Distribution Agreement

In presenting this thesis or dissertation as a partial fulfillment of the requirements for an advanced degree from Emory University, I hereby grant to Emory University and its agents the non-exclusive license to archive, make accessible, and display my thesis or dissertation in whole or in part in all forms of media, now or hereafter known, including display on the world wide web. I understand that I may select some access restrictions as part of the online submission of this thesis or dissertation. I retain all ownership rights to the copyright of the thesis or dissertation. I also retain the right to use in future works (such as articles or books) all or part of this thesis or dissertation.

Signature:

_____ _____

Nicole Jepeal Date

The Patient Centered Medical Home and Receipt of Diabetes Management Services

By

Nicole Jepeal
Masters of Science in Pubic Health

Health Policy and Management

_____

Benjamin Druss, MD PhD
Committee Chair

_____

Kimberly Rask, MD PhD
Committee Member

_____

Peter Joski, MSPH
Committee Member

_____

Silke von Esenwein, PhD
Committee Member

The Patient Centered Medical Home and Receipt of Diabetes Management Services

By

Nicole Jepeal

Bachelor of Arts in Biology, Anthropology

Boston University

2011

Thesis Committee Chair: Benjamin Druss, MD PhD

An abstract of

A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University

in partial fulfillment of the requirements for the degree of
Master of Science in Public Health
in Health Policy and Management

2016

Abstract

The Patient Centered Medical Home and Receipt of Diabetes Management Services

By Nicole Jepeal

The Patient-Centered Medical Home (PCMH) is a model of primary care delivery that is thought to be particularly suited to the management of chronic diseases, including diabetes. However, studies have found mixed results regarding whether it improves the quality of patient care. The PCMH does not have a consistent definition in research literature, with most PCMH studies testing the adoption of a specific PCMH intervention. There is a lack of studies which examine the PCMH from the perspective of the patient. To address this gap in the literature, components of the PCMH will be tested for association with better diabetes management. Components will be measured from the perspective of patterns of care experienced by the patient. All respondents of the Diabetes Care Survey component of the 2012 Medical Expenditure Panel Survey (MEPS) will be included in the study. Logistic, ordered logistic, and multinomial logistic regression models will be used to test four PCMH components: personal provider, whole-person orientation, coordinated/integrated care, and enhanced access against measures of the quality of diabetes management including receipt of annual A1C testing, cholesterol screening, foot exams, eye exams, and flu shots. Having a person provider was associated with an increased likelihood of receiving any and 4 A1C tests, a foot exam, a cholesterol test, a flu shot, and all five services. There was no association between whole person orientation or coordinated/integrated care and any of the diabetes outcomes measures. Enhanced access was negatively associated with the receipt of an annual cholesterol test or flu vaccine. The findings indicate that the processes driving improvements in diabetes care quality may not be visible to the patient. In addition, the difficulty in measuring the PCMH suggests that provider organizations and government agencies may need to rethink conceptualization of the model.

The Patient Centered Medical Home and Receipt of Diabetes Management Services

By

Nicole Jepeal

Bachelor of Arts in Anthropology, Biology
Boston University
2011

Thesis Committee Chair: Benjamin Druss, MD PhD

A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of

Master of Science in Public Health
in Heath Policy and Management

2016

Acknowledgements

The author would like to thank the committee members: Benjamin Druss, Kimberly Rask, Peter Joski and Silke von Esenwein for their invaluable guidance in conducting this thesis. In addition, the author thanks other HPM faculty members Sarah Blake and Janet Cummings for their support and advice. Finally, thank you to the entire 2016 Rollins School of Public Health HPM MSPH cohort for their support and feedback over the past two years.

TABLE OF CONTENTS

Chapter I. Introduction 1

Chapter II. Literature Review 3

Diabetes Mellitus 3

The United States Diabetes Epidemic 5

Diabetes Management Guidelines 5

Patient-Centered Medical Home Model 6

Figure 1. Joint Principles of the Patient Centered Medical Home[6] 7

Figure 2. AHRQ conceptual framework for the effectiveness of the medical home[39] . 9

Patient-Centered Medical Home Model and Diabetes Management 10

Table 1. Summary of research on effects of PCMH on diabetes management 11

Chapter III. Methods 14

Database 14

Sample 15

Figure 3. Study sample inclusion criteria 15

Research Design 16

Table 2. Independent and Dependent Variable Operational Definitions 19

Measures 20

Conceptual Model 20

Fig 4. Conceptual model for the relationship between the Patient-Centered Medical Home and use of diabetes management services. 23

Table 3. Key Variable Measures 24

Data Analysis 26

Chapter IV. Results 28

Descriptive Results 28

Table 4. Characteristics of 2012 MEPS participants who completed the diabetes care survey 29

Table 5. Frequency of receipt of diabetes management services by PCMH component 31

Regression Results 32

Table 6. Summary of regression results 33

Table 7. Marginal effects of usual source of care on the likelihood of receiving DMS 34

Table 8. Marginal effects of whole person orientation on the likelihood of receiving DMS 37

Table 9. Marginal effects of coordinated care on the likelihood of receiving DMS 42

Table 10. Marginal effects of enhanced access on the likelihood of receiving DMS 46

Chapter V. Disussion 50

Strength and Limitations 52

Implications and Recommendations 54

References 56

CHAPTER I. INTRODUCTION

Diabetes is one of the most pressing health concerns in the United States today. The American Diabetes Association estimates that nearly 10% of the US population, and 25% of those 65 and older, have diabetes, and this number is rapidly increasing.[1] Due to its rapid growth in prevalence, diabetes is putting an increasingly large strain on the health care system. In 2012, diabetes accounted for half of all physician office visits, emergency department visits and prescriptions in the United States.[1] It is estimated that in the US, $245 billion in total direct and indirect costs are attributable to diabetes which is equivalent to 1 out of every 5 health care dollars.[2,3] In particular, Medicaid and Medicare bear a disproportionate burden of these costs.

While prevention of diabetes is an inarguably important goal, the US healthcare system must also better meet the needs of individuals who already have diabetes. Their care is often fragmented, uncoordinated, expensive, and uncomprehensive.[4] The Patient-Centered Medical Home (PCMH) is a model of health care delivery that may address these gaps in care.[5] The PCMH is a model of primary care delivery that focuses on providing well-coordinated, comprehensive healthcare in a way that meets the preferences of the patient.[6] It has been promulgated by many medical associations as well as the Centers for Medicare and Medicaid Services.[6,7] The model was also strongly featured in the Affordable Care Act of 2010.[7]

While the PCMH has received a lot of attention, results are mixed about its effectiveness for chronic disease management.[8] This is likely due to the complexity of the model, uneven adoption, and varying definitions of PMCH in research.[9] However, not much is known about how the components of the model work independently and synergistically to improve patient care. In addition, much of the existing research has limited generalizability beyond the specific study population.[10,11] This research aims to

answer the question: which components of the Patient-Centered Medical Home are most important for diabetes management in adults? The PCMH model will be conceptualized using the model set out in the American Academy of Pediatrics' Joint Principles of the Patient-Centered Medical Home. Management of diabetes will be operationalized as the receipt of diabetes management services.

This question was examined within the framework of Andersen's Behavioral Model of Health Service Use.[12] Andersen's Behavioral Model seeks to elucidate the factors that influence the use of health services among individuals including individual and environmental characteristics as well as organizational characteristics and processes of care. The focus on both individual and organizational characteristics makes it an ideal framework to answer this research question.

This research was conducted using the 2012 Medical Expenditure Panel Survey (MEPS), a nationally representative sample of the United States civilian, non-institutionalized population.[13] The study had a cross-sectional design. Analysis was conducted using a combination of logistic, ordered logistic and multinomial logistic regression models.

The results of this research may have implications for primary care practices. Many primary care practices do not have the resources both monetary and human, to fully implement the PCMH model.[14] This research may help practices identify which components of the model they should prioritize in order to maximize the effect on diabetes management.

CHAPTER II. LITERATURE REVIEW

Diabetes Mellitus

Diabetes mellitus is "a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both" as defined by the American Diabetes Association and is one of the leading causes of mortality in the US according to the CDC.[2,15] Diabetes is classified into three major categories: Type 1, Type 2 and gestational. Type 1 is characterized by an absolute deficiency in insulin production. This is caused by the autoimmune destruction of beta cells. The destruction of beta cells can happen rapidly, leading to diagnosis in infants or children, or slowly, leading to diagnosis in adults. It has a genetic components and is linked to DQA and DQB genes. Type 2 diabetes is characterized by a combination of the body's resistance to insulin and a relative insulin deficiency which develops over time. Type 2 diabetes has a stronger genetic link than type 1. In addition, obesity is a strong risk factor for Type 2 diabetes. Obesity, and in particular excess abdominal weight, can cause insulin resistance. Other risk factors for Type 2 diabetes include age, physical inactivity, hypertension and dyslipidemia. Type 1 diabetes accounts for 5-10% of cases while Type 2 diabetes accounts for the remaining cases. Gestational diabetes is a glucose intolerance that has its onset during pregnancy, but usually resolves after delivery. [15-18]

Diabetes is diagnosed through the use of laboratory tests that measure blood glucose levels. Three tests are currently approved for diagnosis: fasting plasma glucose (FPG), glycated hemoglobin (A1C), and an oral glucose tolerance test (OGTT). Diabetes is diagnosed by an FPG of ≥125 mg/dL, an A1C of ≥6.5%, or an OGTT of ≥200 mg/dL. An A1C can only be used for diagnosis when performed by a certified lab, not when provided at the point of care.[15]

Diabetes is a major contributor to morbidity and disability particularly when left uncontrolled. For instance, uncontrolled diabetes is the chief cause of non-injury related lower limb amputations, kidney failures and new cases of adult blindness in the US.[2] Diabetes can lead to ulcers, nerve damage, and poor circulation in the lower limbs. Uncontrolled blood sugar can cause diabetic retinopathy and also increases the risk of developing cataracts and glaucoma.[15] Finally, uncontrolled blood sugar puts stress on the kidneys, which over the course of years can lead to kidney disease and eventually even end stage renal disease (ESRD).[15,16] Other complications include hypo and hyperglycemic episodes, heart disease, stroke and neuropathic pain.[2] The most effective method of preventing these complications is good blood sugar control. When blood sugar levels are well-controlled, individuals experience a significantly lower rate of complications compared to individuals with uncontrolled blood sugar.[19]

Comprehensive treatment of diabetes, like many other chronic diseases is very complex and involves both lifestyle and medical intervention. Treatment focuses on arresting progression of the disease and prevention of associated complications by maintaining low blood glucose levels. Individuals with Type 1 diabetes produce no insulin and require treatment with injections of insulin.[18] Individuals with Type 2 or gestational diabetes may be treated with one or more oral medications such as metformin or with insulin, depending on the severity of the progression of the disease.[18] Insulin may be prescribed along with an oral medication treatment regimen or on its own. Life style interventions include weight management and physical activity.[18] In addition, diabetes often occurs alongside other chronic diseases including hypertension, hyperlipidemia, cardiovascular disease, and mood disorders.[16] Proper treatment of these comorbid conditions is necessary for successful management of diabetes.[16]

The United States Diabetes Epidemic

In the 1960s fewer than 5 million Americans had diabetes, today that number is 29.1 million. It is estimated that 8 million of those remain undiagnosed.[2] The increase in the prevalence of diabetes is due almost entirely to an increase in the incidence of Type 2 diabetes and future predictions estimate that by 2050 diabetes prevalence will have reached approximately 50 million or 12% of the US population.[20] The increase in Type 2 diabetes is attributed to a combination of increased rates of obesity, increasingly sedentary lifestyles, and an aging population.[21]

The burden of diabetes is not shared equally among all groups of people in the United States. Hispanic, black, and American Indian/Alaska Native individuals bear a disproportionate share of the burden of diabetes.[22] In addition, racial minorities are more likely to have comorbid chronic conditions like hypertension, and to experience complications from poorly controlled diabetes.[22,23] A major risk factor for diabetes is age, with the disease being far more common in older populations.[24] However, diabetes is becoming increasingly common in younger individuals, even those under 20 years of age.[2] Finally, individuals of low socioeconomic status experience as much as a twofold increase in diabetes related mortality after controlling for confounding factors including race/ethnicity.[25]

Diabetes Management Guidelines

In spite of the severity of the US diabetes epidemic, proper management can prevent disease progression and its associated complications.[16] The American Diabetes Association and American Association of Clinical Endocrinologists also recommend a bundle of preventive and screening services for people with diabetes to monitor progression of the disease and to detect complications early.[16,18] These services include A1C tests, foot exams, eye exams, cholesterol tests, creatinine labs, and blood pressure

checks.[16,18] While there is high level of clinical evidence to support the use of this bundle of services,[16] many people with diabetes still do not receive any or all of them. According to the Behavioral Risk Factor Surveillance Survey (BRFSS), 84.6% of diabetics receive an annual lipid profile and 68.3% receive an annual foot exam.[26] In addition, on average, less than 50% of diabetic Americans receive an annual retinopathy eye exam;[27] this percent is even lower among the medically underserved.[28] African-Americans are more likely than whites to report never having had an eye exam[22] and Hispanics are less likely to have annual A1C tests, foot exams and eye exams than non-Hispanic individuals.[29]

Patient-Centered Medical Home Model

The Patient-Centered Medical Home (PCMH) has been proposed as a model of primary care that may be particularly suited to improve the management of chronic diseases, including diabetes.[7] The PCMH is characterized by a team-based approach focused on improving the health of people, families, and communities, through the provision of personalized, comprehensive, and integrated care.[30]

The PCMH model has a long history. The medical home was first conceptualized in the 1960s as a way to care for children who had chronic illness or other special health care needs. However, it was not until 1992 that the American Academy of Pediatrics (AAP) created a formal definition of the medical home. They defined it as "including care that was accessible, continuous, comprehensive, family-centered, coordinated, compassionate, and based on trusting relationships."[31] Around the same time the Chronic Care Model (CCM) was developed by Ed Wagner and Michael von Korff as a way to inform chronic disease management in the primary care setting. The CCM has six main elements: self-management support, decision support, clinical information systems, delivery system design, community resources and policies, and health care organization.[32] By 2003 Americans were still receiving less than half of the preventive and chronic disease

management that they needed.[33,34] This led to the call to expand the PMCH model to adults, especially those with chronic illness.[33] Inspired partly by the CCM, the American College of Physicians, the American Academy of Family Physicians, the American Academy of Pediatrics and the American Osteopathic Association developed and adopted a formal set of joint principles to define the PCMH in 2007 (Fig. 1).[6 31,33]

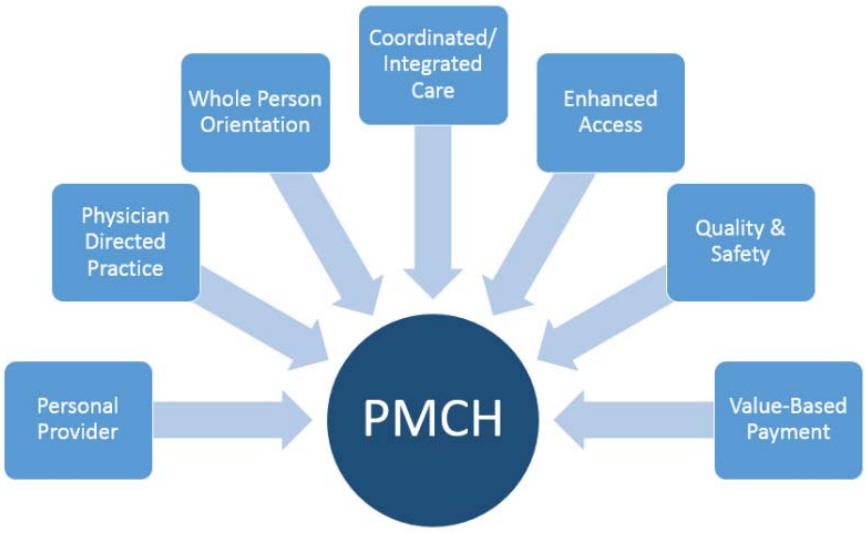

Figure 1. Joint Principles of the Patient Centered Medical Home[6]

