DOES THE PATIENT CENTERED MEDICAL HOME IMPROVE THE CARE FOR THE HIGH NEED, HIGH COST POPULATION?

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ABSTRACT

Background: The patient-centered medical home (PCMH) has been proposed as a transformative model of delivery of health care that aims to improve health outcomes and lower health spending by providing care that is patient centered, comprehensive, coordinated, accessible and focused on quality and safety[1]. Although PCMH is rapidly becoming widespread, there is mixed evidence on the effectiveness of current medical homes in delivering any or all of these objectives[3]. There is disagreement as to whether this model is intended to improve care for all or should be targeted only at patients with high medical needs.[4] However, recent findings are identifying benefits among subgroups with chronic conditions. Studies are also finding that care for mental health conditions is not commensurate with care for physical conditions in the PCMH. Individuals with multiple chronic conditions and those with comorbid depression are among the most medically needy and costliest patients. In addition, the role of payment reform in PCMH is understudied. This dissertation evaluates how adults with multiple chronic conditions and co-morbid depression respond to a specific PCMH intervention with two methods of reimbursement; fee-for-service and partial capitation.

Methods: Administrative medical and pharmacy claims from a single commercial payer in the Albany and upstate New York areas for the years 2008 – 2013 are used. A segmented, interrupted time series design with individual level data clustered at the PCP level, with matched practice-level controls, was used to assess the effect of the transformation to PCMH of 22 practices recognized as NCQA Level 3, and the subsequent adoption of partial capitation of 13 of those practices. Outcomes include total

medical, inpatient, ambulatory and drug expenditures as well as inpatient, emergency department, and office visit utilization.

Results: PCMH affects subgroups with multiple chronic conditions. Payment through partial capitation increased access to ambulatory services and drugs while reducing the expenditures among those who used these services. PCMH continuing to remain on FFS had no effect among patients with co-morbid depression whereas PCMH with partial capitation has significant effects on ambulatory and drug expenditures.

Conclusions: This study finds that PCMH affects outcomes for those with multiple chronic conditions. Further innovations in care need to be implemented in the PCMH to address the subgroup of patients with multiple chronic conditions with co-morbid depression. Payment reform is critical for the success of PCMH.

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1. INTRODUCTION, BACKGROUND AND STUDY RATIONALE

1.1 *Introduction*

The patient centered medical home (PCMH) evolved from models such as the Pediatric Medical Home Model and the Chronic Care Model and elements of these efforts have been incorporated into payment reform efforts to create the Joint Principles of the Patient-Centered Medical Home.[5-9] The Joint Principles describe the characteristics of a PCMH. They are that each patient has an ongoing relationship with a primary care physician who leads a team of clinicians in the coordinated care of the patient. Care of the patient is focused on the entire patient's health needs (whole person orientation) supporting enhanced access, quality of care and patient safety.

However, there are concerns that PCMH will not be the "rising tide that lifts all boats" and that it is necessary to appropriately match the person to the appropriate type of the medical home as people with different medical and psycho-social conditions may need different types of care delivery systems. There is concern that particular patient populations are not being well served with a non-specialty care medical home or without a well-established medical neighborhood that can bridge accountability and facilitate coordination between specialists and the medical home.[10,11] As a result, it is unclear how the health benefits of the PCMH will vary across different patient populations; simply looking at the average effect may lead to misleading conclusions.

There are a number of different patient populations that are expected to benefit from PCMHs. For instance, psychiatric conditions are associated with increases in utilization and spending for both physical and mental health services. There is also concern that

patients with multiple co-morbidities will have difficulty identifying the appropriate delivery system[12,13]. Managing care among this group is important as multiple chronic conditions increase the risks for poor outcomes including mortality and functional limitations. In addition, havng multiple chronic conditons increases the utilization of high cost services such as hospitalizations and emergency room visits and spending.[14,15] For some patients with complex personal circumstances or illnesses, such as those with persistent mental disorders, cancer or AIDS, PCMH may not be the most appropriate model since their care may need to be coordinated by a specialist.[16,17] If so, it is especially important to find a good match for these populations and to adequately evaluate the impact of PCMH on these populations.

In addition to the challenge to PCMH to achieve success across certain populations is the challenge of how to adequately fund primary care so as to reimburse for care coordination and team-based care. Some have warned providers to wait to implement PCMH until it current pilots discover what levels of reimbursement are needed to get providers to engage in the necessary care activities.[18,19] Various approaches to funding and implementing the medical home concept have been found to improve care and/or reduce spending. However, relatively few comprehensive evaluations that specifically focus on the reimbursement model have been carried out, and the net economic impact is uncertain.[20,21]

The approach evaluated in this study used a reimbursement model, whereby primary care processes receive a monthly, risk-adjusted partial capitation payment for the comprehensive care of all patients in the practice.

The purpose of this study is to evaluate whether coupling a coordinated, team-based care transformation plan with this novel reimbursement model would result in more cost-effective medical home practices that were able to decrease total spending and utilization, while still improving outcomes. We are particularly interested in the impact of these initiatives on two population subgroups; those with multiple chronic conditions and those with mental and behavioral health conditions. Adults with multiple chronic conditions account for more than two-thirds of health care spending[15], see multiple physicians, have worse outcomes, and experience more care transitions than other adults. Over 40% of patients seen in primary care settings have behavioral health conditions[23]. Both subgroups need more care and are expected to benefit from care coordination and access to timely care and thus present more actionable opportunities for providers to reign in service use and expenditures and address unmet needs. In addition, the higher rates of service use allow these patients to respond to coordinated care in shorter post-implementation follow-up periods. We hypothesize that these population subgroups will stand to benefit more from coordinated care delivered by PCMH and are interested in evaluating the impact of PCMH with payment reform on these populations.

1.2 *Background*

The term "medical home" is attributed to the American Academy of Pediatrics to describe a single central source of care for children with special health needs.[24] The current model of PCMH has refined this "medical home" concept by incorporating other primary care efforts including Wagner's Chronic Care Model which seeks to improve chronic health care.[25,26] In 2007, the Joint Principles of the Patient-Centered Medical Home were endorsed by the four primary care physician societies[1] – the American

Academy of Family Physicians (AAFP), the American Academy of Pediatrics (AAP), the American College of Physicians (ACP), and the American Osteopathic Association (AOA). They did so in response to rising health care costs, increasing physician burnout and a workforce shortage and the expectation that the PCMH may lower costs and improve outcomes[27,29] Since then, an additional 19 physician organizations have endorsed the concept. The Patient Centered Primary Care Collaborative (PCPCC) has been established; it is a not-for-profit organization dedicated to advancing primary care and the patient-centered medical home[30,193], and it has adopted the Joint Principles of the Patient-Centered Medical Home.[31] More recently PCMH has endorsed the operational definition from the Agency for Healthcare Research and Quality (AHRQ)[32]; a PCMH intervention contains five functions and three foundations. This definition is promoted by the Patient-Centered Primary Care Collaborative. There are a wide variety of PCMH initiatives which differ in specifics of their implementation. However, multiple groups have set out to provide functional definitions of the PCMH. To be considered a PCMH as delivering care that is comprehensive, patient-centered, coordinated, accessible and committed to quality and safety. Table 1.7.1 details these components.

[Table 1.7.1 Functions of a PCMH as defined by AHRQ]

In addition to these functions AHRQ recognizes three foundational supports that are necessary in order to obtain the full potential of PCMH. These include a strong primary care workforce, the use of Health IT, proper payment reform to support PCMH goals.[32]

Although peer-reviewed evaluations of patient-centered medical homes have shown mixed results for quality of care and overall costs, they have shown generally positive effects on patient and staff experience, rate of ED visits and delivery of preventive care services.[5-9,20,33-34] (More details on evaluations that have been performed are in Section 1.6; *Evaluations of Impact of PCMH*.) The concept of the patient-centered medical home has gained momentum and the adoption of PCMH as a model of care delivery has demonstrated significant growth over the past 6 years and has particularly "ramped up" since the ACA in 2010.[20, 35-36]

1.3 *Implementation of PCMH*

There are many different types of PCMH. Health plans, states or multi-stakeholder groups have organized different PCMH initiatives. State governments, public payers, private payers and multi-payer programs where multiple payers align their model of payment to enable the PCMH with payment reform have sponsored PCMH programs. The transformation of a primary practice into a patient-centered medical home has been aided through learning-collaboratives or transformation consultants.[35]

State legislation may support PCMH initiatives by instituting definitions and standards, authorizing new state programs, appropriating funds for new and existing programs and mandating commercial payer participation in multi-payer programs.

In general, patient-centered medical homes combine payment reform with such operational changes such as (but not limited to) the use of multidisciplinary care teams, enhanced health information technology including patient portals, transition care management, and chronic disease registries. In addition, some but not all PCMH

programs incorporate payment reform. A more detailed discussion of payment reform in PCMH can be found in Section 1.6; *Payment Reform and the PCMH*.

1.4 *PCMH Recognition*

The growth of PCMH initiatives has heralded the growth of PCMH recognition initiatives. There are many programs offering accreditations and tools for PCMH recognition.[36] A selection of the main programs is detailed in table 1.7.2. In addition to these efforts more general efforts various individual payers have developed state-level tools.

