Health Care Spending. *Health Affairs*, W4: 437- 445.

Thorpe, KE. 2005. The Rise of Health Care Spending and What to Do About It. *Health Affairs,* 6: 1436-1445.

Thorpe, KE. 2008. Making Health Care More Affordable: Estimated Saving From Care Coordination, Lifestyle Change And System Redesign In Senator Obama's Health Care Plan. Available at: http://www.emory.edu/policysolutions/pdfs/Senator_Obama_Health_Care_Plan.pdf. Retrieved March 3rd 2009.

US Department of Health and Human Services. 2002. *Healthy People 2010: Understanding and Improving Health.* 2nd ed. Washington DC: US Government Printing Office. Available at: www.healthypeople.com/publications. Retrieved October 23rd, 2008.

Vella, F. and Verbeek. M. 1999. ''Estimating and Interpreting Models with Endogenous Treatment Effects.'' *Journal of Business and Economic Statistics,* 17 4: 473–8.

Von Korff, M., Gruman, J., Schaefer, J., Curry, SJ. and Wagner, EH. 1997. Collaborative Management of Chronic Illness. *Annals Internal Medicine,* 12712:1097–102.

Wagner, EH., Austin, BT. and Von Korff, M. 1996. Organizing Care for Patients With Chronic Illness. *Milbank Quarterly,* 74: 511-544.

Wagner EH. 1998. Chronic Disease Management: What Will It Take To Improve Care For Chronic Illness? *Effective Clinical Practice*, 1: 2-4.

Wagner EH. 2000. The Role Of Patient Care Teams In Chronic Disease Management. *BMJ*, 320: 569-72.

Wagner, EH. 2001. Meeting The Needs Of Chronically Ill People. *BMJ,* 323: 945-946.

Walsh EG, Osber DS, Nason CA, Porell MA, Asciutto AJ. 2002. Quality Improvement In A Primary Care Case Management Program. *Health Care Financial Review,* 23: 71–84.

Ware, JE, Kosinski, M, Keller, SD. 1998. *How to Score the SF-12 Physical and Mental Health Summary Scales*. 3rd ed. Lincoln, RI: QualityMetric, Inc.

Wegner, SE., Antonelli, RC. and Turchi, RM. 2009. The Medical Home – Improving Quality of Primary Care of Children. *Pediatric Clinics of North America,* 56: 953-964.

Weiss, BD, Hart, G., McGee, DL., and D'Estelle, S. 1992. Health Status Of Illiterate Adults: Relation Between Literacy And Health Status Among Persons With Low Literacy Skills. *Journal of American Board Family Practice,* 5: 257-264.

Weiss, GL. and Lonnquist, LE. 2006. *The Sociology Of Health, Healing And Illness.* Upper Saddle, NJ: Pearson Prentice Hall.

Wendel, J. and Dumitras, D. 2005. Treatment Effects Model for Assessing Disease Management: Measuring Outcomes and Strengthening Program Management. *Disease Management*, 83: 155-168.

Williams, MV., Baker, DW., Parker, RM., and Nurss, JR 1998. Relationship Of Functional Health Literacy To Patients' Knowledge Of Their Chronic Disease: A Study Of Patients With Hypertension And Diabetes. *Archives Internal Medicine,*158: 166-172.

Whitney, SN. 2003. A New Model Of Medical Decisions: Exploring The Limits Of Shared Decision-making. *Medical Decision Making*, 23: 275-280.

Wolff, JL. and Boult, C. 2005. Moving Beyond Round Pegs And Square Holes: Restructuring Medicare To Improve Chronic Care. *Annals of Internal Medicine*, 143: 439-445.

Wooldridge, JM. 2006. *Introductory Econometrics: A Modern Approach*. Mason, OH: Thomson Higher Education

Wooldridge, JM. 2002. *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press

World Health Organization. *World Health Organization Assesses the World's Health* Systems. The World Health Report. Available at: http://www.who.int/whr/2000/media_centre/press_release/en/index.html. Retrieved May 15, 2009.

World Health Organization. 2003. Global Strategy on Diet, Physical Activity, and Health. Available at: http://www.who.int/dietphysicalactivity/publications/facts/chronic/en/index.html. Retrieved Jan 10th, 2009.

Woolf, SH. and Atkins, D. 2001. The Evolving Role of Prevention In Health Care: Contributions of The U.S. Preventive Services Task Force. *American Journal of Preventive Medicine*, 20S3: 13-20.

Woolf, SH. and Johnson RE. 2005. The Break-Even Point: When Medical Advances Are Less Important Than Improving The Fidelity With Which They Are Delivered. *Annals of Family Medicine*, 36: 545-552.

Wright, PG. 1928. *The Tariff on Animal and Vegetable Oils*. New York: MacMillan.

Wu, SY. and Green, A. 2000 *Projection of Chronic Illness Prevalence and Cost Inflation.* Washington, DC: RAND Health.

Xu, KT. 2002. Preventive Use: A Regular Doctor versus a Regular Site. *Health Services Research,* 376: 1509-1529.

Yarnall, KS., Pollak, KI., Ostbyte, T., Krause, KM. and Michener, JL. 2003. Primary Care: Is There Enough Time For Prevention? *American Journal of Public Health*, 93: 635-641.

Young, AS., Klap, R., Sherbourne, CD. and *Wells KB.* 2001. The Quality Of Care For Depressive And Anxiety Disorders In The United States. *Archives of General Psychiatry*, 58: 55-61.

Zapka J, Kurent JE, Hennessy W, DesHarnais S. 2006. Care At The End Of Life: Focus On Communication And Race. *Journal of Aging Health*, 18: 791–813.

Zuckerman, S., Merrell, K., R. Berenson, R., Gan, DW., Underwood, WS., Williams, A., Erickson, SM., and Hammons, T. 2009. Incremental Cost Estimates for the Patient-Centered Medical Home, The Commonwealth Fund

Zuvekas, SH. and Cohen. JW. 2002. A Guide to Comparing Health Care Expenditures in the 1996 MEPS to the 1987 NMES. *Inquiry,* 39 1: 76-86.

BIOGRAPHICAL SKETCH

Keva S Thompson was born along with her twin brother, Trevor on the sunny idyllic island of Nassau, Bahamas, to Walter and Maxine Thompson. Her parents always impressed upon her and her eight siblings that the world was what you made of it. As a child she believed that medical science was her destiny. However, after completing an undergraduate degree in pharmacy she was employed at a state run hospital where she developed an interest in health policy. In 2000, she left her job to pursue a master's in Public Health at the University of South Florida. In 2002, after completing her master's she went on to pursue a PhD degree in health services research at the University of Florida. She received training in the areas of health policy and systems, health care utilization and quality, health insurance, health economics, and health outcomes. Her focus is health policy and issues surrounding access to quality care. She graduated in Spring 2011.