Today there are two main frameworks for conceptualizing the PCMH: the Joint Principles of the Patient-Centered Medical Home and the Agency for Healthcare Research and Quality (AHRQ) conceptual framework for the effectiveness of the medical home. The Joint Principles of the PCMH has seven components (Fig 1.). One, each patient should have a long-term relationship with a person physician. Two, the physician directed medical practice where the physician leads a team of individuals who care for the patient. Three, whole person orientation, or the care of all a patient's needs including preventive, acute, chronic, and end of life care. Four, care is coordinated and/or integrated. This includes both integration across the health care system and the use of health information

technology (HIT) to facilitate the delivery of care. Five, there is a focus on quality and safety including the use of clinical decision support tools and quality and performance improvement methodology. Six, there is enhanced access through the extended hours and alternative methods of communication including email and patient portals. Finally, seven, a payment model that recognizes the value of services that fall outside of a traditional fee-for-service payment structure.[6] In the AHRQ framework, the PCMH has five components: 1) comprehensive care, 2) patient-centered, 3) coordinated care, 4) accessible services, and 5) quality and safety (Fig. 2).[35] Comprehensive care is defined similarly as whole person orientation. It involves the meeting of preventive, acute and chronic health care needs, both physical and mental. It also accounts for the presence of a multi-disciplinary health care team that works together to provide high quality care for the patient. Patient-centered is conceptualized as a care that meets each patient's unique needs and preferences and recognizes both the patient and family as important members of the care team. The PCMH also coordinates care across the larger health care system especially during care transitions. Accessible services are defined as the presence of extended hours, 24 hour telephone or electronic access and short wait times. Finally, there is a system-based approach to quality and safety which is demonstrated through ongoing performance measurement activities, the measurement of patient satisfaction and the use of clinical decision support tools. In addition, the AHRQ framework lays out the goals of the PCMH as 1) improving the quality of care, 2) reducing per capita costs 3) improving the experience of patients and caregivers, and 4) improving the experience of healthcare professionals.

There are many similarities between these two frameworks. They both define the PCMH using the same key principles. However, the Joint Principles focus predominantly on the role of the physician in the medical home whereas the AHRQ framework focuses on the functioning of the entire health care organization. In addition, the joint principles

are highly theoretical while the AHRQ framework provides examples of practices engaged in by PCMHs. The AHRQ framework also conceptualizes the impact of the PCMH on outcomes. Finally, the joint principles fail to adequately define the concept of "patient-centered." However, the construction of the Joint Principles are less focused on processes of care and most of the literature uses this framework as its underlying theory.[36-38]

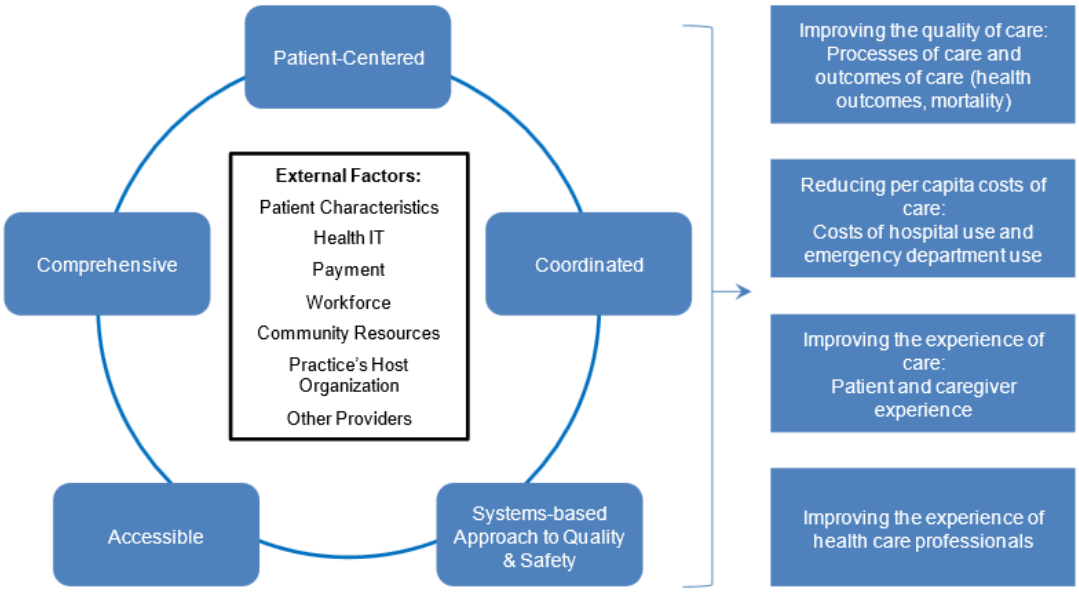

Figure 2. AHRQ conceptual framework for the effectiveness of the medical home[39]

In addition to the two theoretical frameworks, the National Committee for Quality Assurance (NCQA) and the Joint Commission both offer PCMH recognition programs with standardized criteria to assist practices in transformation. However, both of these certification programs focus highly on structural factors (e.g. availability of translation services, electronic prescribing).[40] They do not consider patient experiences with the primary care practice.

Over the past decade, the PCMH model has received attention from state and federal policy makers. For instance, in 2008, 20 bills were introduced into state

legislatures to create PCMH demonstration projects, and a total of 108 bills referenced the model.[7] The Centers for Medicare and Medicaid Services (CMS) funded National Demonstration Projects of the PCMH model which focus particularly on providers who treat patients with multiple chronic conditions.[7] The Health Resources and Services Administration (HRSA) has been offering supplemental funding for practices who are seeking or have achieved PCMH recognition since 2010.[35] Even the Patient Protection and Affordable Care Act (ACA) authorizes the testing of alternative healthcare delivery models like the PCMH through the Center for Medicare and Medicaid Innovation.[41] It also authorizes the Secretary of Health and Human Services to expand the PCMH model with both Medicaid and Medicare if it shown to be effective.[42]

Patient-Centered Medical Home Model and Diabetes Management

In the subsequent years since the adoption of the Joint Principles, the PCMH has quickly become a popular framework for the treatment of adults with chronic disease. For instance, according to a 2013 study, approximately half of all Californians living with a chronic disease receive care that meets the standards of the PCMH.[38]

Despite quick adoption of the model for the management of chronic conditions, there is limited evidence regarding its effectiveness for this purpose (Table 1). Much of the research that has been conducted on the PCMH has been from National Demonstration Projects. These pilot projects are observational studies that generally have a pre/post design. Some, but not all, also have a nonequivalent control group. Those that looked specifically at diabetes care found that PCMH adoption improved A1C, blood pressure and cholesterol control.[5,43-45] Others found increases in the screening and diagnosis of diabetes,[45-47] as well as increases in retinopathy, foot and nephropathy screening exams.[44-46] One found a 2.7 percentage point increase in lipid testing among diabetics while simultaneously reducing total cost of care and reducing ambulatory care-sensitive

emergency department visits.[48] Another study found that while PMCH adoption reduced ED visits and costs and increased cervical cancer screening, it also resulted in lower rates of A1C screening in patients with diabetes, even those with two or three comorbidities.[49] In addition, while many believe the PCMH model has the potential to reduce health disparities, current PCMH initiatives do not make disparities an explicit priority, which is a missed opportunity for diabetes population management.[50]

Table 1. Summary of research on effects of PCMH on diabetes management

Author	Study Type	Outcome Variables	Findings	Limitations
Bojadzievksi[5]	Review of PCMH transformation projects	Diabetes quality measures	All 8 reviewed studies showed a positive impact of the intervention on the quality of diabetes care	Each study had a different intervention or method of PCMH transformation
Wexler[43]	PCMH transformation	A1C and blood pressure control	Increase in A1C and blood pressure control	Limited generalizability
Gabbay[44]	PCMH transformation	Cholesterol, blood pressure, and A1C control	Improvements in cholesterol, blood pressure, and A1C control among high risk individuals	Practice sites self-selected into study, each study site had a different intervention
Stevens[46]	Patient experience with PCMH	Quality of life among Medicaid patients with Type 2 diabetes	Better patient-reported PCMH performance was associated with higher quality of life	Limited to Medicaid population, predominantly Hispanic women, no diabetes specific outcomes
Smith[47]	PCMH transformation	Diabetes diagnosis, A1C testing, A1C control	Increase in diagnosis, inconclusive results for A1C screening rates and A1C control	Limited generalizability, difficulty determining what change is due to intervention and

				what is just underlying trends
Rosenthal[48]	PCMH transformation	A1C testing, lipid testing, eye exam	Increase in odds of lipid testing for patients with diabetes but no impact on A1C or eye exam	Limited generalizability, short follow up period, different interventions in study sites
Rosenthal[49]	PCMH transformation	A1C testing, lipid testing, eye exam	No impact A1C, lipid or eye exam	Limited generalizability, different interventions in study sites

In addition to demonstration projects, there has been research on the PCMH using large, existing datasets. Much of this research has focused on the PCMH and children with special health care needs,[36,51-55] but a small number of studies have used these databases to look at the PCMH and adult populations. One policy study using California Health Interview Survey found that patients with diabetes, asthma, or heart disease who received patient centered care were more likely to have had a recent visit with a medical provider, more likely to have a flu shot, and had better communication with their providers.[38] A study using the Ambulatory Care Experiences Survey (ACES) examined the relationship of seven PCMH domains: organizational access, integration of care, comprehensive knowledge, office staff, communication, and interpersonal treatment, on patient satisfaction.[56] It found that the domains related to the patient-provider relationship were associated with higher patient satisfaction.[56] Furthermore, five studies used the Medical Expenditures Panel Survey (MEPS) to conduct research on the PCMH. The first examined Latino access to the PCMH and found that Latinos with a PMCH used more preventive care and reported having better patient experiences than those without a PCMH.[37] The

second found that patients in a PCMH used more health care services than patients not in a PCMH.[57] The third examined the association between "primary care attributes" and preventive care services.[58] The primary care attributes aligned closely with components of the PCMH model as defined in the Joint Principles. They found the number of primary care attributes was associated with the probability of receiving a mammography, a flu vaccine, an annual exam, a colorectal cancer screening, a pap smear, a PSA and a cholesterol test. In addition, comprehensive care and patient-centeredness were associated with the likelihood of receiving each preventive measure. Enhanced access was not associated with receipt of services. Finally two MEPS studies found that the implementation of PCMH components was largely unassociated with health care expenditures in both adult and Medicare populations.[59,60]

The majority of the studies conducted on the PCMH that look at diabetes quality or outcomes are evaluations of demonstration projects. These studies are limited by their generalizability beyond the study population. In addition, each practice undergoes PCMH transformation differently, which makes it difficult to compare results across them. In addition, these studies examine the PCMH exclusively from the perspective of structural changes which excludes the patient completely. Given that the goal of PCMH is to provide care patient-centered care, it is important to evaluate the PCMH model from the perspective of the patient as well as the organization. The studies that do study the PCMH from the patient perspective are either not focused exclusively on individuals with diabetes, or do not include measures of diabetes quality or outcomes. This research will seek to fill these gaps in the literature by using a nationally representative sample to examine the relationship between the PCMH components and diabetes care quality (receipt of diabetes management services) from the perspective of the patient.

CHAPTER III. METHODS

Database

This research was determined to be exempt from review by the Emory University Institutional Review Board (IRB). It utilized data from the 2012 Medical Expenditure Panel Survey (MEPS) to examine the relationship between PCMH and use of diabetes management services.

MEPS is a household panel survey, funded by the Agency for Healthcare Research and Quality (AHRQ) that uses a national probability sample. The survey is designed to be representative of the US civilian, non-institutionalized population. Households are selected to participate in MEPS from the National Health Interview Survey (NHIS) sampling frame. In addition, Black, Hispanic and Asian individuals are oversampled in the dataset.[13]

Each year a new panel begins, and panels are followed for 30 months during which 5 rounds of interviews are conducted. These interviews collect data on a 2 year period. MEPS interviews are conducted in person by a trained interviewer using Computer Assisted Personal Interviewing (CAPI). Because of the panel design of the survey, the 2012 dataset contains data from two panels (16 and 17). The unweighted sample size was 38,974 and the response rate was 56.3%.[13]

In addition to the standard questionnaires, each individual aged 18 or older who has ever been diagnosed with diabetes (excluding gestational diabetes) is asked to complete the Diabetes Care Survey (DCS) two times during their participation in the survey (once per year). This survey is self-administered. The sample size of the 2012 DCS was 2348.[13]

Including MEPS, only three population-based surveys are appropriate for measuring the PMCH.[36] The other surveys are the National Survey of Children with Special Health Care Needs (CSHCN) and the Consumer Assessment of Health Plans Survey (CAHPS). The CSHCN only samples children, and as such cannot be used to conduct research on adults. Alternatively, CAHPS has separate modules for adults and children, however it is administered by individual practices or insurance providers (including Medicaid/Medicare) and responses are submitted voluntarily by practices to a large database. Thus, there is no systematic sampling process and self-selection by organizations to submit their results would likely create a strong bias. This leaves MEPS as the best publicly available, population-based dataset with which to answer the research questions. The 2012 dataset is the most currently available year of data that contains all the necessary independent, dependent, and confounding variables.

Sample

The study sample includes all individuals who completed the DCS (Fig 3). The inclusion criteria for the DCS is 1) diagnosis of diabetes by a doctor and 2) age ≥18. The DCS has a separate sampling weight that allows the responses to be nationally representative.

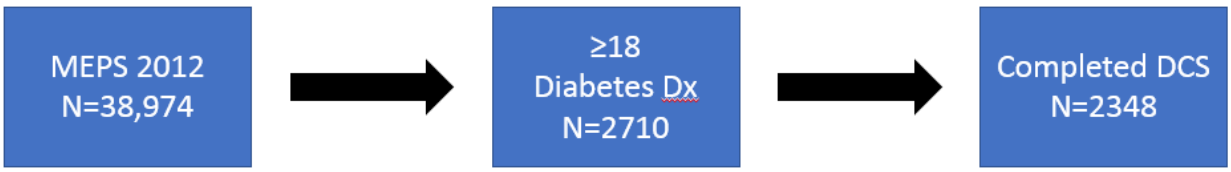

Figure 3. Study sample inclusion criteria

Research Design

The research had a cross-sectional design. The dependent variables were receipt of diabetes management services. The key independent variables were four PCMH components: usual source of care, whole person orientation, coordinated care, and enhanced access. In addition, confounding variables were including in all analyses.