[Table 1.7.2 PMCH recognition programs]

PCMH initiatives may establish standards for qualifying as a patient-centered medical home by relying on external certification agencies or by developing standards within the initiative. A third alternative is by the enabling state or health plan. External recognition of PCMHs is provided by groups such as the Joint Commission, the National Committee for Quality Assurance (NCQA) and the Utilization Review and Accreditation Commission (URAC). NCQA certification provides three levels of certification at the practice site level indicative of the practice's achievements in attaining a pre-defined set of standards such as enhanced access and continuity, identifying and management patient populations and tracking and coordinating care among others .[37] State legislations may consider both external and internal standards in order to recognize a practice as a PCMH. For instance the Maryland legislation SB 855/HB 929 recognizes a PCMH with NCQA

recognition and the additional expectations such as capabilities with 24/7 access and medication reconciliation among others.

PCMH evaluations consider levels of recognition in order to ensure a consistency of features across comparisons. NCQA recognizes practices using a three-level topology that reflects the number of reforms the PCMH has in place. Successful adoption of each reform must be demonstrated by the PCMH and points are assigned accordingly. This evaluation looks specifically at PCMH's with level 3 NCQA PCMH accreditation, the most rigorous and highest attainable level obtainable from NCQA.

1.5 *Current landscape of PCMH activities*

There are a wide variety of PCMH initiatives. PCMH initiatives can be 1) sponsored by single private payers (commercial health plans) with variable market share in their region, 2) sponsored by multiple payers – private and/or public, and 3) designed to serve the Medicaid populations only, Medicare populations only, or both and 4) independently by individual primary care practices. Many of these initiatives have limited market share. Generally, initiatives that are led by single commercial payers or inclusive of Medicaid only populations encompass 20% or less of the health plan market share for their region whereas multi-payer initiatives tend to encompass more than 60% of the health plan market share.[35] Databases that catalogue patient-centered medical home initiatives are maintained by both the Patient-Centered Primary Care Collaborative[30] and the National Academy for State Health Policy.[38]

The initiative evaluated in this study is sponsored by a single commercial health plan with a significant market share in the geographic area. The following is a summary of current PCMH activities to provide an idea of the landscape of concurrent and similar programs underway. We briefly describe each type of initiative and where the program that we are evaluating fits in. The PCMH activities include private payer initiatives (integrated systems and private community practices), multi-payer initiatives, and federal initiatives.

Private-payer PCMH initiatives

Commercial payers may incentivize PCMH initiatives with the goals of reducing costs, improving satisfaction of members and providers and to improve the health of their members. PMCH initiatives undertaken by commercial payers vary widely with respect to their approach, financing, and extent of their coverage areas. These initiatives also vary widely with respect to the health plan market share and the extent of their coverage area within a state.[30]Although PCMH efforts undertaken by large, integrated systems have more resources at their disposal, a large number of the pilots have been single-payer projects. The single-payer health plans face their own unique set of challenges which includes; partial composition of a provider's panel comes from any particular payer and EHR interconnectivity with referring or collaborating providers is generally not well integrated. However, when single payers support PCMH implementations they provide much needed financial support for the initial capital and transformation expenses, as well as a blue-print for the transformation. Our study focuses on a PCMH initiative sponsored by a single commercial health plan described at the end of this chapter that provided the financial support to implement the program.

Multi-payer PCMH initiatives

A total of seventeen multi-payer medical home initiatives have been launched between 2008 and 2014.[39] Currently there are 24. Nineteen states have reported multi-payer PCMH initiatives and an additional two are planning for a multi-payer initiative.[38]

Federal PCMH initiatives

Federal PCMH activities include a catalogue of initiatives and a Federal Collaborative which provides opportunities to increase collaboration on PCMH-related activities among Federal agencies.[193] In addition, several programs have been instituted to foster development of primary care and implementation of PCMH. These programs include the Medicare Multi-Payer Advanced Primary Care Practice Initiative (MAPCP), CMS Comprehensive Primary Care Initiative (CPCI), Federally Qualified Health Center Advanced Primary Care Demonstration (FQHC APCP), CMS State Innovation Model (SIM), ACA Section 2703 Health Homes, and Section 1115 demonstrations.

Medicare Multi-Payer Advanced Primary Care Practice Initiative (MAPCP)

Beginning in 2011, The CMS CMMI has implemented a Medicare Multi-Payer Advanced Primary Care Practice Initiative, Medicare and state Medicaid programs in eight states joined with private health insurers. These collaborations included defining methods of payment for Medicare beneficiaries receiving advanced primary care through monthly care management fees and to cover care coordination, improved access, patient education, and other supporting services for chronically ill patients. Beginning in 2011, 8 states participated in the demonstration.[194]

Comprehensive Primary Care Initiative (CPCI)

A second Federal PCMH activity is the Comprehensive Primary Care Initiative (CPCI), a multi-payer initiative in which Medicare joined with state Medicaid agencies and private health insurance plans to offer bonus payments to PCPs for care coordination. This four year program engaged 500 high-performing primary care practices with over 2,000 providers.[195] The eight states include Maine, Michigan, Minnesota, New York, North Carolina, Pennsylvania, Rhode Island, and Vermont.

CMS State Innovation Model (SIM)

The State Innovation Models (SIM) initiative provides financial and technical support to states for the development and testing of multi-payer payment and service delivery models with the goals of improving health system performance, increasing quality of care and decreasing the costs for Medicare, Medicaid and CHIP beneficiaries.[198]

ACA 2703 – Health Homes

The Affordable Care Act Section 2703 provides for the development of health home services for Medicaid beneficiaries with chronic conditions. Twenty-five states are pursuing ACA Section 2703 Health Homes. This provision is a Medicaid Plan Option that provides a comprehensive system of care coordination for eligible beneficiaries whereby health home providers coordinate primary, acute, behavioral and long term services for patients. Specifically the health home services include comprehensive care management, care coordination, health promotion, transitional and follow-up care, patient and family support and referral to community and social support services.[199] States receive a 90% enhanced Federal Medical Assistance Percentage (FMAP) for the first 8 quarters of the program (which does not apply to the underlying Medicaid services).

Medicaid beneficiaries may be eligible to receive health home services if they have two or more chronic conditions, one chronic condition with risk for a second one, or a serious and persistent mental health condition. Health home state plan amendments may be submitted and currently 15 states have health plan amendments. For instance, Maryland has a Section 2703 health home state plan amendment approved in 2013 to create homes for Medicaid enrollees with opioid substance use disorder.

Section 1115 Demonstrations

Section 1115 of the Social Security Act gives the Secretary of Health and Human Services authority to approve demonstration projects pursuant of Medicaid and CHIP programs. Although demonstrations allowed through Section 1115 are broader than PCMHs, these waivers have been used for PCMH-like activities or to accelerate adoption of PCMH.

1.6 *Evaluations of the impact of PCMH*

We examined review articles that synthesized existing PCMH evaluations. We conducted a literature search of Pubmed to peer-reviewed articles linked with major mesh terms "Patient-Centered Care", Publication Type "Review", and general term PCMH. This search yielded 20 articles of which 5 were systematic reviews of PCMH evaluations.[23,40-44]

In general, evaluations of PCMH exhibit challenges and methodological concerns of existing initiatives such that current evidence is still deemed insufficient to determine most clinical and economic effects. Some of these concerns include variability between

PCMH implementations, limited consistency in nomenclature for PCMH, no inclusion of a payment model, the use of evaluation designs without comparison groups, insufficient rigor in the analytical methods, an inadequate number of practices that lead to low power, insufficient follow-up time, and estimating effects on a non-standardized list of outcomes.[41]

In 2009, the Commonwealth Fund established the Patient-Centered Medical Home Evaluator's Collaborative, a group of over 75 researchers tasked with defining a methodology for evaluation of PCMHs that would enable cross-PCMH comparisons, facilitate best evaluation practices and exchange information to improve evaluation designs. One of the main goals of this collaborative was to reach consensus on a standard core set of outcome measures and instruments.[45] These outcome measures will be used in our study and are discussed in more detail in Chapter 2.

Evaluations have focused on the overall population and only recently have they begun to focus of the impact of PCMH among people with multiple chronic condtions.[46-53] Some evaluations only focus on the subgroup of older adults with multiple chronic conditions.[23] In order to understand the impact of PCMH evaluations need to consider the effects on the overall population as well as on select subgroups that stand to benefit with more immediacy.[23,41] Our study seeks to address some of these gaps by performing an analysis of PCMH with two different types of payment models, using some of the Patient-Centered Medical Home Evaluator's Collaborative's outcome measures on, as it affects 1) the entire patient population, 2) the multi-morbid population and 3) the subgroup of multi-morbid with co-morbid depression.

We also performed two literature searches in Pubmed identifying peer-reviewed articles that were not literature reviews. One was linked with major mesh terms "Patient-Centered Care" and "Mental Health Services" and using the terms "PCMH". 6 articles were excluded because they did not focus on adults. The second search was linked with major mesh terms "Patient-Centered Care" and "Chronic Disease" and using the terms "patient-centered medical home" and "medical home". Fourteen of the 17 articles were excluded because they did not focus on adults with multiple chronic conditions. In all 3 cases the studies looked at one or two outcomes and a subset of the multi morbid population.

A study by Beadles et al[200], found that among Medicaid enrollees with multiple chronic conditions, adherence to new medications is greater for those enrolled in the medical home. This study examined the effect on the proportion of days covered on treatment medication as a measure of adherence using person-level fixed effect models. This study was limited Medicaid only eligible patients (excluding dual eligible for Medicare) and does not include all patients with MCC. Only a portion of the population with at least 2 chronic conditions from a list of pre-determined conditions selected based on their high prevalence and health expenditure were included.

David et al[201] assessed the impact of PCMH on ED utilization among patients with and without chronic illness. Chronic illness was defined as having one of 6 pre-determined conditions and patients were separated into two groups; non-chronic patients - those who did not have any chronic condition and chronic patients - those who had at least one chronic condition. This study found that among chronically ill patients who had some ED utilization, transition to PCMH is associated with 5-8% reductions in ED utilization.

Liss et al[202] assessed the impact of a PCMH redesign implemented at a clinic within an integrated health plan. This study found that PCMH patients have 21% fewer ambulatory care sensitive conditions, 7% fewer admissions, 17% lower inpatient costs and 7% lower total healthcare costs as compared to their controls. Patients were selected for the evaluation if they had at least one of three pre-determined chronic conditions.

These studies all found positive effects of PCMH on patients with at least one chronic condition. The studies evaluated different outcomes so there is no ability to compare the effect on similar outcomes. In addition, none of these studies differentiate the impact of PCMH on patients by number of chronic conditions. More studies evaluating the impact of PCMH on MCC population are necessary to determine if these effects are systematic.

1.7 *Payment reform and the PCMH*

The PCMH model endorsed in the Joint Principles of the Patient-Centered Medical Home includes payment reform as one of the critical elements of the model.[1] Traditional fee-for- service payments are often considered inadequate in supporting essential functions of the PCMH.[12,13,54-57] A couple of reasons stand behind the need for payment reform in PCMH. The first is that primary care in general is suffering from physician shortages. In order to attract more physicians into primary care, compensation for this field needs to increase. The way primary care physicians are paid through prevailing fee-for-service systems is inadequate and does not pay doctors for more cognitive-based services such as care coordination. One solution that is being tested to address this shortcoming of fee-for-service is through CMSs implementation of Chronic Care Management Services.[58] Recognizing that care management is one of the critical components of primary care

CMS has implemented, under the Medicare Physician Fee Schedule under the American Medical Current Procedural Terminology, a code for non-face-to-face care coordination for Medicare beneficiaries with multiple chronic conditions.

The second is that transformation to a PCMH requires a fundamental shift in the way healthcare is delivered, and hence, in the way these practices are reimbursed. This shift will need, among other things, compensation for additional staff required to support the evolving PCMH structural and process changes. For instance, care coordination and team-based care require capital such as health information technology and patient registries. It also requires incentives that encourage clinicians to work together in teams.[59]

PRIMARY CARE PAYMENT MODELS

Traditionally, there have been three dominant alternatives to physician payment in primary care: fee-for-service (FFS), salary and capitation[8]. Each of the three structures fall short of providing needed support for primary care delivery in different ways.[13] In traditional FFS practitioners are reimbursed for each procedure or service provided to the patient. As currently designed this does not effectively cover the activities necessary to deliver high quality primary care because of the greater volume of work associated with primary care visits relative to the allotted visit time duration.[60] For instance, enhanced access, care coordination and patient-centered care are some of the key primary care functions required of the PCMH for which physicians are not remunerated in a standard FFS model. In capitation, physicians are paid to deliver primary care services through a

lump sum per patient according to the number of patients they are assigned with risk-adjustment for patient complexity. This affords the provider financial flexibility to redesign and invest in their care delivery processes or infrastructure. Some of the concerns surrounding pure capitated payments is a potential incentive to withhold services.[13] Also of concern is the method of calculating the capitation amount and the method for risk adjustment as a challenge to providing sufficient funding to implement and maintain innovations in care delivery deemed necessary by the provider for their patient population.[17]

Salaried practitioners may receive a fixed sum of money commensurate with the amount of time devoted to their work. This method of payment might work well in integrated delivery centers but does not work well for private practices as most payers do not employ their own physicians and practices accept patients insured in a variety of health plans. In addition, salaried payments are considered by some to potentially lead to selectively detrimental delivery of care as more complex patients will consume more time and resources within the limited time constraints of the care provider.[13]

To address the shortfalls of these payment systems for primary care Berenson and Rich describe various payment models with the idea of identifying the elements of a successful PCMH.[12,13] These payment models include enhanced fee for service, fee for service with PCMH-specific billing codes, pay for performance, PMPM capitation in addition to fee for service, shared savings and comprehensive payments[12-13] Current PCMH initiatives implement one or more of these models.

Some PCMH initiatives have implemented shared savings programs where the PCMH shares responsibility for the total cost of care for patients.[61] In these practices the shared savings go back to the practices. One of the disincentives for payers for entering into shared savings programs with primary care practice is that smaller providers are at risk of variation in income leading to potential shared savings fluctuating.[3,16]

In a study aimed at cataloguing medical home initiatives with payment incentives, a variety of payment methods were found to be used, but the dominant payment model for PCMH initiatives is the traditional fee-for-service payments with PMPM payments and pay-for-performance bonuses.[35] All but two of the Patient-Centered Medical Home initiatives surveyed used standard or enhanced fee-for-service payments for office visits. The enhanced payments provided additional billing codes intended to reimburse services not traditionally covered by fee-for-service such as care coordination. Approximately 16% of the initiatives used only enhanced fee-for-service payments. The rest of the initiatives adopted additional forms of payment or opted for alternative forms of reimbursement. These alternative forms of payment include pay-for-performance bonuses (8%), per member per month payments (29%) or both (55%).

Our study looks at a PCMH implementation that used two reimbursement models; 1) fee-for-service and 2) partial capitation using a primary care based risk adjustment model, with performance bonuses. These are discussed in more detail in Chapter 2.

New payment structures and incentives are considered necessary to support implementation and sustainability of the PCMH model as there is not income to sustain the use of practice resources and infrastructure that support PCMH.[11] Various payment

models have been suggested for support of the PCMH criteria.[113,116] and additional models have been analyzed for the integration of mental health treatment into primary settings.[118] The best studied PCMH initiatives have been within integrated managed care plans such as Geisenger and the Veterans Health administration. These sites have salaried providers; a method of payment that is not applicable to practices supporting patients from multiple health plans. Other pilots have generally retained fee for service payments coupled with supplemental fees for care coordination.

Current fee-for-service payment models do not adequately support the functions required of practices to become a PCMH.[12,13] Proper financing is considered a necessary foundation for achievement of PCMH goals.[37] In traditional FFS practitioners are reimbursed for each procedure or service provided to the patient. As currently designed this does not effectively cover the activities necessary to deliver high quality primary care it has resulted in an increasing volume of work associated with primary care visits relative to the allotted visit time duration.[119] For instance, enhanced access, care coordination and patient-centered care are some of the key primary care functions required of the PCMH for which physicians are not remunerated in traditional FFS model.

In capitation, physicians are paid to deliver primary care services through a lump sum per patient according to the number of patients they are assigned with risk-adjustment for patient complexity. This affords the provider financial flexibility to redesign and invest in their care delivery processes or infrastructure. Partial capitation is commonly implemented by PCMH. This method retains a FFS component but reimburses for a pre-

defined set of services, and any additional care coordination efforts, through a risk-adjusted monthly payment per patient.

Although certain payment models are touted to provide proper financing for the patient-centered, care-coordinated models of care, a literature search uncovered no studies that assessed the use of different financial incentives and its differential impact on health outcomes. Evaluations of PCMHs with payment models other than FFS are wholly centered on the effects of the PCMH as a whole and do not assess whether the use of the particular delivery model or specific incentive has an effect. The effectiveness of one model over another has not been evaluated and many fundamental questions about the effectiveness of payment models considered to be supportive of PCMH are left unanswered. For instance, is payment reform an indispensable aspect for a successful PCMH? Are there certain types of patients that benefit more than others from these models?

1.8 *Adults with multiple chronic conditions*

Adults with multiple chronic conditions account for more than two-thirds of health care spending[15], see multiple physicians, consume more prescription drugs, and experience more care transitions than other adults. Patients suffering from comorbidities are more likely to need constant management to reduce their propensity for re-hospitalizations and frequent emergency room visits.[46,47] The organization of medical homes may be more conducive, as compared to usual source of care, to the care of patients who see multiple physicians and would benefit from coordinated care and the effective management of

patients with chronic conditions in order to reduce duplication of services and preventable hospitalizations.[61] For these reasons this study examines the impact of PCMH on the multi-morbid adult population. We focus on the adult population; children with MCCs face unique challenges that make the nature of their illness burden distinctly different from that of adults. For instance, children face different challenges with respect to treatment adherence, exposure to risk factors and disease acceptance.[86,,87]

There is concern that patients with more co-morbidities will have difficulty finding the appropriate delivery system because of the intensity of their use of and dependence on healthcare services.[12,13,62] The PCMH, as a significant redesign of primary care, proposes to offer a delivery system that will take all of the patient's health needs into account; however many of the evaluations of medical homes and other similar programs have not carefully examined the effects of multi-morbidity.