Use of Diabetes Management Services. Utilization of diabetes preventive services was assessed using several measures (Table 2). First, dichotomous indicator variables were created for: foot exams, dilated eye exams, blood cholesterol tests and flu vaccines. Eye exams are unique among the dependent variables because they these exams are usually not provided in the primary practice and are instead conducted by an outside ophthalmologist. Most The dichotomous variables categorized individuals into those who had the service during the 2012 calendar year and those who did not.[61,62] A1C testing was originally conceived as a dichotomous variable. Those who received at least 4 A1C tests during the 2012 calendar years were coded as "yes" while those who did not have an A1C test or had fewer than four during the year were coded as "no". This corresponds both to guidelines that recommend four A1C tests per year as well as previous research.[16,18,61] A large number of individuals reported more than 12 tests in a year. This is not consistent with care guidelines and it is possible these individuals confused A1C tests with blood glucose finger prick tests. Based on expert recommendation, this variable was cut at 12 tests per year. Any individual who reported more than 12 tests was combined with individuals who responded "don't know" into a third category. In addition, individuals who did not respond were included in a fourth category. The strategy of including these additional categories was chosen because a large portion of the sample fell into one of these two categories. Dropping these observations from regression models could have introduced a bias. Sensitivity analyses were run on the A1C variable construction with the

cut off at one or more A1C tests and three or more A1C tests per year. Second, a composite, ordinal variable was created to measure use of all diabetes management services. The variable was measured on a scale from 0 to 5 where an individual with a "5" received all the recommended services listed above. Conversely, an individual with "0" received no recommended services. Only individuals who were coded as "yes" to receiving four A1C tests in the year were given credit for the service in the composite variable. Individuals who were coded as "no", "don't know", or "no response" did not receive credit in the composite variable.

Patient-Centered Medical Home

The PCMH components (Table 2) were measured using the Joint Principles[6,36] and an algorithm published by Beal.[37] The algorithm was developed through a combination of face validity based on the Joint Principles and sensitivity analyses of multiple alternative constructions. The Joint Principles lay out 7 principles or components of the PMCH: 1) Personal physician, 2) Physician-directed medical practice, 3) Whole person orientation, 4) Coordinated care, 5) Quality and safety, 6) Enhanced access, and 7) Payment. Several of these components occur at the practice level and may be not be directly observable by patients. Therefore, 4 components are measurable using MEPS: personal provider, whole person orientation, coordinated care, and enhanced access.[36,37] These components were operationalized as dichotomous variables. Within the personal provider component, there were two questions: "Do you have a usual source of care (USC)?" and "Does this provider work in a clinic, a hospital outpatient department, an emergency room at a hospital, or some other kind of place?" Individuals were categorized as "yes" if they reported having a usual source of care and did not identify this source of care as the emergency department. Whole person orientation had four questions: "Do you go to your USC for a new health problem?"; "Do you go to your USC for ongoing health problems?"; "Do you go to your

USC for preventive health care?"; and "Do you go to your USC for referrals?" Coordinated care had two questions: "Does your USC usually ask about prescription medications and treatments other doctors give you?" and "If there were a choice between treatments, how often would your USC ask you to help make the decision?" Finally, Enhanced access had three questions within it: "Does your USC have office hours on nights and weekends?"; "How difficult is it to contact your USC by phone?"; and "How difficult is it to contact your USC after hours?"

Table 2. Independent and Dependent Variable Operational Definitions

Independent Variables – PCMH Components		
Component	Questions	Required Response for PCMH
Personal Provider	• Do you have a usual source of care provider? • Does this provider work in a clinic, a hospital outpatient department, an emergency room at a hospital, or some other kind of place?	• Yes to Q1 • Any response except emergency room
Whole Person Orientation	• Do you go to USC for a new health problem? • Do you go to USC for ongoing health problems? • Do you go to USC for preventive health care? • Do you go to USC for referrals?	• Yes, and • Yes, and • Yes, and • Yes
Coordinated Care	• Does USC usually ask about prescription medications and treatments other doctors give you? • If there were a choice between treatments, how often would USC ask you to help make the decision?	• Usually/Always, or • Usually/Always
Enhanced Access	• Does USC have office hours on nights/weekend? • How difficult is it to contact USC by phone? • How difficult is it to contact USC after hours?	• Yes, or • Not at all difficult, or • Not at all difficult

Dependent Variables – Diabetes Service Use Measures (self-reported)		
Measure	Criteria	Variable Type
A1C Test	At least 4 A1C test in the past 12 months	Categorical
Foot Exam	One foot exam in the past 12 months	Dichotomous (yes/no)
Dilated Eye Exam	One dilated eye exam in the past 24 months	Dichotomous (yes/no)
Cholesterol Test	One cholesterol test in the past 12 months	Dichotomous (yes/no)
Flu Vaccine	One flu vaccine in the past year	Dichotomous (yes/no)
Total Diabetes Service Use	Count of positive indicators for A1C test, foot exam, eye exam, cholesterol test, and flu vaccine	Ordinal (0-5)

Measures

Conceptual Model

This research drew from Anderson's Behavioral Model of Health Care Utilization to build a framework to describe the relationship between the PCMH components and use of diabetes management services.[12] This model (Fig 4.) uses the interaction between individual characteristics and the health system to explain utilization of health care services. Individual characteristics are organized into predisposing, enabling and need factors. Predisposing factors include demographics or social characteristics that may predispose a person to use or not use health services. Enabling factors, such as socioeconomic status and insurance coverage are those that ease or impede the use of health services. Finally, need factors include the individual's perceived and evaluated need for services.

Focal Relationship

This study examined the relationship between the Patient-Centered Medical Home (PCMH) components and utilization of diabetes services. The PCMH is jointly defined by the American College of Physicians, the American Academy of Family Physicians, the American Academy of Pediatrics, and the American Osteopathic Association as a physician-led primary care practice where: 1) patients have access to their own personal provider; 2) there is a whole person orientation; 3) care is coordinated; 4) there is a focus on quality of safety; 5) there is enhanced access; and 6) there are payment mechanisms in place to recognize efforts that are not reimbursed for in fee-for-service payments.[6] Diabetes services are a bundle of preventive and screening services recommended for diabetics by the American Diabetes Association and American Association of Clinical Endocrinologists. These services include A1C tests, foot exams, eye exams, cholesterol labs, and flu vaccines.[16,18]

Predisposing Characteristics

The measured predisposing characteristics were age, race, ethnicity, gender, marital status, urbanicity, and diabetes self-efficacy. Age was measured as a continuous variable. Next, race was captured by a categorical measure (White, Black, and Other). Ethnicity was captured as a dichotomous variable (Hispanic, non-Hispanic). Gender was assessed through a dichotomous measure of sex (male, female) and marital status was categorized into three groups: currently married, previously married (e.g. widowed, divorced, separated) and never married. Urbanicity was measured by whether a person lives in a metropolitan statistical area (urban, suburban) or a non-Metropolitan statistical area (rural). Finally, diabetes self-efficacy was measured by the question "How confident are you taking care of your diabetes?" Self-efficacy was a four group ordinal variable (not confident at all, somewhat confident, confident, very confident).

Enabling Characteristics

The enabling characteristics included in the analysis were SES and health insurance status. Socioeconomic Status (SES) was measured using two variables: annual household income and education. Annual household income was continuous while educational attainment was assessed with five categories (Less than High School, High school Graduate, Some College, College Graduate, Graduate School). Health insurance status was categorized into three groups: any private insurance (including Tricare/ChampVA), public insurance only (e.g. Medicaid, Medicare, other public) and uninsured. For individuals with more than one type of insurance priority assignment was given to private insurance.

Need Characteristics

The need characteristics included in the research were evaluated and perceived health status.[12] Perceived health status had two components: perceived physical health status and perceived mental health status which were both assessed using a self-reported, five point scale (poor, fair, good, very good, excellent). Evaluated health status also had two components: disease severity and comorbidities.

Disease severity was captured through a dichotomous variable with use of insulin marking more severe diabetes. Ten comorbidities (Angina, Arthritis, Cancer, Coronary Heart Disease, High Cholesterol, Emphysema, High Blood Pressure, Heart Attack, Other Heart Disease, and Stroke) were measured using dichotomous indicators of self-reported diagnosis: yes or no.

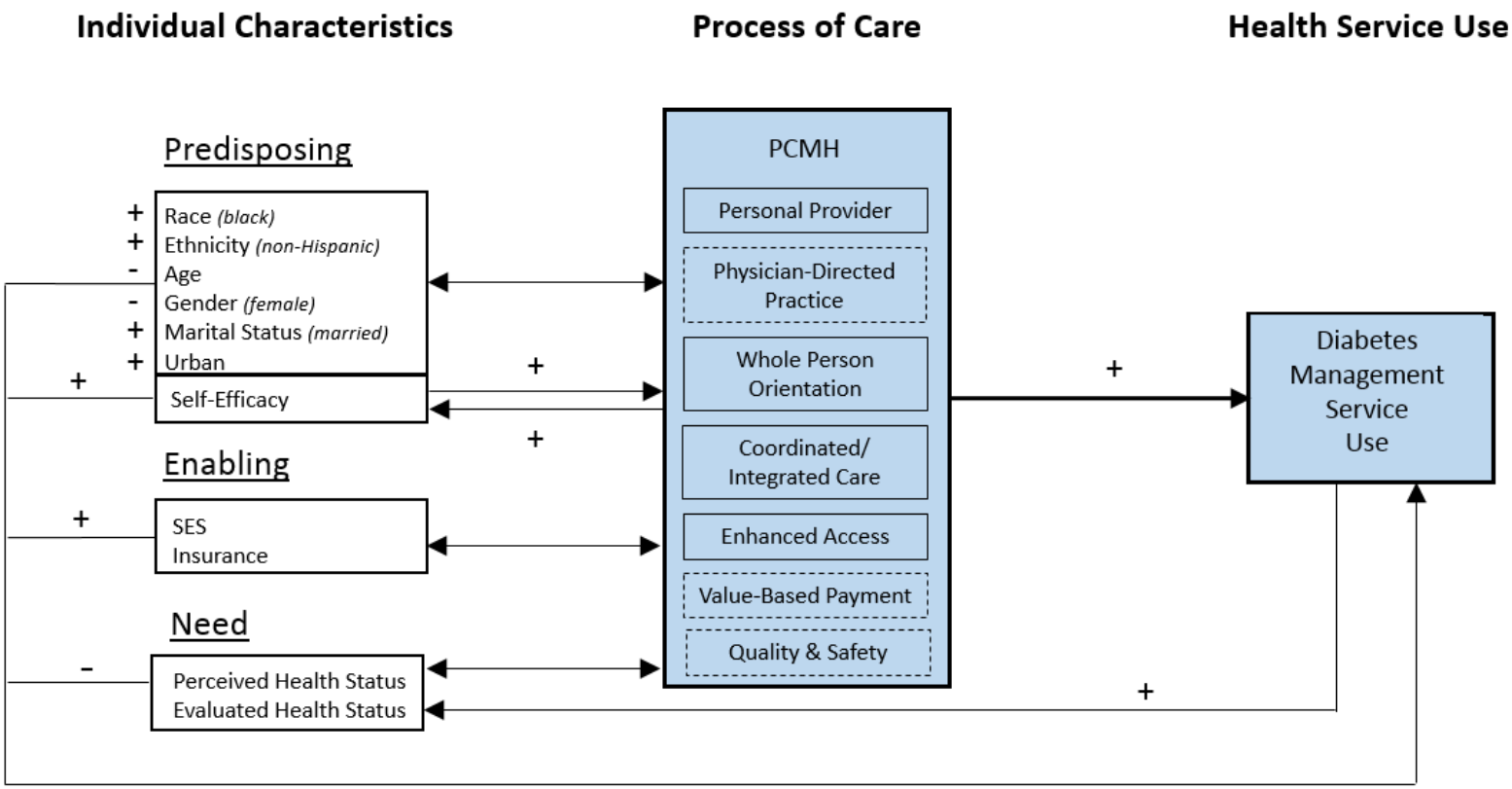

Fig 4. Conceptual model for the relationship between the Patient-Centered Medical Home and use of diabetes management services.

Table 3. Key Variable Measures

Construct	Measure	Hypothesized Relationship with DV
Age	Age was a continuous variable	Age will be negatively associated with diabetes service use.[63,64]
Race	Race was a categorical variable. Individuals were classified into 3 groups: White Black Other	Black will be associated with higher diabetes services use than the other 2 groups.[65,66]
Ethnicity	Ethnicity was a dichotomous variable: Hispanic Non-Hispanic	Hispanic will be associated with lower diabetes service use.[67]
Gender	Sex was a dichotomous variable: Male Female	Females will have lower diabetes service use than males.[68]
Marital Status	Marital Status was grouped into 3 categories: Currently Married Previously Married (i.e. widowed, divorced, separated) Never Married	Never married persons will have lower diabetes service use than the other 2 groups.[69-71]
Urbanicity	Metropolitan Statistical Area (MSA) was a dichotomous variable: MSA (i.e. urban, suburban) Non-MSA (i.e. rural)	Persons living in MSAs will have higher diabetes service use than those living in non-MSAs[72,73]
Self-Efficacy	Confidence in take care of diabetes will be an ordinal variable: not confident at all confident somewhat confident very confident	Higher confidence will be associated with higher diabetes service use[74]

Socioeconomic Status (SES)	Family Income was a self-reported, continuous variable Education Individuals were categorized into 5 groups: Less than High School High School Graduate Some College College Graduate Graduate School	Higher family income will be positively associated with diabetes service use.[75] Higher education will be positively associated with diabetes service use[75]
Health Insurance Status	Health Insurance Coverage was categorized into 3 groups: Any Private Public Only Uninsured Priority assignment will be given to private insurance	Uninsured persons will have lower diabetes service use than the persons in either of other two categories.[75]
Perceived Health Status	Perceived Health Status was categorized as: Excellent Very Good Good Fair Poor	Higher perceived health status will be negatively associated with diabetes service use.[71]
Mental Health Status	Perceived Mental Health Status was categorized as: Excellent Very Good Good Fair Poor	Higher perceived mental health status will be positively associated with diabetes service use.
Disease Severity	Insulin Use was a dichotomous variable Uses insulin Does not use insulin	Insulin use will be positively associated with diabetes service use
Comorbidities	Comorbidities were dichotomous variables (yes/no). The following diseases were categorized as comorbidities: High Cholesterol Angina Arthritis Cancer Stroke Emphysema Coronary Heart Disease High Blood Pressure Heart Attack Other Heart Disease	Persons with a comorbidity will have higher diabetes service use than those without the comorbidity.[70]

Data Analysis

Research Question: Which component(s) of the Patient-Centered Medical Home are most important for diabetes management in adults?

H1: Each PCMH component will be positively associated with receipt of total diabetes management services

H1a: Each PCMH component will be positively associated with receipt of A1C tests.

H1b: Each PCMH component will be positively associated with receipt of a foot exam.

H1c: Usual source of care and coordination will be positively associated with receipt of an eye exam.

H1d: Each PCMH component will be positively associated with receipt of a cholesterol test.

H1e: Each PCMH component will be positively associated with receipt of a flu vaccine.

H2: Having a usual source of care will be most strongly associated with receipt of diabetes management services

Analysis was conducted using STATA 14 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP). A combination of logistic, ordered logistic, and multinomial logistic regression models were estimated to test each hypothesis. Logistic regressions were estimated for all dichotomous dependent variables: foot exam, eye exam, cholesterol test, and flu vaccine. Multinomial logistic regressions were estimated for A1C tests and ordered logistic regression were estimated for the composite measure: total service use. These regression models were chosen because they most appropriately fit the characteristics of the dependent variables. None of the dependent variables were continuous thus they violated the assumptions of an OLS regression. Alternatively, logistic regressions can account for the distribution of

categorical variables. The simple logistic regression was suitable for the dichotomous variables, but because the A1C variable had three, unordered categories, a multinomial logistic was required. Finally, total service use required an ordered logistic regression, because the variable had more than two categories with a natural order. Bivariate models were first estimated. Then multivariate models were estimated controlling for predisposing, enabling and need factors were estimated. Survey sample weights provided by MEPS, specific to the DCS, were utilized to provide nationally representative estimates. All results were interpreted as marginal effects. Alpha levels of 0.05 were used to determine statistical significance. Sensitivity analyses were performed on the measures of PCMH as well as dependent variables. Different constructions of the variables were tested to determine the robustness of the measures.