1.9 *Adults with co-morbid depression*

The burden of living with a chronic illness is exacerbated by comorbid behavioral health conditions. The combination of multi-morbid physical and mental conditions may increase the difficulty of an individual in maintaining their health state, leading to greater health care utilization.[46-49] In addition, studies have shown that people with one or more chronic conditions are at increased risk of having major depression[63-74] and mental health conditions are 2 to 3 times more common in patients with chronic medical illnesses.[75,76] The comorbid state of depression has been shown to incrementally worsen health compared with depression alone, with any chronic illness alone and with any combination of chronic disease without comorbid depression[66]. For instance, multiple studies point to reduced utilization rates of disease-specific preventive services in

diabetic patients with comorbid mental disorders.[73] Another study identified that the presence of a depressive symptom in elderly individuals with at least one chronic medical condition has been show to increase the odds of acute medical service use.[70]

Mental health conditions have high prevalence among American patients. Depression is rated as the fourth leading cause of disease burden and without treatment tends to assume a chronic course, may be recurrent and become increasingly associated with disability over the course of an individual's life.[65,66]

Despite the high prevalence of depression and other mental and behavioral health conditions and their negative impact on somatic health for people with co-morbidities, diagnosis by non-specialists is inconsistent and two thirds of these patients receive no or insufficient treatment.[77,78] A key recommendation of the WHO is that treatment for mental health problems should be based in primary care settings[79] yet most people with mental disorders receive no or inadequate treatment.[80] Many studies have found that in primary care settings with collaborative care PCPs can deliver effective treatment for depressive disorders, and improve quality of care.[81-83]

PCMH, with its call to deliver care-coordination and whole-centered care offers the potential for improvement in the delivery of health care for its patients. One survey-based study however has found that NCQA-certified PCMHs were less likely to have procedures for responding to mental health and substance use services than for other subspecialties.[84] However, a literature review mentioned previously uncovered no studies that evaluate the PCMH model that even address mental health, behavioral health or substance abuse issues, despite the increased awareness that more mental health

concerns are seen within primary care as compared to other healthcare settings. This study will look at the effects of mental and behavioral health screening in a PCMH.

1.10 Setting

The data used for this study are pharmacy and medical claims, for members aged 18 and older, obtained from a not-for-profit health plan based in the Albany and upstate New York area for the years 2008 to 2013. Medical practices served by the health plan were given the option to voluntarily transform into PCMHs. These medical practices participating in the PCMH program were required to attain NCQA Level 3 recognition.

Practices were also given the option to voluntarily adopt a practice reform that involved a new payment model or to retain the fee-for-service structure. The payment model offered a primary care based risk-adjusted partial capitation global payment and performance-based bonuses. The global payments were intended to hold providers accountable for services they provide. The bonuses, paid out yearly, were based on 1) quality as measured by HEDIS measures, 2) efficiency through total cost of care and 3) patient experience through CG-CAHPS measures. They were intended to drive transformation at the practice. Bonuses were calculated as follows: patient experience scores were used to determine if the practice was eligible for a bonus and the magnitude of the bonus was determined based on their effectiveness scores. Finally, the amount that was paid out was based on their total costs of care and was capped at 20% of their expenditures.

1.11 Objectives

This study has three objectives: 1) to assess the impact of PCMH with and without payment reform on health care expenditures and utilization for all adults, 2) to assess the impact of PCMH with and without payment reform on health care expenditure for adults with multiple chronic conditions and 3) to assess the impact of PCMH with and without payment reform on health care expenditure for those with behavioral health diagnoses. This dissertation has three specific aims:

Aim 1.1: To assess the differential change in monthly health care expenditures of a PMCH program with FFS and a PCMH program with partial capitation in the adult patient population compared to a population not enrolled in PCMH.

Null Hypothesis Aim 1.1: No difference in the healthcare expenditures between the two programs as compared to the control. Health care expenditures will include total medical, inpatient, ambulatory and prescription drugs.

Aim 1.2: To assess the differential change in monthly health care utilization of a PMCH program with FFS and a PCMH program with partial capitation in the adult patient population compared to a population not enrolled in PCMH .

Null Hypothesis Aim 1.2: No difference in the effect on healthcare utilization between the two programs as compared to the control. Utilization will include inpatient admissions, office visits and emergency room visits.

Aim 2.1: To assess the differential change in monthly health care expenditures of a

PMCH program with FFS and a PCMH program with partial capitation on healthcare expenditures among adults stratified by their number of chronic condition compared to a population not enrolled in PCMH.

Null Hypothesis Aim 2.1: No difference in the types of effect on healthcare expenditures between the two programs as compared to the control. Health care expenditures will include total medical, inpatient, ambulatory and prescription drugs.

Aim 2.2: To assess the differential change in monthly health care utilization of a PMCH program with FFS and a PCMH program with partial capitation on adults stratified by their number of chronic conditions.

Null Hypothesis Aim 2.2: No difference in the types of effect on healthcare utilization between the two programs as compared to the control. Utilization will include inpatient admissions, office visits and emergency room visits.

Aim 3.1: To assess the differential change in monthly health care expenditures of a PMCH program with FFS and a PCMH program with partial capitation on healthcare expenditures among adults screened for mental and behavioral health conditions, stratified by their number of chronic conditions compared to a population not enrolled in PCMH .

Null Hypothesis Aim 3.1: No difference in the types of effect on healthcare expenditures between the two programs as compared to the control. Health care expenditures will

include total medical, inpatient, ambulatory and prescription drugs.

Aim 3.2: To assess the differential change in monthly health care utilization of a PMCH program with FFS and a PCMH program with partial capitation on healthcare utilization among adults screened for mental and behavioral health conditions, stratified by their number of chronic conditions.

Null Hypothesis Aim 3.1: No difference in the types of effect on healthcare utilization between the two programs as compared to the control. Utilization will include inpatient admissions, office visits and emergency room visits.

Chapter 2 will describe the program, methods and data. Chapter 3 will address Aim 1 and assess how a PCMH program with FFS and a PCMH program with partial capitation effects health care expenditures and utilization among all adults regardless of health diagnoses. Chapter 4 will address Aim 2 and assess how a PCMH program with FFS and a PCMH program with partial capitation effects health care expenditures and utilization among adults with zero, one to two, three to four and five or more chronic conditions. Chapter 5 will address Aim 3 and assess how a PCMH program with FFS and a PCMH program with partial capitation effects health care expenditures and utilization among adults screened for behavioral and mental health conditions among adults with zero, one to three, and four or more chronic conditions. Tables and figures will be in the last section of each chapter and numbered accordingly. Chapter 6 will contain a conclusion and policy recommendations for this dissertation. Chapter 7 will contain the references

for the entire document.

1.12 Tables

Table 1.7.1 Functions of a PCMH as defined by AHRQ

Function	Description
Comprehensive Care	Care that is accountable for addressing a large majority of a patient's health needs. These needs include physical and mental needs, preventive care, acute care, and chronic disease care. Some of the concerns identified by AHRQ in this area include ensuring that PCMH effectively serves patients with complex needs, and integrating mental health and substance abuse treatment. A team of care providers is required to provide this care which can be in-house or virtual.
Patient-Centered Care	Relationship -based primary care that meets the individual patient and family's needs, preferences and priorities. This includes active support of patients in learning to manage their care.
Coordinated Care	Care coordinated across settings. For instance, inpatient, outpatient, across specialty and non-specialty care, mental health, referral tracking, care management, care transitions (hospital discharge).
Enhanced Access to Care	Accessible services with shorter waiting time for urgent needs. Examples can include advanced electronic communications, such as Internet or telephone visits, open-access scheduling, group visits, 24/7 coverage, enhanced in person hours.

Quality and Safety	A systems-based approach to improving quality and safety. For instance utilizing care planning process, evidence-based medicine/clinical guidelines, point-of-care resources, electronic prescribing, test tracking, performance measurement, self-management support, accountability, population management and shared decision making.

Table 1.7.2 PMCH recognition programs[87]

Organization	Tool
NCQA PPC-PCMH standards	PPC-PCMH Standards (2008)
NCQA PCMH Standards	PCMH Standards (2011)
Accreditation Association for Ambulatory Health Care	Medical Home Standards (2009)
Joint Commission	PCMH Designation Standards (2011)
URAC	PCMH Health Care Home Program Toolkit (2011)
TransforMED	Medical Home Implementation Quotient (2009)
Center for Medical Home Improvement	Medical Home Index (2008)

2. PROGRAM, METHODS AND DATA

2.1. Program Description (Setting and Intervention)

The data for this study were obtained from a not-for-profit health insurance plan based in the Albany and upstate New York area. All medical practices having patient panels that included health plan members were given the option to voluntarily transform into PCMHs and whether or not to adopt partial capitation or retain fee for service reimbursement. This creates for a unique opportunity to assess if there are differences on health expenditures and utilization among these two types of PCMH reimbursement methods. Intervention sites were not randomized; medical practices elected to undergo voluntary transformation.

However, this lack of randomization will be addressed in the analysis though the use of matching (Section 2.6.3). These medical practices participating in the PCMH program were required to attain NCQA Level 3 certification. As all practices shared the same level of certification and thus fulfilled the same set of guidelines we are assured some similarity in the type of care that is provided across sites.

[Figure 2.7.1 Time Periods]

Figure 2.7.1 illustrates the four time periods considered in our study. The pre-intervention period for our study was from January 2008 through June 2010 (30 months). Beginning in July 2010, there were 22 practices that began PCMH transformation. From

July 2010 through December 2011 (18 months) the 22 practices that transformed to PCMH received financial support from the health plan to undergo change transformation in coordination with TransforMED; an implementation partner. This covered the costs for the infrastructure required to achieve NCQA certification and ensured a consistent transformation model for practice re-design across practices. Our analysis compares difference-in-difference between the pre-intervention period (18 months outlined in purple in Figure 2.7.1) and the post-transformation period (13 months highlighted in blue in Figure 2.7.1), excluding the 18-month transformation period (highlighted in green in Figure 2.7.1) to drop trends resulting from this transition period. This intermediate period is dropped since we want to compare outcomes once the intervention is up and running.

To facilitate the PCMH transformation efforts for group practices the health plan contracted with a non-profit organization launched by the National Academy of Family Physicians called TransforMED. This organization provided site visits, in-person collaborative meetings with coaches for the clinic staff and webinar learning as framework for PCMH transformation. The company allowed the practices to evaluate their clinical processes and determine how to re-align them to support PCMH requirements. The practice transformation encompassed the creation of multidisciplinary care teams, the application of electronic health records towards new uses, the expansion of staff roles and the introduction of data measurement for improvement. In general, multidisciplinary teams were tasked with improving areas such as care coordination and team-based care.

The role of nurses was expanded to provide care during patients' visits and provide support for chronic disease management efforts. Nurse practitioners and physician

assistants were assigned panels of patients whose care they shared with MDs and tasked with managing chronic disease care. Guideline-based care was integrated into daily practices and use of email as portal for patient communication as well as telephonic follow-ups and after-hours telephone access. The approach for fulfilling the guidelines was not prescribed and individual practitioners and practices selected approaches that made the most sense for the particular needs. For instance, to increase access to care a practice may have adopted telephonic support or extended their hours of service.

During the PCMH 18-month transformation period (July 2010 through December 2011), the medical practices continued receiving fee-for-service payment. All practices that underwent PCMH transformation were then offered the opportunity to change payment from fee-for-service to using a partial-capitation, risk-adjusted reimbursement model with limited fee-for-service. There was a practice-by-practice choice for the adoption of a partial capitated reimbursement model. For the analysis, practices selecting adoption of partial capitation will be grouped together into one intervention group and practices transforming to PCMH but electing to retain FFS reimbursement will be grouped into a second intervention group.

The medical practices that became PCMH's have panels of health plan members varying in number from 144 to 5,625 with an average panel size of 2,310 members. Matched control sites range in size from 200 to 7,127 members with an average panel size of 878 members. In general, practices that chose to transform to PCMH were larger than those that did not, perhaps indicative that larger practices are less risk averse to practice transformation. This poses a limitation in our analysis as, though in the methods we match intervention sites to control sites on a number of features discussed in Section

2.6.3, unfortunately, panel size is one of the attributes we are not able to attain parity between intervention and control groups.

2.2. Control Practice Selection

We matched control practices to the PCMH practices from the pool of medical practices with members attributable to the health plan that did not participate in the PCMH program. Matching was performed using principal component analysis (see Section 2.6.3 for details on matching).

2.3. Patient Selection

The data contains claims for 335,503 members enrolled with the health plan between January 2008 and January 2013 for whom there were claims and entries in the eligibility file. After matching and selecting only members in one of the intervention groups and the matched control; 115,306 were adults over the age of 18. Pediatric patients were excluded to reduce the impact of endogenous differences between pediatric and non-pediatric members. Also excluded were patients enrolled in practices that were not a good control match to our intervention as well as individuals for whom we had claims data but were not in the eligibility file. We adjust for age, gender and risk scores in the analysis to improve precision of our estimates and account for variations that may be predicted by differences in age among adults.

[Figure 2.7.2 Member inclusion criteria]

The health plan provided PCP assignments to members. PCMH transformations are (practice) site-specific. The health plan imputed PCP assignments to patients for payment purposes. These PCP assignments were used to assign members was to sites based on the PCP's affiliation with a site. This assumes members received the bulk of their primary care at the site in which their PCP was employed. PCMH sites were matched to control sites and members assigned to PCPs employed by one of these sites were included in the analysis. Of the health plan enrollees over the age of 18 and utilizing health services during the study period, 115,306 were receiving care in the medical practices that transformed to PCMH or the matched control medical practices. As a note; the plan allowed members to opt out of being in a PCMH if they desired. If so, these members would be included in the sample only if they were enrolled to one of the practices included in our matched controls. Table 2.8.1 reports key patient demographics.

[Table 2.8.1 Member Demographics]

Members can chose to enroll and dis-enroll from the health plan at any time. The average number of months that members were enrolled during the 61 month period ranged between 27 and 31 across intervention and control groups. Only 10% (11,502) of the members receiving care in the PCMH sites and their matched controls were continuously enrolled for the entire study period across both cohorts. For this reason we chose to include all members who were enrolled at least one month and received any care in order to increase the sample size and power. Sensitivity analysis run on those continuously

enrolled failed to converge due to low member number and the large number and complexity of the covariates in this model.

Table 2.8.2 reports member enrollment percentages by group. Studies have shown that consumer disenrollment from a health plan is associated with member dissatisfaction[88,89], discontinuity of patient care,[89] and risk selection[90] among others things. Members who enroll or dis-enroll during the study period cannot be followed longitudinally over the course of the entire study. Also, there may be unobservable differences among patients who dis-enroll from the health plan which we are not adjusting for.

We cluster patients by PCP. The model used naively assumes independence of observations. It is a limitation of this study that this approach leads to bias in the estimates of standard errors and significance.[91-92]

[Table 2.8.2 Percent member enrollment by number of months per group.]

2.4. Administrative Claims Data

Administrative claims data for all members enrolled in the health plan (115,306 members) and utilizing health services between January 2008 and January 2013 were used to analyze the change in expenditures and utilization before and after implementation of the PCMH. We focus on expenditures and utilization. Administrative claims data are based on reimbursement information used for billing and contain the

information necessary to determine payment. These claims are representative of medical services received and outpatient pharmacy filled by patients. Only paid claims were considered in the expenditure measures. Utilization measures included both paid and unpaid claims as these were assumed to be reflective of services rendered. Individuals who were in the enrollment list but had no claims information were attributed zero for expenditures and zero for utilization for those months of enrollment.

2.5 Variables

In the following section we describe the dependent and independent variables used in our analysis.

2.5.1 Dependent Variables

In our analyses we use a set of expenditure and utilization measures recommended by the Commonwealth Fund PCMH Evaluators Collaborative.[30] Utilization measures include monthly inpatient admissions, ED visits and ambulatory office visits. For expenditures we look at aggregate medical expenditures of the health plan per member per month on the outcome of interest. The specific outcomes are described in detail below and include total expenditures, inpatient expenditures, ambulatory expenditures, and ambulatory drug expenditures. Expenditures were calculated from claims for medical services and prescription drugs. For each of the dependent variables described below, claims were selected based on definitions applying billing codes and date of service (see Appendix for an example). The expenditures for each claim were then aggregated for all claims, following the definitions indicated in the Appendix for each outcome, for each month for

each person. For the periods of time during which sites were paid on a fee-for-service the calculation of expenditures is identical for both intervention and control practices. For the period in which partial capitation was adopted, the medical services covered by capitation at the intervention sites were excluded from the aggregate of the intervention site expenditures. The capitated monthly reimbursement value was added instead. This reflects the expenditures for each type of payment and the amount reimbursed at each site for each patient. Since this is considering expenditures to the health plan and comparing two different types of payment methods, we also calculate costs using a standardized fee schedule to all services provided. This removes any effect of how the payments are made or the level of payment and focuses simply on the services provided and their relative cost. These measures include inpatient, ambulatory and prescription drug costs. We do this by applying a standardized fee schedule to all DRG and CPT codes to obtain a measure of resource intensity for inpatient, ambulatory and pharmacy use. The Medicare fee schedule from the fiscal year 2012 was applied to the claims. This assigned a standardized cost to each claim. Although PCMH programs are not paid by Medicare, applying a standard fee schedule serves to assign constant values to services of the same type. Using standardized costs for all services means that a decrease in average cost per member must result from a reduction in the number and/or intensity of services provided rather than a mere change in the price of those services. It is effectively a way to apply constant weights to similar services. This allows us to get a "weighted cost" measure that reflects health services utilization and not changes in payment rates that could vary by providers.[93]

Independent variables of interest include both provider and member characteristics: For the patient we include age, gender, and risk score. The payer creates a risk score for each person. The following is a description of each variable and for what specific aim they are used. Models are run, adjusting for these covariates, on different strata of the population depending on the study aims. For Aim 1 the models are run on the entire population. For Aim 2 the models are run on the strata for patients with zero, 1-2, 3-4 and 5 or more chronic conditions. For Aim 3 the models are run on patients with zero, 1-2, 3-4, and 5 or more chronic conditions with filled prescriptions for anti-depressants (evidence of depression).

The dependent variables are defined as follows:

Total Medical Expenditure

This continuous, dependent variable consists of per member per month (PMPM) aggregation of all medical expenditures in the health plan as incurred by members for inpatient care, outpatient care and outpatient drugs.

Inpatient Expenditure

This continuous, dependent variable consists of per member per month (PMPM) aggregation of inpatient medical expenditures as incurred during hospitalizations at

inpatient hospitals. If the hospitalization spans more than one month the expenditures are applied to the month when the admission occurred.

Outpatient Expenditures

This is a continuous, dependent variable consisting of PMPM aggregation of ambulatory medical expenditures as incurred during visits to doctor's offices, outpatient hospitals and emergency rooms. We will consider evaluation and management CPT codes 99201 through 99215 (outpatient services), 99241 through 99245 (outpatient consultations), and 99381 through 99429 (preventive medicine services) to identify the ambulatory visits and identify the type of provider through available codes in the claims list.