Regression equations

Logistic regression equations follow the model:

$$nl[\frac{p(DMS)}{1-p(DMS)} = \beta_o + \beta_{1(PCMH\ Domain)} + \beta_{n(confounders)} + \varepsilon$$

For instance the regression equation for independent variable usual source of care and dependent variable foot exam was:

$$nl[\frac{p(Foot\ Exam)}{1-p(Foot\ Exam)} = \beta_o + \beta_{1(Usual\ Source\ of\ Care)} + \beta_{2(Age)} + \beta_{3(Race)} + \beta_{4(Ethnicity)} + \beta_{5(Sex)} + \beta_{6(Marital\ Status)} + \beta_{7(MSA)} + \beta_{8(Self-Efficacy)} + \beta_{9(Income)} + \beta_{10(Education)} + \beta_{11(Health\ Insurance)} + \beta_{12(Perceived\ Health\ Status)} + \beta_{13(Perceived\ Mental\ Health\ Status)} + \beta_{14(Insulin\ Use)} + \beta_{15(Comorbidities)} + \varepsilon$$

Missing data were handled in several ways. For most variables, missing observations were dropped from the regression population. However, there were two

exceptions to this strategy in which missing observations were included as an additional category in the analysis to prevent a large loss of sample size. As described above, missing data were included for the A1C dependent variable. Missing observations for diabetes self-efficacy were also included in the analysis.

CHAPTER IV. RESULTS

Descriptive Results

The study had a sample size of 2348 (Table 4). The sample was weighted to be nationally representative giving the study a US weighted sample size of 21,421,413. The sample was of an older population, with the mean age 61.4 years. The sample was mostly white (76.3%) and non-Hispanic (83.5%). Females made up 49% of the sample, with males representing the remaining 51%. Half of the sample was currently married (56.2%), while 31.4% were previously married, and 12.5% were never married. Only 18.5% of the sample was rural while the remainder of the sample was urban/suburban. Seventy percent of the sample reported being confident or very confident in taking care of their diabetes. The mean reported annual family income was approximately $56,000. Close to 60% of the sample had private insurance while 34% had only public insurance. Only 5.6% of the sample reported being in excellent health. The largest portion of the sample (37.4%) reported good health and 24.4% reported fair health. Perceived mental health status was higher with 22.7% reporting excellent mental health, 27.7% very good and 34.4% good. Insulin use was reported by 31.9% of the sample. The most common comorbidities in the sample were high blood pressure (77.8%), high cholesterol (71.8%), and arthritis (50.3%).

Table 4. Characteristics of 2012 MEPS participants who completed the diabetes care survey

MEPS Sample Size	2348
US weighted sample size	21,421,413
Mean age (y)	61.4
Race (%)	
White	76.3
Black	15.6
Other	8.2
Hispanic (%)	16.5
Female (%)	49.1
Marital Status (%)	
Currently Married	56.2
Previously Married	31.4
Never Married	12.5
Rural (%)	18.5
Self-Efficacy (%)	
Very Confident	33.0
Confident	37.8
Somewhat Confident	21.4
Not At All Confident	3.0
Don't Know	4.8
Mean Family Income ($)	55,932
Education	
Less than High School	22.7
High School Graduate	33.9
Some College	24.5
College Graduate	11.4
Graduate School	7.6
Health Insurance Coverage (%)	
Any Private	57.9
Public Only	34.0
Uninsured	8.0
Perceived Health Status (%)	
Excellent	5.6
Very Good	23.2
Good	37.4
Fair	24.4
Poor	9.3

Perceived Mental Health Status (%)	
Excellent	22.7
Very Good	27.7
Good	34.4
Fair	11.8
Poor	3.5
Insulin Use (%)	31.9
Comorbidities (%)	
High Blood Pressure	77.8
High Cholesterol	71.8
Arthritis	50.3
Other Heart Disease	22.9
Cancer	19.3
Coronary Heart Disease	18.7
Heart Attack	12.6
Stroke	10.9
Angina	8.7
Emphysema	3.5

MEPS = Medical Expenditure Panel Survey
All estimates have been adjusted using survey weights to be nationally representative

A significantly higher percentage of individuals with a usual source of care had any A1C test and the recommended four A1C tests in the year compared to individuals with no usual source of care (Table 5). They also had a statistically significant higher percentage of foot exams, eye exams, cholesterol tests, and flu vaccines. Those with a usual source of care also received more total number of services than those without a usual source of care. More individuals with a whole person orientation had at least one A1C (61.5%) compared to whose without a whole person orientation (51.8%). There was not a different in the receipt of any other diabetes management services between these two non-equivalent groups. There was no difference in the receipt of diabetes management services between those who received coordinated care and those who did not. Fewer individuals with enhanced access received a flu vaccine (67.2%) than those without enhanced access (74.6%). However, it is important to note that these frequencies do not account take into account for differences in demographic and other individual characteristics.

Table 5. Frequency of receipt of diabetes management services by PCMH component

	Personal Provider	No Personal Provider	p value	Whole Person Orientation	No Whole Person Orientation	p value	Coordinated Care	No Coordinated Care	p value	Enhanced Access	No Enhanced Access	p value
No A1C	5.2%	22.1%	<0.001	4.8%	15.4%	0.02	4.9%	9.3%	0.27	5.3%	5.1%	0.26
At least 1 A1C	61.1%	34.2%		61.5%	51.8%		61.8%	52.1%		62.8%	56.6%	
<4 A1C	43.7%	44.7%	0.01	43.4%	52.5%	0.4	43.3%	51.0%	0.11	44.6%	40.4%	0.28
4 A1C	22.6%	11.6%		22.9%	14.7%		23.3%	10.4%		23.5%	21.3%	
Don't Know	13.3%	22.9%		13.4%	9.4%		13.1%	12.9%		12.3%	14.3%	
No Ascertained	20.5%	20.8%		20.4%	23.3%		20.2%	25.8%		19.6%	24.0%	
Foot Exam	72.8%	44.5%	<0.001	72.9%	71.4%	0.84	73.0%	68.2%	0.46	73.5%	74.6%	0.68
No Foot Exam	27.2%	55.5%		27.1%	28.6%		27.0%	31.8%		26.5%	25.4%	
Eye Exam	67.6%	52.4%	0.003	67.5%	68.7%	0.89	68.4%	59.2%	0.16	67.3%	65.6%	0.63
No Eye Exam	32.4%	47.6%		32.5%	31.3%		31.6%	40.8%		32.7%	34.4%	
Cholesterol Test	86.2%	64.5%	<0.001	86.2%	86.5%	0.95	86.3%	81.3%	0.35	85.7%	88.1%	0.24
No Cholesterol Test	13.8%	35.5%		13.8%	13.5%		13.7%	18.7%		14.3%	11.9%	
Flu Vaccine	68.6%	36.5%	<0.001	68.9%	60.9%	0.32	68.7%	63.6%	0.41	67.2%	74.6%	0.007
No Flu Vaccine	31.4%	63.5%		31.1%	39.1%		31.3%	36.4%		32.8%	25.4%	
No Services	3.9%	18.3%	<0.001	3.9%	4.7%	0.55	3.9%	6.1%	0.14	3.5%	5.0%	0.12
1 Service	8.1%	21.2%		7.8%	14.6%		7.8%	17.1%		9.3%	4.5%	
2 Services	15.1%	23.2%		15.1%	14.9%		14.6%	11.7%		15.0%	16.4%	
3 Services	24.6%	18.0%		25.0%	16.1%		24.8%	30.5%		24.3%	22.9%	
4 Services	35.8%	11.7%		35.6%	38.3%		36.1%	27.4%		34.8%	37.7%	
5 Services	12.5%	7.7%		12.5%	11.4%		12.8%	7.2%		13.1%	13.6%	

Regression Results

Seven logistic models were estimated using the primary independent variable usual source of care (Table 7). Having a personal provider was associated with an 18 percentage point (pp) increase in the likelihood of have at least one A1C test and an 8 pp increase in the likelihood of having at least four A1C tests. Individuals with a usual source of care were also 15.3 pp more likely to receive an annual foot exam, 6.9 pp more likely to receive cholesterol test, and 18.5 pp more likely to receive a flu vaccine. Having a usual source of care was also associated with a 7.1 pp increase in the likelihood of receiving all 5 diabetes management services. There was no association between having a usual source of care and receiving an annual eye exam. Seven logistic models were estimated using the PMCH component whole person orientation (Table 8). Whole person orientation was not associated with an increase in likelihood of receiving any of the diabetes management services. Nor was it associated with the likelihood of receiving all five services. Coordinated care (Table 9) was also not associated with the receipt of any diabetes management services or with receiving all five services. Enhanced access (Table 10) was associated with a 3.6 pp decrease in the likelihood of receiving a cholesterol test and a 7.2 pp decrease in the likelihood of receiving a flu vaccine. There was no significant association between enhanced access and the receipt of any or 4 A1C tests, a foot exam, an eye exam, or all five diabetes management services.

Table 6. Summary of regression results

	1 A1C	4 A1C	Foot Exam	Eye Exam	Cholesterol Test	Flu Shot	All 5 Services
Personal Provider	+	+	+	NS	+	+	+
Whole Person Orientation	NS	NS	NS	NS	NS	NS	NS
Coordinated Care	NS	NS	NS	NS	NS	NS	NS
Enhanced Access	NS	NS	NS	NS	–	–	NS

NS = non-significant result

Certain cofounders were closely associated with the receipt of diabetes management services. Age was positively associated with the receipt of an annual foot exam, eye exam, cholesterol test, and flu vaccine in all estimated models. Identifying as black was associated with a decreased likelihood of receiving any A1C, at least 4 A1C tests, and a flu vaccine compared to white. Completing college or graduate school was associated with an increased likelihood of receiving an annual eye exam and flu shot in all model compared to completing less than high school. Being uninsured was negatively associated with the receipt of any or 4 A1C tests, a foot exam, an eye exam, and a flu shot compared to having private insurance. It was not consistently associated with the receipt of a cholesterol test across all models. Insulin use was positively associated with the receipt of an annual foot exam, eye exam, cholesterol test, and flu vaccine. It had a borderline significant association with the receipt of at least one A1C test, but a much stronger association with receipt of at least 4 A1C tests.

Table 7. Marginal effects of usual source of care on the likelihood of receiving DMS

	(1) 1 A1C	(2) 4 A1C	(3) Foot Exam	(4) Eye Exam	(5) Cholesterol Test	(6) Flu Vaccine	(7) All 5 Services
Usual Source of Care	0.18*** [0.073,0 .286]	0.08*** [-0.033,0.194]	0.153*** [0.064, 0.243]	0.009 [-0.086, 0.103]	0.069** [0.0278, 0.111]	0.185*** [0.087, 0.284]	0.071*** [0.035,0.108]
Age	-0.003 [-0.004,0.001]	0.0 [-0.002,0.002]	0.003** [0.001, 0.005]	0.005*** [0.003, 0.007]	0.002*** [0.001, 0.003]	0.007*** [0.004, 0.009]	0.002*** [0.001,0.003]
White	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Black	-0.118*** [-0.184, -0.052]	-0.07*** [-0.124,-0.016]	0.053 [-0.008, 0.114]	0.013 [-0.046, 0.073]	-0.035 [-0.077, 0.006]	-0.119** [-0.191, -0.046]	-0.018 [-0.043,0.006]
Other	-0.047 [-0.16,0.067]	-0.083 [-0.167,0.002]	0.014 [-0.083, 0.111]	-0.004 [-0.096, 0.087]	-0.042 [-0.116, 0.032]	-0.047 [-0.132, 0.038]	-0.028 [-0.059,0.003]
Hispanic	-0.028 [-0.112,0.057]	0.051 [-0.014,0.116]	0.031 [-0.032, 0.094]	0.028 [-0.041, 0.097]	-0.01 [-0.048, 0.027]	0.026 [-0.043, 0.095]	0.012 [-0.013,0.037]
Female	0.037 [-0.015,0.09]	0.027 [-0.019,0.074]	-0.001 [-0.057,0.055]	0.053 [-0.0 ,0.106]	0.019 [-0.018, 0.055]	0.028 [-0.021, 0.076]	0.015 [-0.004,0.035]
Currently Married	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Previously Married	-0.025 [-0.089,0.039]	-0.028 [-.083,0.028]	0.022 [-0.04, 0.084]	-0.051 [-0.119, 0.016]	0.029 [-0.009, 0.067]	0.015 [-0.05, 0.079]	-0.005 [-0.029,0.0178]
Never Married	0.035 [-0.041,0.111]	-0.11 [-0.183,-0.037]	0.028 [-0.048, 0.104]	-0.021 [-0.098, 0.057]	0.03 [-0.014, 0.074]	0.024 [-0.066, 0.115]	-0.008 [-0.034,0.0189]
Rural	-0.003 [-0.074,0.067]	0.023 [-0.041,0.086]	-0.018 [-0.075, 0.039]	0.027 [-0.051, 0.105]	0.02 [-0.028,0.067]	0.061 [-0.021, 0.142]	0.017 [-0.01,0.044]

Not at all Confident	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Somewhat Confident	0.118 [-0.023,0.259]	0.043 [-0.088,0.175]	0.048 [-0.069, 0.165]	0.144* [0.032, 0.255]	-0.048 [-0.152, 0.055]	0.044 [-0.088, 0.176]	0.04* [-0.000,0.079]
Confident	0.09 [-0.046,0.226]	0.025 [-0.099,0.149]	0.120* [0.007, 0.233]	0.153* [0.026, 0.280]	-0.004 [-0.089, 0.081]	0.112 [-0.012, 0.236]	0.057** [0.014,0.101]
Very Confident	0.182** [0.044,0.32]	0.076** [-0.051,0.202]	0.123* [0.01, 0.236]	0.136* [0.016, 0.256]	-0.012 [-0.099, 0.075]	0.096 [-0.032, 0.225]	0.061** [0.017,0.105]
Unknown Confidence	-0.03 [-0.213,0.154]	0.027 [-0.159,0.214]	0.006 [-0.156, 0.168]	0.136* [0.019, 0.253]	-0.083 [-0.227, 0.062]	0.096 [-0.039, 0.231]	0.031 [-0.03,0.093]
Income	0 [-0.000,0.000]	0 [-0.000,0.000]	0 [-0.000,0.000]	0 [-0.000,0.000]	0 [-0.000,0.000]	0 [-0.000,0.000]	0 [-0.000,0.000]
< High School	Ref	Ref	Ref	Ref	Ref	Ref	Ref
High School Graduate	0.009 [-0.072,0.091]	-0.003 [-0.07,0.064]	0.015 [-0.055, 0.086]	0.046 [-0.024, 0.115]	-0.01 [-0.05, 0.03]	0.003 [-0.074, 0.08]	0.006 [-0.019,0.032]
Some College	0.037 [-0.039,0.112]	-0.017 [0-.095,0.061]	0.048 [-0.023, 0.120]	0.035 [-0.046, 0.116]	0.002 [-0.043, 0.047]	0.052 [-0.04, 0.144]	0.022 [-0.007,0.051]
College Graduate	0.109 [-0.002,0.221]	0.027 [-0.065,0.119]	0.100* [0.002, 0.198]	0.130* [0.026, 0.234]	0.055 [-0.01, 0.119]	0.152** [0.042, 0.263]	0.052** [0.019,0.086]
Graduate School	0.177* [0.035,0.319]	0.04* [-0.066,0.147]	-0.053 [-0.153, 0.047]	0.185** [0.062, 0.308]	0.051 [-0.036, 0.137]	0.152** [0.041, 0.263]	0.039 [-0.001,0.079]