Inpatient Admissions

There are two variables for inpatient admissions; a binary variable (0/1) indicating presence or absence of any admissions in a given month and a count of admission indicating count of unique inpatient admissions per member per month. If the hospitalization spans more than one month the admission is applied to the month when the admission occurred.

Emergency Room Visits

This is a count consists of per member per month aggregation of ER visits incurred.

This count consists of the per member per month aggregation of ER visits incurred as determined by claims encoded with CPT codes ranging between 99281 and 99288 and taking place in an Emergency Department. Multiple visits in a single day will be counted as a single visit. These codes ranges are taken from the AMA's CPT 2014 Professional Edition Codebook.

Ambulatory Visits

This is a count, dependent variable consisting of per member per month aggregation of ambulatory medical expenditures as incurred during visits to doctor's offices, outpatient hospitals and emergency rooms. We will consider evaluation and management CPT codes 99201 through 99215 (outpatient services), 99241 through 99245 (outpatient consultations), and 99381 through 99429 (preventive medicine services) to identify the ambulatory visits

2.5.2 Independent Variables

Patient Characteristics

The patient variables will be used as covariates in the regressions of the intervention variable on the outcomes. These include patient age (continuous), gender (binary), and risk scores. The PCAL risk score includes number of chronic conditions. These risk scores were developed so as to establish appropriate payment rates for the delivery of

primary care.[103] The algorithm used to determine these risk scores are proprietary and were not made available for the study.

2.6 Analysis

The following section describes the analytic aspects of the evaluation including model development and descriptions and our approach to matching intervention members to controls.

2.6.1 Models

An piecewise interrupted time series segmented generalized linear regression model with patient-level data is used to estimate changes over time in the outcome variables of interest to assess the effect of PCMH relative to a control. We analyzed patients grouped by number of chronic conditions as well as those with co-morbid depression separately, to determine whether there are differential effects across time periods attributable to PCMH transformation [and/or adoption of partial capitation] between these groups.

The time periods considered for our analyses are discussed and illustrated in section 2.1 and include; for analysis 1) a pre-intervention period consisting of 30 months (from January 2008 through June 2010) and a post-intervention period consisting of 13 months (from January 2012 through January 2013).

In this study, we evaluate the impact of the PCMH transformation on per member per month (PMPM) health care and pharmacy expenditures to the health plan, and PMPM utilization of services.

For utilization, we include 1) the PMPM likelihood of having ambulatory office visits, hospitalizations, and emergency room visits and the cost (using a standardized fee schedule) of health care services rendered including inpatient, ambulatory and outpatient pharmacy standardized costs. For expenditures, we include PMPM 2) total medical, inpatient, ambulatory and outpatient pharmacy expenditures. We will look at these across the categories of patients based on their total number of mutually exclusive chronic conditions as described in Chapter 4 (Section 4.3).

To adjust for differences between intervention and control groups that may be attributable to differences in other characteristics we adjust for patient characteristics over time including patient age, gender, and risk scores in the regression model. The risk scores consisted of primary care activity level (PCAL) scores calculated by the health plan.

In health services research data often comes with an abundance of zeroes indicating no utilization or spending for a given month. For instance, patients enrolled in the health plan for whom there are no claims for health care utilization (e.g. inpatient hospitalization or ambulatory office visit) in a given month will be assigned a zero value for that month in our dataset. We will model these binary outcomes with discrete distributions such as the binomial distribution. However, there may be cases when the proportion of zeroes leads to a highly skewed distribution for which no transformation will suffice to normalize the data or allow it to approximate other distributions that could be modeled such as Weibul or Gamma distributions. In these cases we will use a two-part model.[94-95] and model the predicted odds of having any expenditure separately from the effect on log expenditures of those who have some expenditures.

We used PMPM observations to establish a trend in the baseline time period and trends in the post transformation time period. Two populations are compared over the study time period: patients who received usual care under providers not affiliated with PCMH-transformed sites (the control group) and patients who received care under providers affiliated with PCMH-transformed sites.

2.6.1.1 Simplified Model

The simplified general model with only two time periods and a single intervention is presented to facilitate interpretation of the final model. This simple model was run and incrementally built on by adding a second intervention and a third time period. The time period break-down for the simplified model is illustrated in Figure 2.7.1 (labeled Analysis 1). This simplified model can be written as

$$Y_{it} = \beta_0 + \beta_1 PCMH + \beta_2 TIMEit + \beta_3 PCMH * TIMEit + \beta_4 POST + \beta_5 PCMH * POST + \beta 6 POST * TIMEit + \beta 7 PCMH * POST * TIMEit + \sum_{j=12}^{J*} \beta_j x_{ijt} + \sum_{j=J*}^{J**} \beta_j x_{ij} + \varepsilon + \mu_{it}$$

Where $\boldsymbol{Y_{it}}$ is the outcome of interest for patient *i* seen in month *t*. $\boldsymbol{\beta_0}$ represents the intercept of the regression for the end of the pre-implementation period for the control group.

PCMH is a dichotomous variable coded 0 for members in the control practices and 1 for members in the intervention practices; $\boldsymbol{\beta_1}$ captures the estimate for the change in intercept for the intervention versus control members at the end of the pre-implementation period. $\mathbf{Time_t}$ is a time counter that runs from -30 (January 2008) to 31 (January 2013); $\boldsymbol{\beta_2}$ captures the estimate for the slope for the control group in the pre-implementation period.

$Time_t$ * PCMH is an interaction term for time among the intervention group; **B_3** is an estimate for the slope of the intervention group. **$\beta_2 + \beta_3$** is the estimate for the pre-intervention slope among members in the intervention group whereas **β_2** is an estimate of the pre-intervention slope of members in the control group.

β_4 POST is a dichotomous variable that is 0 prior to intervention (when time is less than 30) and 1 post intervention. The coefficient **β_4** is the intercept of the control group post intervention. The interaction term **PCMH*POST** represents the post implementation counter for the intervention group and the coefficient **β_5** is the estimate for the intercept for the intervention group.

β_6 POST*$time_{it}$ is a time counter representing the post-intervention period of Analysis 1 (defined in Section 2.10.1). The coefficient **β_6** is the slope of the control group post intervention. The interaction term **PCMH*POST*$TIME_{it}$** represents the post implementation counter for the intervention group and the coefficient **β_7** is the estimate for the slope for the intervention group post implementation.

Figure 2.7.3 illustrates this simplified model. This model was run as a test on all subsets of patients including those with 0, 1-2, 3-4, and 5 or more chronic conditions. This model adjusts for patient-level covariates (time variant - $\boldsymbol{\beta_j x_{ijt}}$ - and time invariant - $\boldsymbol{\beta_j x_{ij}}$**)** including age, gender, and risk score.

[Figure 2.7.3 Simplified Model]

2.6.1.2 Finalized Model

Model B compares differences across two different periods than model A. Model B compares the 30-month pre-intervention period with the 13-month post implementation period; discounting the 18-month transformation period (July 2010 through December 2011). This model will also adjust for the same patient-level covariates as model A. Figure 3.7.4 illustrates model B.

[Figure 2.7.4 Finalized Model]

The finalized model is:

$$Y_{it} = \beta^0 + \beta^1 PCMH_{NR} + \beta^2 PCMH_{PR} + \beta^3 TIMEit + \beta^4 (PCMH_{NR} * TIMEit) + \beta^5 (PCMH_{PR} * TIMEit) + \beta^6 TP2 + \beta^7 (PCMH_{NR} * TP2) + \beta^8 (PCMH_{PR} * TP2) + \beta^9 (TIMEit * TP2) + \beta^{10} (PCMH_{NR} * TIMEit * TP2) + \beta^{11} (PCMH_{NR} * TIMEit * TP2) + \beta^{12} TP3 + \beta^{13} (PCMH_{NR} * TP3) + \beta^{14} (PCMH_{PR} * TP3) + \beta^{15} (TIMEit * TP3) + \beta^{16} (PCMH_{NR} * TIMEit * TP3) + \beta^{17} (PCMH_{NR} * TIMEit * TP3) + \sum_{j=18}^{J*} \beta_j x_{ijt} + \sum_{j=J*}^{J**} \beta_j x_{ij} + \varepsilon + \mu_{it}$$

We will walk through all the terms but during our presentation of the results will pay specific attention to the terms β_{16} and β_{17} which represent the average monthly difference in effects on the post-implementation slope of PCMH with FFS or PCMH with partial capitation respectively relative to individuals receiving care in a non-PCMH practice.

Where $\boldsymbol{Y_{it}}$ is the outcome of interest for patient *i* seen in month *t*.

$\boldsymbol{\beta_0}$ represents the intercept of the regression for the end of the pre-implementation period for the control group.

$PCMH_{NR}$ is a dichotomous variable coded 0 for members in the control community and 1 for members in the PCMH with FFS community; **β_1** captures the estimate for the change in intercept for the PCMH with FFS versus control members at the end of the pre-implementation period.

$PCMH_{PR}$ is a dichotomous variable coded 0 for members in the control community and 1 for members in the PCMH with partial capitation community; **β_2** captures the estimate for the change in intercept for the PCMH with partial capitation versus control members at the end of the pre-implementation period.

$Time_{ti}$ is a time counter that runs from -30 (January 2008) to 31 (January 2013); **β_3** captures the estimate for the slope for the control group in the pre-implementation period.

$Time_t$ * $PCMH_{NR}$ is an interaction term for time among the group of PCMH with FFS; **B_4** is an estimate for the slope of the intervention group PCMH with FFS in the pre-implementation period. **$B_3 + \beta_4$** is the estimate for the pre-intervention slope among members in the intervention group PCMH with FFS whereas **β_3** is an estimate of the pre-intervention slope of members in the control group.