Any Private Insurance	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Public Insurance	-0.03 [-0.095,0.036]	0.015 [-0.042,0.071]	0.005 [-0.06, 0.069]	-0.044 [-0.114, 0.027]	-0.022 [-0.063, 0.019]	-0.018 [-0.092, 0.056]	-0.011*** [-0.036,0.014]
Uninsured	-0.135*** [-0.235, -0.036]	-0.149** [-0.232,-0.066]	-0.194*** [-0.303, -0.085]	-0.224*** [-0.323,-0.125]	-0.089* [-0.158,-0.02]	-0.165*** [-0.262,-0.068]	-0.099 [-0.137,-0.061]
Poor Health	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Fair Health	-0.043 [-0.171,0.085]	0.067 [-0.055,0.189]	0.117 [-0.009,0.242]	0.039 [-0.078,0.157]	0.016 [-0.065,0.097]	-0.056 [-0.174,0.063]	0.016 [-0.024,0.056]
Good Health	0.005 [-0.122,0.132]	0.082 [-0.033,0.197]	0.056 [-0.07,0.182]	0.028 [-0.079,0.135]	-0.013 [-0.089,0.063]	-0.124* [-0.237,-0.01]	0.016 [-0.044,0.033]
Very Good Health	-0.039 [-0.174,0.096]	0.116 [-0.011,0.243]	0.122 [-0.01,0.253]	-0.005 [-0.119,0.109]	-0.051 [-0.130,0.028]	-0.068 [-0.192,0.056]	0.006 [-0.036,0.049]
Excellent Health	0.036 [-0.132,0.202]	0.1 [-0.044,0.244]	0.084 [-0.069,0.237]	-0.026 [-0.152,0.1]	-0.088* [-0.170,-0.006]	-0.129 [-0.287,0.029]	-0.011 [-0.061,0.04]
Poor MH	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Fair MH	-0.023 [-.107,0.06]	0.027 [-0.036,0.09]	-0.01 [-0.084,0.063]	-0.005 [-0.082,0.072]	0.01 [-0.036,0.055]	0.027 [-0.049,0.104]	0.006 [-0.02,0.033]
Good MH	-0.08* [-0.155, -0.004]	-0.02* [-0.086,0.047]	0.049 [-0.019,0.118]	-0.008 [-0.089,0.073]	-0.024 [-0.07,0.022	0.065 [-0.016,0.145]	0.006 [-0.022,0.035]
Very Good MH	-0.005 [-0.109,0.1]	0.069 [-0.014,0.151]	0.052 [-0.049,0.153]	0.004 [-0.092,0.1]	0.006 [-0.055,0.068]	-0.013 [-0.118,0.092]	0.0214304 [-0.015,0.057]
Excellent MH	-0.183 [-0.371,0.004]	0.055 [-0.097,0.207]	-0.009 [-0.138,0.120]	0.056 [-0.106,0.218]	0.107* [0.003,0.210]	0.077 [-0.102,0.257]	0.029 [-0.027,0.086]

Insulin Use	0.059 [-0.005,0.122]	0.112 [0.063,0.161]	0.146*** [0.090,0.203]	0.132*** [0.082,0.181]	0.045* [0.007,0.083]	0.140*** [0.081,0.198]	0.076*** [0.055,0.097]
High Cholesterol	0.041 [-0.02,0.102]	-0.021 [-0.073,0.031]	0.005 [-0.061,0.07]	-0.001 [-0.06,0.057]	0.071*** [0.036,0.106]	-0.017 [-0.071,0.036]	0.005 [-0.016,0.027]
Angina	-0.046 [-0.166,0.074]	0.044 [-0.039,0.128]	-0.021 [-0.124,0.081]	0.029 [-0.082,0.140]	0.003 [-0.072,0.078]	-0.084 [-0.190,0.021]	0.005 [-0.035,0.044]
Arthritis	0.056 [-0.002,0.114]	0.027 [-0.018,0.071]	-0.005 [-0.06,0.049]	0.059 [-0.000,0.118]	0.021 [-0.019,0.061]	0.074* [0.015,0.133]	0.015 [0-.005,0.035]
Cancer	0.03 [-0.027,0.087]	0.004 [-0.053,0.062]	-0.015 [-0.078,0.048]	0.024 [-0.051,0.1]	-0.024 [-0.071,0.023]	0.101* [0.023,0.179]	0.007 [-0.018,0.032]
Stroke	-0.007 [-0.096,0.082]	-0.006 [-0.08,0.0689]	-0.062 [-0.147,0.024]	-0.015 [-0.097,0.066]	0.002 [-0.054,0.058]	-0.003 [-0.093,0.086]	-0.008 [-0.041,0.025]
Emphysema	-0.003 [-0.135,0.129]	-0.058 [-0.166,0.05]	0.014 [-0.135,0.163]	-0.021 [-0.153,0.111]	-0.087* [-0.168,-0.006]	-0.007 [-0.165,0.152]	-0.019 [-0.075,0.036]
Coronary Heart Disease	-0.033 [-0.107,0.041]	0.02 [-0.055,0.095]	-0.01 [-0.105,0.086]	0.017 [-0.066,0.1]	-0.013 [-0.063,0.038]	0.038 [-0.0485,0.124]	0.012 [-0.017,0.041]
High Blood Pressure	-0.025 [-.097,0.047]	0.009 [-0.054,0.071]	0.006 [-0.054,0.067]	0.004 [-0.058,0.067]	0.042* [0.004,0.081]	0.077* [0.014,0.140]	0.021* [0.001,0.041]
Heart Attack	0.03 [-0.06,0.121]	-0.022 [-0.113,0.069]	-0.049 [-0.136,0.038]	-0.024 [-0.116,0.069]	0.009 [-0.051,0.069]	-0.035 [-0.131,0.061]	-0.016 [-0.053,0.021]
	N = 2,268	N = 2,268	N= 2,206	N= 2,236	N= 2,235	N = 2,218	N = 2,128

Marginal effects; 95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
MH = Mental Health

Table 8. Marginal effects of whole person orientation on the likelihood of receiving DMS

	(1) 1 A1C	(2) 4 A1C	(3) Foot Exam	(4) Eye Exam	(5) Cholesterol Test	(6) Flu Vaccine	(7) All 5 Services
Whole Person Orientation	0.063 [-0.098,0.225]	0.112 [-0.011,0.235]	0.035 [-0.098,0.168]	0.001 [-0.161,0.163]	0.005 [-0.080,0.091]	0.103 [-0.040,0.246]	0.028 [-0.032,0.089]
Age	-.002 [-0.005,0]	-0.001 [-.003,.002]	0.002* [0.000,0.005]	0.005*** [0.002,0.007]	0.002*** [0.001,0.004]	0.006*** [0.003,0.008]	0.002*** [0.001,0.003]
White	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Black	-0.128*** [-0.198,-0.057]	-0.086** [-0.148,-0.024]	0.034 [-0.023,0.091]	0.012 [-0.051,0.075]	-0.043* [-0.085,-0.001]	-0.113** [-0.187,-0.039]	-0.024 [-0.051,0.004]
Other	-0.022 [-0.134,0.09]	-0.079 [-0.168,.01]	0.039 [-0.055,0.133]	0 [-0.091,0.091]	-0.02 [-0.089,0.050]	-0.021 [-0.104,0.062]	-0.02 [-0.053,0.013]
Hispanic	-0.047 [-0.136,0.043]	0.043 [-0.029,0.115]	0.012 [-0.054,0.079]	0.043 [-0.027,0.113]	0.014 [-0.024,0.051]	0.015 [-0.057,0.087]	0.017 [-0.011,0.045]
Female	0 .023 [-0.031,0.077]	0.025 [-0.024,0.075]	-0.004 [-0.061,0.053]	0.029 [-0.023,0.081]	0.016 [-0.019,0.052]	0.008 [-0.043,0.059]	0.011 [-0.011,0.033]
Currently Married	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Previously Married	-0.018 [-0.084,0.047]	-0.028** [-0.087,0.031]	0.011 [-0.049,0.071]	-0.037 [-0.104,0.030]	0.028 [-0.010,0.066]	0.018 [-0.044,0.080]	-0.005 [-0.032,0.021]
Never Married	0.034 [-0.046,0.115]	-0.115 [-0.191,-0.039]	0.021 [-0.052,0.094]	-0.008 [-0.088,0.071]	0.023 [-0.022,0.069]	0.01 [-0.079,0.099]	-0.009 [-0.039,0.021]
Rural	-0.017 [-0.088,0.054]	0.023 [-0.044,0.09]	-0.027 [-0.083,0.028]	0.032 [-0.049,0.113]	0.017 [-0.031,0.065]	0.047 [-0.037,0.132]	0.016 [-0.015,0.046]

Not at all Confident	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Somewhat Confident	0.053 [-0.105,0.21]	0.008 [-0.13,0.146]	0.018 [-0.113,0.148]	0.084 [-0.043,0.211]	-0.017 [-0.112,0.077]	0.038 [-0.093,0.168]	0.026 [-0.019,0.070]
Confident	0 .025 [-0.122,0.171]	-0.011 [-0.143,0.121]	0.076 [-0.054,0.206]	0.09 [-0.047,0.227]	0.022 [-0.059,0.103]	0.111 [-0.013,0.234]	0.0445 [-0.003,0.093]
Very Confident	0.116 [-0.035,0.268]	0.037 [-0.095,0.169]	0.086 [-0.037,0.209]	0.074 [-0.053,0.201]	0.013 [-0.069,0.094]	0.095 [-0.032,0.223]	0.049 [0,0.097]
Unknown Confidence	-0.095 [-0.289,0.098]	0.013 [-0.189,0.214]	0.008 [-0.170,0.185]	0.036 [-0.122,0.194]	-0.037 [-0.162,0.088]	0.091 [-0.040,0.222]	0.018* [-0.054,0.089]
Income	0 [-0.000,0.000]	0 [-0.000,0.000]	0 [-0.000,0.000]	0 [-0.000,0.000]	0 [-0.000,0.000]	0 [-0.000,0.000]	0 [-0.000,0.000]
< High School	Ref	Ref	Ref	Ref	Ref	Ref	Ref
High School Graduate	0 [-0.081,0.081]	-0.008 [-0.081,0.064]	0.012 [-0.058,0.082]	0.038 [-0.029,0.105]	0.002 [-0.040,0.044]	0.001 [-0.077,0.079]	0.006 [-0.023,0.035]
Some College	0.020 [-0.057,0.098]	-0.019 [-0.103,0.065]	0.032 [-0.041,0.104]	0.037 [-0.047,0.121]	0.005 [-0.041,0.051]	0.042 [-0.053,0.137]	0.022 [-0.012,0.057]
College Graduate	0.097 [-0.019,0.212]	0.026 [-0.072,0.124]	0.097 [-0.000,0.194]	0.137* [0.029,0.245]	0.059 [-0.005,0.124]	0.158** [0.045,0.271]	0.058** [0.02,0.096]
Graduate School	0.132 [-0.007,0.272]	0.034 [-0.081,0.149]	-0.065 [-0.162,0.032]	0.176** [0.048,0.304]	0.049 [-0.032,0.129]	0.136* [0.023,0.249]	0.039 [-0.007,0.086]
Any Private Insurance	Ref	Ref	Ref	Ref	Ref	Ref	Ref

Public Insurance Only	-0.024 [-0.094,0.046]	0.011 [-0.05,0.071]	-0.005 [-0.070,0.060]	-0.054 [-0.126,0.018]	-0.026 [-0.065,0.012]	-0.021 [-0.094,0.052]	-0.018 [-0.045,0.01]
Uninsured	-0.125* [-0.232,-0.017]	-0.114** [-0.203,-0.025]	-0.205*** [-0.326,-0.085]	-0.215*** [-0.323,-0.106]	-0.055 [-0.135,0.024]	-0.151** [-0.257,-0.046]	-0.098*** [-0.144,-0.051]
Poor Health	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Fair Health	-0.125* [-0.232,-0.017]	0.073 [-0.064,0.211]	0.162* [0.039,0.285]	0.054 [-0.069,0.176]	0.024 [-0.060,0.108]	-0.057 [-0.186,0.071]	0.028 [-0.015,0.072]
Good Health	-0.032 [-0.166,0.102]	0.103 [-0.028,0.234]	0.09 [-0.031,0.212]	0.045 [-0.063,0.153]	0.004 [-0.075,0.082]	-0.128* [-0.247,-0.009]	0.005 [-0.035,0.045]
Very Good Health	0 .017 [-0.115,0.148]	0.140 [-0.003,0.284]	0.149* [0.021,0.277]	0.021 [-0.094,0.137]	-0.028 [-0.112,0.056]	-0.064 [-0.199,0.071]	0.02 [-0.026,0.067]
Excellent Health	-0.028 [-0.169,0.114]	0.121 [-0.035,0.277]	0.117 [-0.035,0.268]	-0.017 [-0.150,0.115]	-0.062 [-0.146,0.022]	-0.149 [-0.312,0.014]	-0.001 [-0.050,0.056]
Poor MH	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Fair MH	-0.026 [-0.111,0.058]	0.031 [-0.035,0.097]	-0.023 [-0.095,0.049]	0.005 [-0.074,0.084]	0.001 [-0.046,0.048]	0.032 [-0.045,0.108]	0.007 [-0.023,0.037]
Good MH	-0.088* [-0.16,-0.017]	-0.019 [-0.087,0.049]	0.04 [-0.032,0.111]	-0.015 [-0.098,0.069]	-0.029 [-0.074,0.016]	0.055 [-0.024,0.135]	0.005 [-0.027,0.037]
Very Good MH	-0.015 [-0.12,0.089]	0.063 [-0.024,0.145]	0.047 [-0.056,0.149]	-0.004 [-0.106,0.098]	-0.002 [-0.063,0.059]	-0.013 [-0.115,0.089]	0.019 [-0.022,0.06]
Excellent MH	-0.187 [-0.372,-0.001]	0.057 [-0.101,0.215]	0.023 [-0.123,0.170]	0.03 [-0.134,0.194]	0.086 [-0.028,0.199]	0.035 [-0.137,0.206]	0.025 [-0.043,0.093]