$Time_t$ * $PCMH_{PR}$ is an interaction term for time among the group of PCMH with partial capitation; **B_5** is an estimate for the slope of the intervention group PCMH with partial capitation in the pre-implementation period. **$B_3 + \beta_5$** is the estimate for the pre-intervention slope among members in the intervention group PCMH with FFS whereas **β_3** is an estimate of the pre-intervention slope of members in the control group.

β_6 TP_2 is a dichotomous variable that is coded 1 for the months between (July 2010) to 18 (December 2011). It is coded 0 for the pre-intervention period and the post-

implementation period. All sites began PCMH transformation on July 2010 and this represents the implementation period of the analysis.

TP_2 * $PCMH_{NR}$ is an interaction term for implementation time among the group of PCMH with FFS; **B_7** is an estimate for the intercept of the intervention group PCMH with FFS at the beginning of time period 2; the implementation period.

$Time_t$ * $PCMH_{PR}$ is an interaction term for time among the group of PCMH with partial capitation; **B_5** is an estimate for the slope of the intervention group PCMH with FFS.

$Time_t$ * TP_2 is a time counter that runs from -30 (January 2008) to 31 (January 2013); **β_9** captures the estimate for the slope for the control group.

$Time_t$ * $PCMH_{NR}$ * TP_2 is an interaction term for time during the implementation period among the group of PCMH with FFS; **B_{10}** is an estimate for the slope of the intervention group PCMH with FFS. **$\beta_3 + \beta_4 + B_9 + \beta_{10}$** is the estimate for the implementation slope among members in the intervention group PCMH with FFS whereas **$\beta_3 + \beta_4$** is an estimate of the implementation period slope of members in the control group.

$Time_t$ * $PCMH_{PR}$ * TP_2 is an interaction term for time during the implementation period among the group of PCMH with partial capitation; **B_{11}** is an estimate for the slope of the intervention group PCMH with partial capitation. **$\beta_3 + \beta_4 + B_9 + \beta_{11}$** is the estimate for the implementation slope among members in the intervention group PCMH with FFS whereas **$\beta_3 + \beta_4$** is an estimate of the implementation period slope of members in the control group.

β_{12} TP_3 is a dichotomous variable that is coded 1 for the months starting on January 2012 and ending January 2013. It is coded 0 for the pre-intervention and implantation periods and 1 for the post-implementation period.

TP_3 * $PCMH_{NR}$ is an interaction term for post implementation time among the group of PCMH with FFS; **B_{13}** is an estimate for the intercept of the intervention group PCMH with FFS at the beginning of time period 3; the post implementation period. **$Time_t$ * TP_3** is a time counter that runs from January 2012 to January 2013. **B_{14}** captures the estimate for the slope for the control group.

This model was run as a test on all subsets of patients including those with 0, 1-2, 3-4, and 5 or more chronic conditions. This model adjusts for patient-level covariates (time variant - $\boldsymbol{\beta_j x_{ijt}}$ - and time invariant - $\boldsymbol{\beta_j x_{ij}}$) including age, gender, and risk score. The dependent variables (described in Section 2.5.1) include dichotomous measures and continuous measures. The same statistical model is used with all but it is adjusted according to the outcome measure. As estimates for these outcomes can be skewed due to the non-normality of the data (outliers of rare and extremely high cost events lead to distributions that have a long right tail and a mean that differs from the median) estimation problems would arise in common parametric tests such as OLS regression. To avoid these problems given the non-normality of health care date we use Generalized Linear Models (GLMs). GLMs allow for the specification of the family and link functions for the mean. We used the Box-Cox test to find optimal nonlinear transformations for the dependent variable and test the fit of the most appropriate link function to specify in the GLM. As suggested by Manning and Mullahy the Modified[96] the Modified Park Test was used on continuous outcomes to estimate the relationship between the mean and the variance and determine the distribution.

Expenditures outcome distributions were right-skewed with a substantial fraction of observations at zero. In these cases the standard OLS model may predict negative and nonsensical values. It is also possible that the zero mass is an indication of different modalities of health care use as compared to those with any use and thus respond differently to covariates in the regression. For instance, part of the zero mass may be indicative of access problems that may have a higher correlation with age or gender. In these cases alternative estimators are used. We employ a two-part model that splits consumption into two parts[97]: the probability of any expenditures and the level of expenditures. To model the probability of any expenditure we use GLM with a logit link. To model the level of use we use GLM on a log-transformed data.

The outcomes were modeled as follows: expenditures (total medical, inpatient, ambulatory, and pharmacy) were modeled with log links to normalize the data distribution; and the family specified is that of the Gaussian distribution since once transformed the data was normalized. The binary outcomes representative of probability of admission or visit (ED visits, ambulatory office visits and inpatient admissions) were modeled using models with logit link and the binary distribution. The distributions were chosen after using the Box-Cox test to find optimal nonlinear transformations for the dependent variable and test the fit of the most appropriate link function to specify in the GLM.

Analyses were completed using a p value < 0.05 was considered statistically significant. All analysis was completed using SAS/STAT 9.0 (SAS Institute, Cary, NC, 2011). The Johns Hopkins Bloomberg School of Public Health's Institutional Review Board approved this study.

2.6.3 Matching

In order to minimize estimate bias due to unmitigated differences in the covariates, a matching method is used to match intervention practices to control practices in order to balance the baseline distributions of patient and practice characteristics across intervention and control groups.[98,99] Matching is based on information on site characteristics that were available including: 1) number of CDPHP members receiving care in the site, 2) number of CDPHP member visits per month in a site, 3) average provider age across site, 4) percent of providers that are MDs across site, 5) percent of male providers across sites, 6) average member age across sites, 7) percent male members across sites, 8) average HEDIS value across sites, and 9) average member risk score across site. Although matching on more characteristics would have been preferable, we used all the information made available by the health plan that could be used to describe sites and match based on similarities. A complete match was attempted across all variables using values at baseline (2008) in an attempt to mimic balancing of practice and provider characteristics that would have occurred had we been able to do a randomized study starting in 2008.

We used principal components analysis[100] for the matching despite the fact that the use of propensity scores to summarize all the covariates used for matching into one scalar is a popular approach used for matching. The reasoning behind this was based on the requirement in the use of propensity scores that there be 10 events per variable in the regression to ensure validity of the propensity score. Given there were only 22 intervention sites we would only have been able to use 2 or 3 of the covariates. For this reason propensity score matching was deemed inappropriate for this study. Using

principal components analysis we created a single linear combination (the 'first principal component') of the original 9 matching variables that contains as much information of the original 9 variables that can be retained in a single variable. To minimize the absolute difference between the 'first principal component' in the intervention and potential control sites a 'greedy' distance algorithm proposed by Rosenbaum[99] was used. The SAS utility program %match_cc, written by the Division of Biostatistics at the University of Minnesota was used.[101] Five control matches for each intervention site were obtained. This method of matching yielded 110 controls matched to the 22 practices.

[Table 2.8.3: Average values on matching characteristics across PCMH and matched control sites]

A pooled t-test was used to determine significant differences between characteristics of the intervention and control practices. The algorithm balanced 7 of the baseline characteristics (including average provider age across site, percent of providers that are MDs across site, percent of male providers across sites, average member age across sites, percent of male members across sites, average HEDIS value across sites, and average member risk score across site) in intervention and control sites (i.e., no significant difference in the average of the variable between the intervention and control practices). It was unable to achieve balance on two baseline characteristics: number of plan members receiving care at a site and the number of plan member visits per month at a

site. Intervention sites tend to be sites that service more patients and it is very difficult to balance these two variables between groups given this intrinsic difference between sites.