Insulin Use	0.067* [0.002,0.133]	0.122*** [0.068,0.177]	0.157*** [0.101,0.213]	0.119*** [0.067,0.172]	0.040* [0.001,0.079]	0.144*** [0.084,0.204]	0.084*** [0.06,0.109]
High Cholesterol	0.038 [-0.027,0.103]	-0.013 [-0.069,0.043]	0.002 [-0.064,0.068]	-0.008 [-0.072,0.056]	0.060** [0.023,0.097]	-0.019 [-0.072,0.034]	0.004 [-0.02,0.029]
Angina	-0.049 [-0.166,0.068]	0.048 [-0.041,0.1361]	-0.016 [-0.117,0.084]	0.045 [-0.070,0.160]	-0.005 [-0.077,0.066]	-0.097 [-0.200,0.006]	0.006 [-0.039,0.05]
Arthritis	0.064 [0.005,0.124]	0.030 [-0.019,0.08]	0.006 [-0.049,0.060]	0.061 [-0.000,0.122]	0.022 [-0.016,0.061]	0.082** [0.023,0.140]	0.022 [-0.002,0.046]
Cancer	0.025 [-0.033,0.083]	0.003 [-0.057,0.064]	-0.018 [-0.080,0.044]	0.035 [-0.042,0.112]	-0.027 [-0.071,0.017]	0.095* [0.020,0.170]	0.007 [-0.021,0.034]
Stroke	-0.009 [-0.093,0.076]	-0.003 [-0.082,0.075]	-0.06 [-0.147,0.026]	-0.01 [-0.092,0.072]	0.002 [-0.051,0.056]	0.005 [-0.087,0.096]	-0.008 [-0.046,0.03]
Emphysema	-0.039 [-0.172,0.095]	-0.109 [-0.234,0.016]	-0.019 [-0.172,0.135]	-0.024 [-0.175,0.126]	-0.094* [-0.174,-0.013]	0.029 [-0.143,0.201]	-0.029 [-0.095,0.037]
Coronary Heart Disease	-0.038 [-0.11,0.034]	0.023 [-0.056,0.103]	-0.006 [-0.102,0.089]	0.023 [-0.056,0.102]	-0.019 [-0.066,0.028]	0.039 [-0.044,0.122]	0.014 [-0.018,0.046]
High Blood Pressure	-0.028 [-0.106,0.05]	0.010 [-0.059,0.078]	0.008 [-0.055,0.072]	0.023 [-0.042,0.088]	0.036 [-0.006,0.078]	0.083* [0.016,0.149]	0.025 [0.001,0.049]
Heart Attack	0 .044 [-0.049,0.136]	-0.023 [-0.121,0.075]	-0.03 [-0.114,0.053]	-0.02 [-0.112,0.072]	0.019 [-0.038,0.077]	-0.026 [-0.123,0.071]	-0.012 [-0.054,0.03]
Other Heart Disease	0.031 [-0.022,0.084]	0.014 [-0.0389,0.067]	-0.048 [-0.109,0.013]	-0.005 [-0.086,0.077]	0 [-0.027,0.028]	0.015 [-0.036,0.066]	0.002 [-0.02,0.02]
	N = 2,053	N = 2,053	N= 1,997	N= 2,024	N= 2,024	N = 2,005	N = 1,924

Marginal effects; 95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
MH = Mental Health

Table 9. Marginal effects of coordinated care on the likelihood of receiving DMS

	(1) 1 A1C	(2) 4 A1C	(3) Foot Exam	(4) Eye Exam	(5) Cholesterol Test	(6) Flu Vaccine	(7) All 5 Services
Coordinated Care	0.02 [-0.105,0.145]	0.156 [-0.011,0.323]	0.044 [-0.080,0.167]	0.023 [-0.099,0.146]	0.027 [-0.058,0.112]	-0.028 [-0.142,0.085]	0.027 [-0.022,0.076]
Age	-0.002 [-0.005,0.000]	-0.001 [-0.003,0.002]	0.002* [0.000,0.004]	0.005*** [0.002,0.007]	0.002*** [0.001,0.004]	0.006*** [0.003,0.008]	0.002*** [0.001,0.003]
White	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Black	-0.126*** [-0.195,-0.056]	-0.086** [-0.149,-0.024]	0.03 [-0.028,0.089]	0 [-0.065,0.066]	-0.038 [-0.080,0.003]	-0.114** [-0.190,-0.037]	-0.026 [-0.054,0.003]
Other	-0.018 [-0.132,0.096]	-0.079 [-0.169,0.011]	0.038 [-0.057,0.134]	-0.013 [-0.105,0.079]	-0.015 [-0.083,0.054]	-0.026 [-0.109,0.058]	-0.023 [-0.057,0.010]
Hispanic	-0.043 [-0.132,0.047]	0.041 [-0.033,0.114]	0.006 [-0.060,0.072]	0.032 [-0.039,0.104]	0.014 [-0.024,0.053]	0.014 [-0.060,0.088]	0.013 [-0.016,0.043]
Female	0.018 [-0.036,0.071]	0.022 [-0.029,0.073]	-0.008 [-0.067,0.050]	0.02 [-0.032,0.073]	0.017 [-0.019,0.053]	0.011 [-0.043,0.064]	0.009 [-0.014,0.031]
Currently Married	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Previously Married	-0.024 [-0.092,0.045]	-0.026 [-0.086,0.034]	0.024 [-0.036,0.084]	-0.034 [-0.103,0.035]	0.026 [-0.013,0.064]	0.022 [-0.040,0.084]	-0.003 [-0.029,0.022]
Never Married	0.021 [-0.060,0.103]	-0.118** [-0.194,-0.042]	0.026 [-0.047,0.100]	-0.006 [-0.088,0.076]	0.024 [-0.023,0.071]	0.013 [-0.075,0.100]	-0.009 [-0.039,0.021]
Rural	-0.013 [-0.085,0.058]	0.023 [-0.044,0.090]	-0.016 [-0.073,0.042]	0.04 [-0.044,0.123]	0.018 [-0.030,0.066]	0.044 [-0.040,0.129]	0.018 [-0.014,0.050]

Not at all Confident	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Somewhat Confident	0.032 [-0.129,0.194]	-0.001 [-0.143,0.141]	0.021 [-0.112,0.154]	0.073 [-0.058,0.205]	-0.028 [-0.130,0.074]	0.047 [-0.085,0.179]	0.024 [-0.021,0.069]
Confident	0.02 [-0.132,0.171]	-0.022 [-0.159,0.115]	0.079 [-0.054,0.212]	0.089 [-0.050,0.228]	0.014 [-0.070,0.099]	0.124* [0.000,0.248]	0.046 [-0.004,0.095]
Very Confident	0.102 [-0.056,0.259]	0.027 [-0.108,0.161]	0.098 [-0.026,0.222]	0.068 [-0.061,0.198]	0.008 [-0.078,0.094]	0.102 [-0.026,0.230]	0.050* [0.000,0.099]
Unknown Confidence	-0.114 [-0.311,0.084]	0.001 [-0.207,0.209]	0.027 [-0.164,0.218]	0.042 [-0.118,0.202]	-0.047 [-0.182,0.088]	0.113 [-0.005,0.231]	0.023 [-0.048,0.094]
Income	0.000** [0.000,0.000]	0 [-0.000,0.000]	0 [-0.000,0.000]	0 [-0.000,0.000]	0 [-0.000,0.000]	0 [-0.000,0.000]	0 [-0.000,0.000]
< High School	Ref	Ref	Ref	Ref	Ref	Ref	Ref
High School Graduate	0.01 [-0.072,0.092]	-0.006 [-0.082,0.071]	0.007 [-0.062,0.075]	0.025 [-0.043,0.093]	0.001 [-0.043,0.044]	-0.004 [-0.081,0.073]	0.003 [-0.027,0.032]
Some College	0.031 [-0.049,0.112]	-0.024 [-0.113,0.065]	0.015 [-0.060,0.091]	0.031 [-0.052,0.113]	0.002 [-0.045,0.049]	0.039 [-0.056,0.134]	0.017 [-0.019,0.054]
College Graduate	0.105 [-0.011,0.220]	0.025 [-0.075,0.126]	0.076 [-0.020,0.173]	0.126* [0.019,0.233]	0.055 [-0.011,0.120]	0.176** [0.061,0.292]	0.055** [0.017,0.094]
Graduate School	0.170* [0.028,0.312]	0.033 [-0.085,0.151]	-0.082 [-0.181,0.017]	0.187** [0.062,0.311]	0.054 [-0.032,0.139]	0.137* [0.025,0.248]	0.038 [-0.009,0.086]
Any Private Insurance	Ref	Ref	Ref	Ref	Ref	Ref	Ref

Public Insurance Only	-0.026 [-0.096,0.044]	0.013 [-0.050,0.077]	-0.009 [-0.074,0.056]	-0.057 [-0.128,0.013]	-0.03 [-0.070,0.010]	-0.024 [-0.097,0.049]	-0.019 [-0.047,0.009]
Uninsured	-0.123* [-0.231,-0.015]	-0.117* [-0.210,-0.025]	-0.196** [-0.317,-0.075]	-0.223*** [-0.332,-0.114]	-0.056 [-0.138,0.026]	-0.157** [-0.266,-0.049]	-0.100*** [-0.148,-0.053]
Poor Health	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Fair Health	-0.02 [-0.154,0.114]	0.072 [-0.069,0.213]	0.172** [0.049,0.295]	0.041 [-0.084,0.166]	0.03 [-0.056,0.116]	-0.078 [-0.205,0.049]	0.026 [-0.019,0.072]
Good Health	0.022 [-0.110,0.154]	0.1 [-0.034,0.233]	0.104 [-0.016,0.225]	0.035 [-0.076,0.145]	0.007 [-0.072,0.086]	-0.158** [-0.274,-0.042]	0.002 [-0.039,0.044]
Very Good Health	-0.03 [-0.172,0.112]	0.135 [-0.011,0.282]	0.155* [0.027,0.282]	0.004 [-0.113,0.121]	-0.026 [-0.111,0.059]	-0.097 [-0.231,0.038]	0.015 [-0.033,0.062]
Excellent Health	0.057 [-0.114,0.227]	0.121 [-0.039,0.282]	0.139 [-0.012,0.289]	-0.033 [-0.170,0.103]	-0.057 [-0.143,0.028]	-0.173* [-0.329,-0.016]	-0.003 [-0.062,0.056]
Poor MH	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Fair MH	-0.032 [-0.114,0.051]	0.037 [-0.029,0.103]	-0.022 [-0.097,0.052]	0.004 [-0.075,0.083]	0 [-0.048,0.048]	0.019 [-0.058,0.096]	0.006 [-0.025,0.036]
Good MH	-0.089* [-0.165,-0.012]	-0.016 [-0.086,0.055]	0.036 [-0.035,0.108]	-0.006 [-0.090,0.078]	-0.029 [-0.075,0.018]	0.053 [-0.029,0.135]	0.007 [-0.026,0.040]
Very Good MH	-0.003 [-0.109,0.103]	0.07 [-0.020,0.160]	0.054 [-0.051,0.159]	0.02 [-0.084,0.124]	-0.004 [-0.067,0.058]	-0.017 [-0.122,0.088]	0.025 [-0.017,0.067]
Excellent MH	-0.192* [-0.376,-0.007]	0.063 [-0.096,0.222]	0.045 [-0.104,0.194]	0.064 [-0.096,0.225]	0.088 [-0.031,0.208]	0.049 [-0.121,0.220]	0.036 [-0.023,0.095]

Insulin Use	0.061 [-0.002,0.125]	0.112*** [0.055,0.169]	0.151*** [0.096,0.207]	0.110*** [0.057,0.163]	0.041* [0.001,0.080]	0.140*** [0.079,0.201]	0.081*** [0.055,0.106]
High Cholesterol	0.036 [-0.028,0.100]	-0.018 [-0.076,0.041]	0.014 [-0.050,0.078]	0 [-0.063,0.063]	0.062** [0.024,0.099]	-0.01 [-0.067,0.047]	0.008 [-0.017,0.033]
Angina	-0.049 [-0.167,0.068]	0.053 [-0.038,0.143]	-0.012 [-0.112,0.088]	0.059 [-0.056,0.173]	-0.007 [-0.080,0.065]	-0.087 [-0.187,0.013]	0.01 [-0.033,0.054]
Arthritis	0.066* [0.004,0.128]	0.03 [-0.022,0.081]	0.012 [-0.043,0.068]	0.066* [0.006,0.126]	0.024 [-0.016,0.064]	0.084** [0.025,0.144]	0.024* [0.000,0.048]
Cancer	0.025 [-0.034,0.084]	0 [-0.063,0.063]	-0.02 [-0.085,0.044]	0.037 [-0.042,0.117]	-0.031 [-0.076,0.014]	0.101** [0.025,0.178]	0.006 [-0.023,0.035]
Stroke	-0.003 [-0.090,0.084]	-0.003 [-0.084,0.078]	-0.048 [-0.136,0.040]	-0.006 [-0.091,0.079]	0.006 [-0.047,0.059]	0 [-0.094,0.094]	-0.005 [-0.044,0.035]
Emphysema	-0.048 [-0.186,0.089]	-0.112 [-0.238,0.014]	-0.038 [-0.189,0.113]	-0.024 [-0.176,0.128]	-0.085 [-0.170,0.000]	0.017 [-0.151,0.184]	-0.032 [-0.100,0.036]
Coronary Heart Disease	-0.039 [-0.114,0.035]	0.017 [-0.067,0.100]	-0.005 [-0.100,0.090]	0.03 [-0.047,0.108]	-0.02 [-0.068,0.028]	0.047 [-0.036,0.129]	0.015 [-0.016,0.046]
High Blood Pressure	-0.031 [-0.111,0.048]	0.014 [-0.057,0.084]	0.006 [-0.059,0.072]	0.02 [-0.046,0.087]	0.032 [-0.011,0.075]	0.084* [0.016,0.152]	0.025* [0.001,0.050]
Heart Attack	0.049 [-0.045,0.143]	-0.02 [-0.120,0.081]	-0.028 [-0.111,0.056]	-0.027 [-0.118,0.063]	0.022 [-0.037,0.081]	-0.027 [-0.125,0.070]	-0.011 [-0.053,0.031]
Other Heart Disease	0.035 [-0.019,0.088]	0.02 [-0.035,0.076]	-0.042 [-0.100,0.016]	0.006 [-0.062,0.075]	0.003 [-0.024,0.029]	0.019 [-0.030,0.067]	0.006 [-0.013,0.025]
	N = 1,991	N = 1,991	N= 1,938	N= 1,963	N= 1,963	N = 1,945	N = 1,866

Marginal effects; 95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
MH = Mental Health

Table 10. Marginal effects of enhanced access on the likelihood of receiving DMS

	(1) 1 A1C	(2) 4 A1C	(3) Foot Exam	(4) Eye Exam	(5) Cholesterol Test	(6) Flu Vaccine	(7) All 5 Services
Enhanced Access	0.033 [-0.034,0.101]	0.019 [-0.042,0.080]	-0.012 [-0.067,0.044]	0.009 [-0.063,0.081]	-0.036* [-0.071,-0.000]	-0.072* [-0.128,-0.016]	-0.012 [-0.038,0.014]
Age	-0.001 [-0.004,0.002]	0 [-0.002,0.002]	0.003* [0.000,0.005]	0.005*** [0.002,0.007]	0.002*** [0.001,0.004]	0.006*** [0.003,0.008]	0.003*** [0.001,0.004]
White	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Black	-0.128*** [-0.203,-0.053]	-0.093** [-0.160,-0.027]	0.028 [-0.033,0.089]	0.035 [-0.031,0.100]	-0.043 [-0.087,0.000]	-0.119** [-0.196,-0.043]	-0.025 [-0.053,0.003]
Other	-0.01 [-0.137,0.116]	-0.092 [-0.190,0.007]	0.024 [-0.072,0.120]	0.015 [-0.081,0.111]	-0.008 [-0.079,0.062]	0.018 [-0.061,0.098]	-0.016 [-0.052,0.019]
Hispanic	-0.034 [-0.127,0.060]	0.038 [-0.039,0.115]	0.015 [-0.058,0.088]	0.066 [-0.008,0.140]	0.018 [-0.020,0.055]	0.044 [-0.029,0.118]	0.026 [-0.006,0.057]
Female	0.024 [-0.032,0.079]	0.026 [-0.027,0.079]	-0.02 [-0.083,0.043]	0.031 [-0.027,0.089]	0.023 [-0.015,0.062]	-0.002 [-0.059,0.055]	0.007 [-0.018,0.032]
Currently Married	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Previously Married	-0.007 [-0.073,0.058]	-0.015 [-0.077,0.047]	0.044 [-0.017,0.105]	-0.048 [-0.120,0.024]	0.028 [-0.011,0.068]	0.028 [-0.034,0.091]	0.001 [-0.027,0.029]
Never Married	0.049 [-0.037,0.135]	-0.113** [-0.193,-0.033]	0.023 [-0.057,0.103]	-0.01 [-0.097,0.077]	0.011 [-0.036,0.058]	0.041 [-0.043,0.126]	-0.007 [-0.040,0.027]
Rural	-0.017 [-0.096,0.061]	0.029 [-0.046,0.105]	-0.026 [-0.080,0.028]	0.02 [-0.061,0.102]	0.004 [-0.047,0.054]	0.041 [-0.049,0.132]	0.012 [-0.021,0.045]

Not at all Confident	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Somewhat Confident	0.053 [-0.120,0.226]	0.031 [-0.125,0.187]	0.02 [-0.117,0.157]	0.08 [-0.061,0.222]	0 [-0.089,0.090]	0.056 [-0.074,0.185]	0.033 [-0.022,0.087]
Confident	0.025 [-0.136,0.186]	-0.002 [-0.152,0.147]	0.068 [-0.074,0.209]	0.096 [-0.052,0.244]	0.041 [-0.039,0.121]	0.097 [-0.026,0.219]	0.045 [-0.014,0.104]
Very Confident	0.118 [-0.049,0.286]	0.052 [-0.099,0.203]	0.083 [-0.049,0.215]	0.079 [-0.059,0.217]	0.04 [-0.037,0.116]	0.096 [-0.030,0.221]	0.054 [-0.005,0.112]
Unknown Confidence	-0.077 [-0.294,0.141]	0.019 [-0.215,0.253]	0.024 [-0.144,0.192]	0.062 [-0.099,0.224]	0.023 [-0.070,0.117]	0.082 [-0.048,0.213]	0.032 [-0.045,0.109]
Income	0.000** [0.000,0.000]	0 [-0.000,0.000]	0 [-0.000,0.000]	0 [-0.000,0.000]	0 [-0.000,0.000]	0 [-0.000,0.000]	0 [-0.000,0.000]
< High School	Ref	Ref	Ref	Ref	Ref	Ref	Ref
High School Graduate	-0.005 [-0.092,0.083]	-0.021 [-0.101,0.060]	0.017 [-0.059,0.094]	0.05 [-0.026,0.125]	0.01 [-0.034,0.053]	0.032 [-0.049,0.114]	0.013 [-0.020,0.047]
Some College	0.045 [-0.032,0.122]	-0.031 [-0.120,0.059]	0.042 [-0.042,0.127]	0.018 [-0.070,0.105]	-0.002 [-0.050,0.046]	0.061 [-0.040,0.163]	0.023 [-0.019,0.064]
College Graduate	0.084 [-0.040,0.209]	-0.009 [-0.114,0.096]	0.084 [-0.025,0.192]	0.144* [0.032,0.256]	0.073* [0.007,0.140]	0.201*** [0.084,0.319]	0.062** [0.019,0.106]
Graduate School	0.203* [0.048,0.359]	0.031 [-0.092,0.154]	-0.086 [-0.196,0.023]	0.138* [0.007,0.269]	0.046 [-0.041,0.133]	0.128* [0.011,0.244]	0.028 [-0.024,0.080]

Any Private Insurance	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Public Insurance Only	-0.047 [-0.124,0.030]	0.006 [-0.060,0.072]	-0.012 [-0.081,0.056]	-0.05 [-0.126,0.025]	-0.038 [-0.082,0.006]	-0.028 [-0.103,0.046]	-0.022 [-0.052,0.008]
Uninsured	-0.138* [-0.251,-0.025]	-0.111* [-0.213,-0.010]	-0.205** [-0.327,-0.082]	-0.233*** [-0.346,-0.121]	-0.081 [-0.170,0.009]	-0.166** [-0.278,-0.054]	-0.110*** [-0.160,-0.059]
Poor Health	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Fair Health	-0.035 [-0.177,0.107]	0.072 [-0.071,0.214]	0.153* [0.024,0.282]	0.079 [-0.047,0.206]	0.031 [-0.059,0.121]	-0.042 [-0.185,0.102]	0.035 [-0.016,0.086]
Good Health	0.007 [-0.132,0.147]	0.105 [-0.030,0.240]	0.094 [-0.034,0.223]	0.047 [-0.072,0.165]	0.024 [-0.059,0.107]	-0.128 [-0.264,0.008]	0.007 [-0.040,0.054]
Very Good Health	-0.018 [-0.173,0.137]	0.143 [-0.006,0.291]	0.134* [0.000,0.268]	0.044 [-0.082,0.171]	-0.005 [-0.094,0.085]	-0.047 [-0.200,0.107]	0.026 [-0.028,0.081]
Excellent Health	0.052 [-0.124,0.227]	0.132 [-0.033,0.298]	0.098 [-0.058,0.253]	-0.026 [-0.168,0.116]	-0.035 [-0.125,0.054]	-0.153 [-0.331,0.024]	-0.001 [-0.067,0.064]
Poor MH	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Fair MH	-0.018 [-0.103,0.067]	0.05 [-0.026,0.126]	-0.018 [-0.096,0.059]	0.007 [-0.076,0.090]	-0.003 [-0.053,0.048]	0.008 [-0.073,0.090]	0.007 [-0.026,0.040]
Good MH	-0.097* [-0.179,-0.014]	-0.005 [-0.078,0.067]	0.041 [-0.037,0.120]	-0.027 [-0.117,0.064]	-0.038 [-0.086,0.011]	0.034 [-0.052,0.119]	0.002 [-0.033,0.037]
Very Good MH	-0.033 [-0.140,0.074]	0.071 [-0.024,0.166]	0.048 [-0.060,0.156]	0.003 [-0.104,0.111]	-0.003 [-0.068,0.062]	-0.011 [-0.124,0.102]	0.02 [-0.023,0.062]
Excellent MH	-0.211* [-0.398,-0.023]	0.097 [-0.075,0.269]	0.029 [-0.128,0.186]	0.017 [-0.156,0.189]	0.09 [-0.036,0.217]	-0.007 [-0.190,0.177]	0.018 [-0.053,0.089]

Insulin Use	0.085** [0.021,0.149]	0. 124*** [0.067,0.181]	0.159*** [0.097,0.221]	0.114*** [0.058,0.171]	0.034 [-0.006,0.074]	0.145*** [0.086,0.204]	0.087*** [0.061,0.114]
High Cholesterol	0.033 [-0.033,0.099]	-0.025 [-0.086,0.036]	0.011 [-0.053,0.074]	0.01 [-0.054,0.073]	0.059** [0.021,0.096]	-0.007 [-0.066,0.051]	0.009 [-0.017,0.035]
Angina	-0.062 [-0.181,0.058]	0.034 [-0.058,0.126]	-0.05 [-0.156,0.056]	0.058 [-0.069,0.186]	-0.009 [-0.083,0.066]	-0.09 [-0.201,0.021]	0.005 [-0.047,0.057]
Arthritis	0.073* [0.011,0.136]	0.02 [-0.033,0.074]	0.021 [-0.034,0.076]	0.064* [0.001,0.127]	0.021 [-0.020,0.062]	0.088** [0.029,0.148]	0.027* [0.003,0.052]
Cancer	0.027 [-0.039,0.093]	0.011 [-0.049,0.072]	-0.043 [-0.105,0.019]	0.036 [-0.053,0.125]	-0.036 [-0.082,0.010]	0.097* [0.010,0.183]	0.004 [-0.029,0.036]
Stroke	0.001 [-0.089,0.090]	-0.017 [-0.102,0.067]	-0.069 [-0.155,0.017]	-0.006 [-0.094,0.081]	0.027 [-0.033,0.087]	0.003 [-0.095,0.101]	-0.011 [-0.052,0.030]
Emphysema	-0.036 [-0.187,0.116]	-0.119 [-0.257,0.018]	-0.023 [-0.190,0.144]	-0.03 [-0.196,0.136]	-0.106* [-0.189,-0.024]	0.012 [-0.168,0.192]	-0.04 [-0.118,0.039]
Coronary Heart Disease	-0.072 [-0.153,0.008]	0.002 [-0.086,0.090]	0.024 [-0.081,0.128]	0.026 [-0.066,0.118]	-0.025 [-0.079,0.029]	0.054 [-0.034,0.143]	0.021 [-0.020,0.062]
High Blood Pressure	-0.007 [-0.086,0.072]	0.03 [-0.045,0.104]	-0.012 [-0.081,0.056]	-0.01 [-0.081,0.060]	0.035 [-0.012,0.081]	0.080* [0.012,0.147]	0.019 [-0.008,0.046]
Heart Attack	0.045 [-0.051,0.141]	-0.017 [-0.123,0.089]	-0.043 [-0.123,0.037]	-0.058 [-0.159,0.044]	0.015 [-0.044,0.075]	-0.069 [-0.171,0.034]	-0.028 [-0.073,0.017]
Other Heart Disease	0.007 [-0.066,0.079]	-0.001 [-0.070,0.068]	-0.027 [-0.100,0.047]	-0.064 [-0.144,0.016]	0.008 [-0.039,0.056]	-0.01 [-0.084,0.065]	-0.005 [-0.040,0.029]
	N = 1,809	N = 1,809	N = 1,762	N = 1,789	N= 1,786	N = 1,765	N = 1,696

Marginal effects; 95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
MH = Mental Health

Chapter V. Disussion

The analysis found that having a personal was associated with a higher likelihood of receiving any A1C, at least 4 A1Cs, a foot exam, a cholesterol test, and a flu vaccine. It was not associated with receipt of an eye exam. Whole person orientation and coordinated care were not associated with receipt of any of the diabetes management services. Enhanced access was negatively associated with the receipt of a cholesterol test and flu vaccine, but not associated with the remainder of the diabetes management services. Therefore, the analysis failed to reject the main null hypothesis, and sub-hypotheses, that each PCMH component will be unassociated with the receipt of each diabetes management service. The second main hypothesis predicted that usual source of care would have the strongest relationship with receipt of diabetes management services. This hypothesis was confirmed. Not only was usual source of care have an association with the largest number of diabetes management services, but the magnitude of the marginal effects were also the largest.

The finding that having a usual source of care was strongly associated with receipt of A1C testing, foot exam, cholesterol tests, and flu vaccines is consistent with the literature. Many studies have similarly found that having a usual source of care is positively associated with receipt of routine and preventive care services.[76] Drivers behind utilization of preventive or routine services and acute care could be very different. Utilization of acute care is driven primarily by perceived need. Alternatively, perceived need for preventive and routine services is often inadequate to motivate utilization. Instead, primary care providers, and other usual sources of care, often provide a cue to action[77] for the individual based on evaluated need that leads to uptake. This is particularly true for diabetes management because of low self-efficacy. Among the study population, only 33% of individuals reported being very confident in their ability to manage their

diabetes. Individuals with lower self-efficacy are less likely to seek routine management services autonomously and instead require a recommendation from a usual source of care.[78]

Contrary to the hypotheses, no relationship was found between whole person orientation or coordination and receipt of diabetes management services. Surprisingly, a similar study found that whole person orientation and coordinated care were positively associated with increased odds of receiving a flu vaccine and a cholesterol test.[58] The negative association with between enhanced access and receipt of a cholesterol test or flu vaccine was an unexpected finding, but is consistent with results from another study which found a negative, but only near-significant correlation between them.[58] One possible explanation for this finding relates to the removal of barriers. Individuals with diabetes should be heavy users of primary care services. Guidelines recommend a minimum of 3 to 4 diabetes related visits per year. Thus, if barriers to accessing care are removed, these individuals have frequent primary care visits. It is possible that this spreads the responsibility for providing cholesterol tests and flu shots out. If the healthcare practitioner thinks that he/she can perform this procedure at the next visit, it may remove urgency from the situation and result in fewer individuals receiving the recommended services. Finally, receipt of an annual eye exam was unassociated with any of the independent variables. Given that most primary care practices are unequipped to screen for diabetic retinopathy, screening is usually done by an outside ophthalmologist. This likely explains the findings. If individuals have an ongoing relationship with an ophthalmologist, their usual source of care may have no involvement in assuring they receive an annual eye exam.[79]

The findings of this study may suggest that the PCMH model may not improve the management of diabetes, and other chronic diseases, as was predicted. These unexpected

results could be explained by limitations in the ability of the data to measure the PCMH components. Friedberg identifies three categories of studies examining the PCMH.[80] The first includes studies that measure the impact of a PMCH intervention in a primary care practice. The second category is made of studies that classify practices into PCMHs and non-PCMHs and look at differences in outcomes according to these primary care characteristics. Finally, the third category includes studies, like this one, which examine patterns of care experienced by patients. As a result, each type study utilizes a different definition of the PCMH. This could explain the mixed findings in the PCMH literature. In addition, much of the model governs organizational level practices which may be invisible to the patient.[80] These factors include team-based care, population level management, individuals care planning, and use of HIT. It is possible that these factors drive receipt of diabetes management services, rather than the patterns of care experienced by the patient.

Strength and Limitations

The research has several strengths. The study utilized a nationally representative sample of Americans with diabetes. Much of the research conducted on the PCMH is set in practices that have undergone PCMH transformation, thus the results are not generalizable beyond the population studied. This research can be generalized to all individuals with diabetes in the United States, and is not limited to on health care setting. In addition, much of the research on the PCMH model focuses on organizational processes.[39] This research instead examines the individual's experience with their care. Given that the PCMH is founded upon the concept of patient-centeredness, this a powerful and alternative perspective. Finally, it is the first study of its kind to look specifically at diabetes.

There are also limitations of the study. First, the study has a cross-sectional design which limits the ability to draw causal inferences. The DCS does not allow for the

differentiation between Type 1 and Type 2 diabetes. Individuals with Type 1 diabetes may have very different experiences with their care. However, given the distribution of diabetes cases between 1 and 2, it is probable that the majority of individuals in the DCS have Type 2. The DCS also relies on self-report and is a self-administered component. It is possible that lack of comprehension or poor recollection may have resulted in over or underestimation receipt of services.[81] This is most likely true for the measure of A1C testing. A small number of individuals reported an unreasonably high number of A1C tests in 2012: as many as 95. A possible explanation for this phenomenon is that some individuals confused A1C testing with blood glucose "finger pricks". Overestimating the receipt of A1C tests could have biased the results toward the null. The research attempted to account for this by recoding any observation with more than 12 A1Cs into an alternative category that was included in the regression models. Outcomes data that are not self-reported may be more reliable. The study sample also overwhelming reported that they would go to their usual source of care for preventive care, referrals, new problems, and ongoing care. Discrepancies exist between what individuals speculate they would do and their actual health behaviors.[82] It is possible, that when confronted with the situation, individuals who scored yes to whole person orientation would in actuality utilize the emergency room or urgent care clinic instead of their usual source of care.

Another limitation of the study is the difficulty of measuring the PMCH model. There are components of the PCMH framework that could not be measured using the MEPS dataset. These components include physician-directed practice, quality and safety, and value-based payment. It is possible that these components, particularly quality and safety, drive the management of chronic diseases like diabetes. These components of the PCMH model are highly structural and can be measured as processes of care, but are often invisible to the patient making them difficult to measure in a study examining patients' experiences. There may also be limitations of the measurement of the components of the

PCMH that were included in the research. Not only is the PCMH a complex model, but it is often defined structurally, both in research and in the existing frameworks, particularly using the NCQA criteria. Thus it is challenging to comprehensively capture the constructs using patterns of care that are experienced by patients.

Finally, the study examined the relationship between PCMH components and process measures (receipt of management services), not diabetes health outcomes. While these process measures contribute to high quality diabetes management, they are not the only important factors. High quality health education and the ability of individuals to engage in self-management also impact health outcomes and which may be influenced by the PCMH. A relationship could exist between the PCMH components and diabetes health outcomes like A1C control.

Implications and Recommendations

This research reaffirms that having a usual source of care is critical for patients with diabetes, and likely other chronic diseases. Having a usual source of care significantly increases the likelihood of receiving necessary routine care. While the research was inconclusive regarding the potential of the PCMH for improving the management of diabetes, this does not mean that PCMH does not improve diabetes care. Rather it indicates that the factors driving improvements in quality in other studies may be invisible to the patient. However, this research did illuminate the difficulties of defining and measuring the PCMH. In particular, it revealed the difficulty of applying the process and structural focused PCMH framework to the measurement of patient experiences with care. Future work should focus on creating a PCMH definition that reconciles the three approaches to PCMH measurement: intervention, practice characteristics, and patient experiences. In addition, PCMH frameworks should more closely consider the experiences of patients with their care. Future research could stratify the sample by high and low users

and by Type 1 versus Type 2. Previous research has shown that frequent users of the health care system look and behave differently from infrequent users, and this may reveal more nuanced results.[83] In addition, research should examine the components of the PCMH model that are unobservable to the individual including physician-directed practice (i.e. team-based care), focus on quality and safety, and value-based payment. The Primary Care Assessment Tool and Consumer Assessment of Healthcare Providers and Systems are two survey tools that may be used for further research. Finally, additional research could explore the unexpected finding that enhanced access was negatively associated with the receipt of a cholesterol test and flu shot. Qualitative research may help identify barriers to receiving these services and generate hypotheses to explain the results.

REFERENCES

1. American Diabetes Association. Economic costs of diabetes in the US in 2012. Diabetes care 2013;36:1033-46.

2. Centers for Disease Control and Prevention. National diabetes statistics report: estimates of diabetes and its burden in the United States, 2014. Atlanta, GA: US Department of Health and Human Services 2014.

3. Seaquist ER. Addressing the burden of diabetes. Jama 2014;311:2267-8.

4. Wagner EH, Austin BT, Davis C, Hindmarsh M, Schaefer J, Bonomi A. Improving chronic illness care: translating evidence into action. Health affairs 2001;20:64-78.

5. Bojadzievski T, Gabbay RA. Patient-centered medical home and diabetes. Diabetes Care 2011;34:1047-53.

6. American Academy of Family Physicians. Joint principles of the patient-centered medical home. Delaware medical journal 2008;80:21.

7. Iglehart JK. No place like home—testing a new model of care delivery. New England Journal of Medicine 2008;359:1200-2.

8. Hoff T, Weller W, DePuccio M. The Patient-Centered Medical Home A Review of Recent Research. Medical Care Research and Review 2012;69:619-44.

9. Stange KC, Miller WL, Nutting PA, Crabtree BF, Stewart EE, Jaen CR. Context for understanding the National Demonstration Project and the patient-centered medical home. Ann Fam Med 2010;8 Suppl 1:S2-8; S92.

10. Crabtree BF, Nutting PA, Miller WL, Stange KC, Stewart EE, Jaen CR. Summary of the National Demonstration Project and recommendations for the patient-centered medical home. Ann Fam Med 2010;8 Suppl 1:S80-90; S2.

11. Nutting PA, Miller WL, Crabtree BF, Jaen CR, Stewart EE, Stange KC. Initial lessons from the first national demonstration project on practice transformation to a patient-centered medical home. The Annals of Family Medicine 2009;7:254-60.

12. Andersen RM. Revisiting the behavioral model and access to medical care: does it matter? Journal of health and social behavior 1995:1-10.

13. Agency for Healthcare Research and Quality. MEPS HC-155 2012 Full Year Consolidated Data File. Rockville, MD2014.

14. Group GSW. The" top 5" lists in primary care: meeting the responsibility of professionalism. Archives of Internal Medicine 2011;171:1385.

15. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care 2014;37:S81-S90.

16. American Diabetes Association. Standards of medical care in diabetes—2014. Diabetes care 2014;37:S14-S80.

17. American Diabetes Association. 1. Strategies for Improving Care. Diabetes Care 2015;38:S5-S7.

18. Handelsman Y, Mechanick JI, Blonde L, et al. American Association of Clinical Endocrinologists Medical Guidelines for Clinical Practice for developing a diabetes mellitus comprehensive care plan. Endocrine Practice 2011;17:1-53.

19. Shamoon H, Duffy H, Fleischer N, et al. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes-mellitus. New England Journal of Medicine 1993;329:977-86.

20. Narayan KV, Boyle JP, Geiss LS, Saaddine JB, Thompson TJ. Impact of recent increase in incidence on future diabetes burden US, 2005–2050. Diabetes care 2006;29:2114-6.

21. Skyler JS, Oddo C. Diabetes trends in the USA. Diabetes/metabolism research and reviews 2002;18:S21-S6.

22. Miller ST, Schlundt DG, Larson C, et al. Exploring ethnic disparities in diabetes, diabetes care, and lifestyle behaviors: the Nashville REACH 2010 community baseline survey. Ethnicity and Disease 2004;14:S1-38.

23. Walton JW, Snead CA, Collinsworth AW, Schmidt KL. Reducing diabetes disparities through the implementation of a community health worker–led diabetes self-management education program. Family & community health 2012;35:161-71.

24. Cowie CC, Rust KF, Byrd-Holt DD, et al. Prevalence of diabetes and high risk for diabetes using A1C criteria in the US population in 1988–2006. Diabetes care 2010;33:562-8.

25. Saydah S, Lochner K. Socioeconomic status and risk of diabetes-related mortality in the US. Public health reports 2010;125:377.

26. Saaddine JB, Cadwell B, Gregg EW, et al. Improvements in diabetes processes of care and intermediate outcomes: United States, 1988–2002. Annals of Internal Medicine 2006;144:465-74.

27. Garg S, Davis RM. Diabetic retinopathy screening update. Clinical diabetes 2009;27:140.

28. Olayiwola J, Sobieraj D, Kulowski K, Hilaire DS, Huang J. Improving diabetic retinopathy screening through a statewide telemedicine program at a large federally qualified health center. Journal of health care for the poor and underserved 2011;22:804-16.

29. Chen R, Cheadle A, Johnson D, Duran B. US trends in receipt of appropriate diabetes clinical and self-care from 2001 to 2010 and racial/ethnic disparities in care. The Diabetes Educator 2014;40:756-66.

30. Stange KC, Nutting PA, Miller WL, et al. Defining and measuring the patient-centered medical home. J Gen Intern Med 2010;25:601-12.

31. Kilo CM, Wasson JH. Practice redesign and the patient-centered medical home: history, promises, and challenges. Health Affairs 2010;29:773-8.

32. Bodenheimer T, Wagner EH, Grumbach K. Improving primary care for patients with chronic illness. JAMA 2002;288:1775-9.

33. Carrier E, Gourevitch MN, Shah NR. Medical Homes: Challenges in Translating Theory Into Practice. Medical care 2009;47:714-22.

34. McGlynn EA, Asch SM, Adams J, et al. The quality of health care delivered to adults in the United States. New England journal of medicine 2003;348:2635-45.

35. 2015 Patient-Centered Medical Home Recognition Award. 2015. (Accessed January 31, 2016, at http://bphc.hrsa.gov/programopportunities/fundingopportunities/pcmh.html.)

36. Bethell CD, Read D, Brockwood K. 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 2004;113:1529-37.

37. Beal A, Hernandez S, Doty M. Latino access to the patient-centered medical home. J Gen Intern Med 2009;24 Suppl 3:514-20.

38. Pourat N, Lavarreda SA, Snyder S. Patient-centered medical homes improve care for adults with chronic conditions. 2013.

39. Agency for Heatlhcare Research and Quality. The Medical Home: What Do We Know, What Do We Need to Know? A Review of the Earliest Evidence on the Effectiveness of the Patient-Centered Medical Home Model Rockville, MD2013. Report No.: 12(14)-0020-1-EF

40. National Committee for Quality Assurance. 2014 PCMH Standards and Guidelines. 2014.

41. Reid RJ, Larson EB. Financial implications of the patient-centered medical home. JAMA 2012;308:83-4.

42. Cassidy A. Patient-centered medical homes. A new way to deliver primary care may be more affordable and improve quality. But how widely adopted will the model be. Health Affairs Retrieved from http://www healthaffairs org/healthpolicybriefs/brief php 2010.

43. Wexler R, Lehman J, Welker MJ. Patient Centered Medical Home transformation at an academic medical center. Journal of Hospital Administration 2015;5:p34.

44. Gabbay RA, Bailit MH, Mauger DT, Wagner EH, Siminerio L. Multipayer patient-centered medical home implementation guided by the chronic care model. Joint Commission Journal on Quality and Patient Safety 2011;37:265-73.

45. Nelson KM, Helfrich C, Sun H, et al. Implementation of the patient-centered medical home in the Veterans Health Administration: associations with patient satisfaction, quality of care, staff burnout, and hospital and emergency department use. JAMA Intern Med 2014;174:1350-8.

46. Stevens GD, Shi L, Vane C, Nie X, Peters AL. Primary Care Medical Home Experience and Health-Related Quality of Life Among Adult Medicaid Patients with Type 2 Diabetes. Journal of general internal medicine 2014:1-8.

47. Smith JJ, Johnston JM, Hiratsuka VY, Dillard DA, Tierney S, Driscoll DL. Medical home implementation and trends in diabetes quality measures for AN/AI primary care patients. Primary care diabetes 2014.

48. Rosenthal MB, Alidina S, Friedberg MW, et al. Impact of the Cincinnati Aligning Forces for Quality Multi-Payer Patient Centered Medical Home Pilot on Health Care Quality, Utilization, and Costs. Medical Care Research and Review 2015:1077558715618566.

49. Rosenthal MB, Alidina S, Friedberg MW, et al. A difference-in-difference analysis of changes in quality, utilization and cost following the Colorado multi-payer patient-centered medical home pilot. Journal of general internal medicine 2015:1-8.

50. Reibling N, Rosenthal MB. The (Missed) Potential of the Patient-centered Medical Home for Disparities. Medical care 2016;54:9-16.

51. Hoilette LK, Blumkin AK, Baldwin CD, Fiscella K, Szilagyi PG. Community health centers: medical homes for children? Acad Pediatr 2013;13:436-42.

52. Kieckhefer GM, Greek AA, Joesch JM, Kim H, Baydar N. Presence and characteristics of medical home and health services utilization among children with asthma. Journal of Pediatric Health Care 2005;19:285-92.

53. Romaire MA, Bell JF. The medical home, preventive care screenings, and counseling for children: evidence from the Medical Expenditure Panel Survey. Academic pediatrics 2010;10:338-45.

54. Romaire MA, Bell JF, Grossman DC. Health care use and expenditures associated with access to the medical home for children and youth. Medical care 2012;50:262-9.

55. Romaire MA, Bell JF, Grossman DC. Medical home access and health care use and expenditures among children with special health care needs. Archives of pediatrics & adolescent medicine 2012;166:323-30.

56. Mills J, Hall A, Tanner R, Harman J, Wood DL, Lorbeer C. The comparative impact of different patient-centered medical home domains on satisfaction among individuals living with type II diabetes. Patient Experience Journal 2015;2:132-41.

57. Estrada D. Effects of patient centered medical homes on expenditures of healthy populations: UNIVERSITY OF FLORIDA; 2012.

58. VanGompel ECW, Jerant AF, Franks PM. Primary Care Attributes Associated with Receipt of Preventive Care Services: A National Study. The Journal of the American Board of Family Medicine 2015;28:733-41.

59. Philpot LM, Stockbridge EL, Padrón NA, Pagán JA. Patient-Centered Medical Home Features and Health Care Expenditures of Medicare Beneficiaries with Chronic Disease Dyads. Population health management 2015.

60. Xin H, Kilgore ML, Menachemi N, Sen BP. The relationships between access to and use of a patient-centered medical home and healthcare utilization and costs: A cohort study using Medical Expenditure Panel Survey data from 2007 to 2010. Health Services Management Research 2014;27:70-81.

61. Krishna S, Gillespie KN, McBride TM. Diabetes burden and access to preventive care in the rural United States. The Journal of Rural Health 2010;26:3-11.

62. Owens MD, Beckles GL, Ho KK-Y, Gorrell P, Brady J, Kaftarian JS. Women with diagnosed diabetes across the life stages: underuse of recommended preventive care services. Journal of Women's Health 2008;17:1415-23.

63. Barer ML, Evans RG, Hertzman C, Lomas J. Aging and health care utilization: new evidence on old fallacies. Social Science & Medicine 1987;24:851-62.

64. Rosenstock IM. The health belief model and preventive health behavior. Health Education & Behavior 1974;2:354-86.

65. Brown AF, Gregg EW, Stevens MR, et al. Race, ethnicity, socioeconomic position, and quality of care for adults with diabetes enrolled in managed care the Translating Research Into Action for Diabetes (TRIAD) study. Diabetes care 2005;28:2864-70.

66. Harris MI. Racial and ethnic differences in health care access and health outcomes for adults with type 2 diabetes. Diabetes care 2001;24:454-9.

67. Oster NV, Welch V, Schild L, Gazmararian JA, Rask K, Spettell C. Differences in self-management behaviors and use of preventive services among diabetes management enrollees by race and ethnicity. Disease Management 2006;9:167-75.

68. Correa-de-Araujo R, McDermott K, Moy E. Gender differences across racial and ethnic groups in the quality of care for diabetes. Women's Health Issues 2006;16:56-65.

69. Seeff LC, Nadel MR, Klabunde CN, et al. Patterns and predictors of colorectal cancer test use in the adult US population. Cancer 2004;100:2093-103.

70. Ozminkowski RJ, Goetzel RZ, Shechter D, Stapleton DC, Baser O, Lapin P. Predictors of preventive service use among Medicare beneficiaries. Health care financing review 2005;27:5-23.

71. Selvin E, Brett KM. Breast and cervical cancer screening: sociodemographic predictors among White, Black, and Hispanic women. American journal of public health 2003;93:618-23.

72. Paustian ML, Alexander JA, El Reda DK, Wise CG, Green LA, Fetters MD. Partial and incremental PCMH practice transformation: implications for quality and costs. Health services research 2014;49:52-74.

73. Harris R, Leininger L. Preventive care in rural primary care practice. Cancer 1993;72:1113-8.

74. Sarkar U, Fisher L, Schillinger D. Is self-efficacy associated with diabetes self-management across race/ethnicity and health literacy? Diabetes care 2006;29:823-9.

75. Sambamoorthi U, McAlpine DD. Racial, ethnic, socioeconomic, and access disparities in the use of preventive services among women. Preventive medicine 2003;37:475-84.

76. DeVoe JE, Fryer GE, Phillips R, Green L. Receipt of preventive care among adults: insurance status and usual source of care. American journal of public health 2003;93:786-91.

77. Becker MH. The health belief model and personal health behavior: Slack; 1974.

78. Heisler M, Smith DM, Hayward RA, Krein SL, Kerr EA. How well do patients' assessments of their diabetes self-management correlate with actual glycemic control and receipt of recommended diabetes services? Diabetes care 2003;26:738-43.

79. Farley TF, Mandava N, Prall FR, Carsky C. Accuracy of primary care clinicians in screening for diabetic retinopathy using single-image retinal photography. The Annals of Family Medicine 2008;6:428-34.

80. Friedberg MW. What Do You Mean by Medical Home? Annals of Internal Medicine 2016.

81. Ritter PL, Stewart AL, Kaymaz H, Sobel DS, Block DA, Lorig KR. Self-reports of health care utilization compared to provider records. Journal of clinical epidemiology 2001;54:136-41.

82. Fisher RJ. Social desirability bias and the validity of indirect questioning. Journal of consumer research 1993:303-15.

83. Mehl-Madrona LE. Frequent users of rural primary care: comparisons with randomly selected users. The Journal of the American Board of Family Practice 1998;11:105-15.