2.7 Figures

Figure 2.7.1 Time Periods

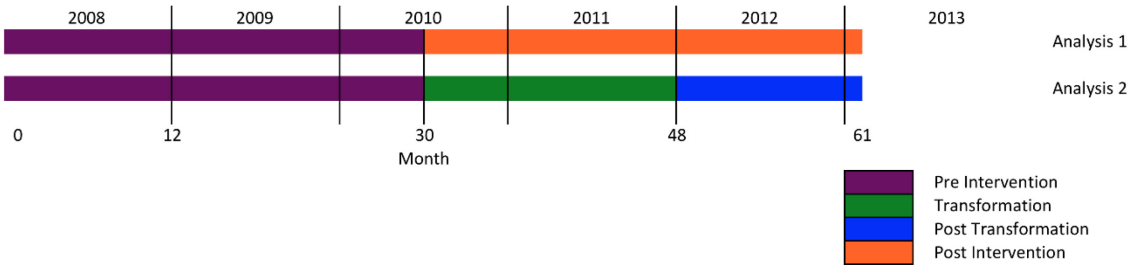


Figure 2.7.2 Member Inclusion Criteria

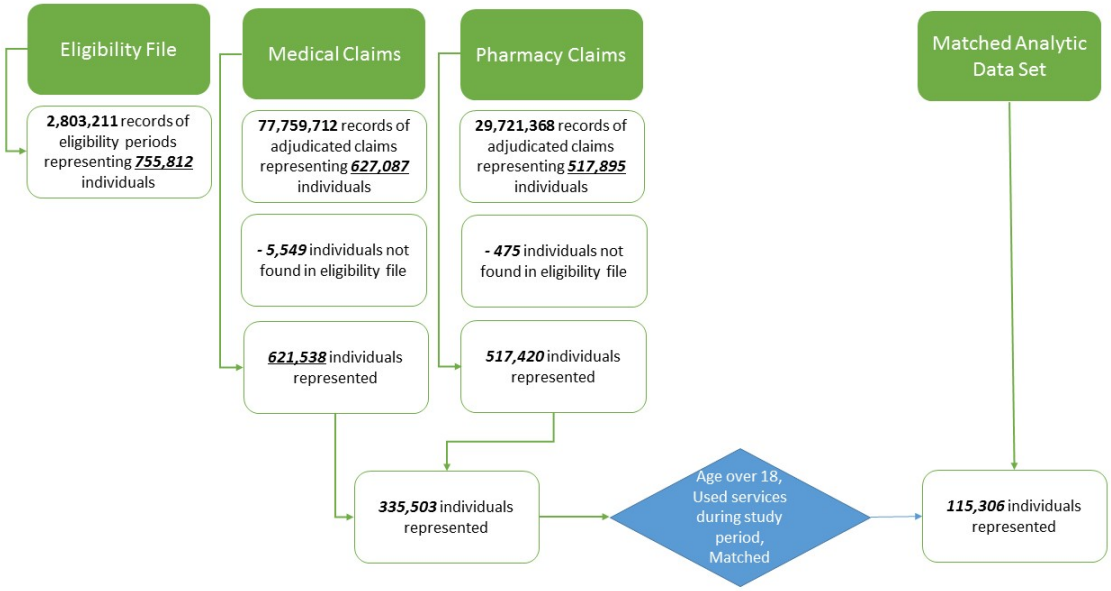
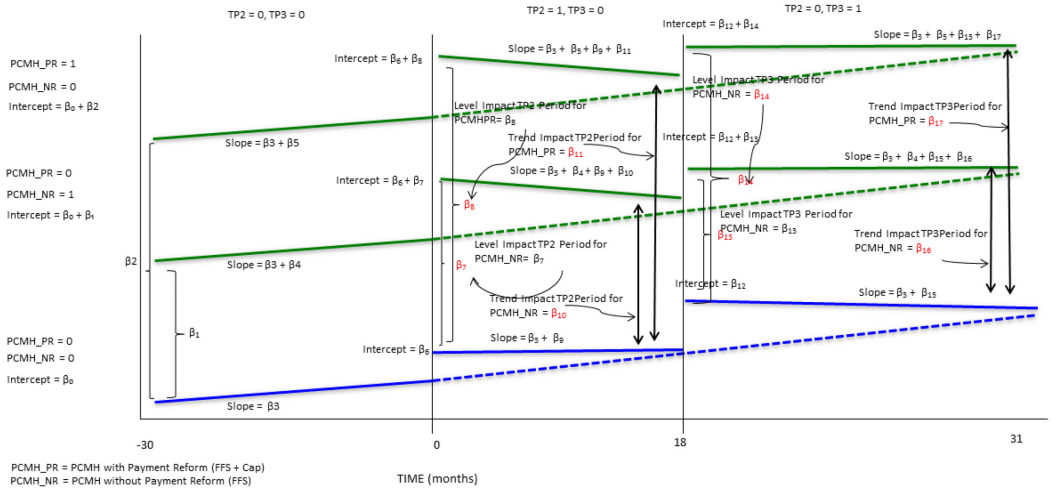


Figure 2.7.3 Simplified Model

Figure 2.7.4 Finalized Model

$$Y_{it} = \beta_0 + \beta_1 PCMH\_NR + \beta_2 PCMH\_PR + \beta_3 TIME_{it} + \beta_4 TIME_{it} * PCMH\_NR + \beta_5 TIME_{it} * PCMH\_PR + \beta_6 TP2 + \beta_7 TP2 * PCMH\_NR + \beta_8 TP2 * PCMH\_PR + \beta_9 TP2 * TIME_{it} + \beta_{10} PCMH\_NR * TP2 * TIME_{it} + \beta_{11} PCMH\_PR * TP2 * TIME_{it} + \beta_{12} TP3 + \beta_{13} TP3 * PCMH\_NR + \beta_{14} TP3 * PCMH\_PR + \beta_{15} TP3 * TIME_{it} + \beta_{16} PCMH\_NR * TP3 * TIME_{it} + \beta_{17} PCMH\_PR * TP3 * TIME_{it} + \sum_{j=12}^{J*} \beta_j x_{ijt} + \sum_{j=J*}^{J**} \beta_j x_{ij} + \varepsilon + \mu_{it}$$



2.8 Tables

Table 2.8.1 Member Demographics

Member Characteristics	PCMH	Matched Controls
N	53,119	62,187
Percent Male	59.5	66.9
Average Age	43.8	43.3
Average number of months enrolled	30.5	27.6
Average number of chronic conditions	2.14	2.31
Average PCAL value	1.71	1.82

Table 2.8.2 Percent member enrollment by number of months per group

No. months enrolled in health plan	PCMH (% of members)	Matched Controls (% of members)
1-10	14.36	18.66
11-20	21.62	24.43
21-30	19.68	17.71
31-40	13.21	13.53
41-50	11.64	10.22
51-60	8.7	7.41
61 (continuous)	10.8	8.04

Table 2.8.3. Average values on matching characteristics across PCMH and matched control sites

	Control	**PCMH FFS**	**PCMH partial capitation**

Number of Sites	110	8	15
Number of PCPs	499	41	112
Number of Members	63,209	16,284	35,813
Average Provider Age	52.32	45.79	49.15
Percent of Providers that are MDs	88.44	100	76.39
Percent of Providers that are males	66.86	54.75	64.23
Average Member Age	43.29	35.69	38.59
Percent Male Members	43.39	43.15	44.47
Average HEDIS Value	72.92	70.82	74.68
Average Member Risk Score	1.82	1.73	1.67

3. THE PATIENT CENTERED MEDICAL HOME; EFFECTS OF PAYMENT REFORM ON OVERALL POPULATION

3.1 Abstract

Objective: The objective of this chapter is to assess whether patients served by PCMH experience changes in healthcare expenditures or changes to health care utilization when enrolled in either 1) PCMH with FFS or 2) PCMH with partial capitation, relative to similar members enrolled in practices not transforming to PCMH.

Data: This study uses claims data from one commercial payer from January 2008 through January 2013 for 115,306 members enrolled in PCMH and their matched controls. In July 2010, 22 practices transformed to PCMH.

Sample: The experimental and controls include adult enrollees of the commercial payer utilizing health care between January 2008 and January 2013.

Methods: An interrupted time-series model analyzing per member per month level data, clustered on PCP.

Results: Both PCMH without payment reform and PCMH with payment reform are associated with modest decreases in the monthly likelihood of having inpatient (0.93, 95% C.I. 0.90, 0.96 and 0.95, 95% C.I. 0.93, 0.97 respectively) and ambulatory expenditures (0.99 95% C.I. 0.99,0.99 and 0.99, 95%C.I. 0.998, 0.99) Among patients with any spending, both types of PCMH show a decrease in the monthly log of inpatient expenditures (-0.074, 95% C.I. -0.103, -0.045 and -0.052, 95% C.I. -0.076, -0.027 respectively) and the monthly log of ambulatory expenditures (-0.009, 95% C.I. -0.012, -

0.005 and -0.012, 95% C.I -0.015, -0.010 respectively). Among patients in PCMH with no payment reform as compared to those those with usual ource of care there was a modest monthly increase in the likelihood of having an ED visit (1.0113 95% CI, 1.1002-1.2070) and a modest decrease in the monthly trend for the predicted odds of having an office visit (0.9964, 95% C.I. 0.9928, 0.9999)

Conclusions: This study finds that PCMH (whether reimbursing providers through FFS or partial capitation) has a financial impact on both inpatient and ambulatory expenditures suggestive of both reductions in the number of patients who incur these expenditures and reductions in how much is spent among those who have inpatient and ambulatory spending. In addition, this study found, in contrast to other studies, that PCMH is associated with an increase in ED visits. This study uncovered no statistically significant effects of PCMH on drug or total medical expenditure.

3.2 Introduction

The PCMH, as endorsed in the Joint Principles of the Patient-Centered Medical Home, is a model for the delivery of primary care that is comprehensive, team-based, coordinated, accessible, and focused on quality of care and patient safety.[111] The PCMH has gained traction and support from the Accountable Cara Act (ACA) as an important strategy forimprovement of primary care delivery. Previous evaluations on the implementation of PCMH have not shown a significant net economic impact.[23,41-44]

Across the U.S. many primary care providers have embraced the medical home concept and transformed their practices to PCMH. One of these transformations was undertaken by a not-for-profit health plan based in the Albany and upstate New York area. In July of 2010 22 practices with members enrolled in this health plan selected to transform to PCMH using a facilitation model in coordination with TransforMED; a practice change organization. The costs of initial capital and transformation costs were covered by the health plan. In a recent systematic review one of the challenges for practices successfully adopting PCMH reimbursement models were considered likely to be inadequate for the transitional costs and sustainability of the PCMH.[41] New payment structures and incentives are considered necessary to support implementation and sustainability of the PCMH model as financial barriers translate into an insufficiency of practice resources and infrastructure[103] as traditional fee-for-service payments are considered inadequate in supporting essential functions of the PCMH.[104-107]

As designed, current payment structures are not linked to the organizational arrangement which physicians need in order to deliver high quality primary care. This disconnect

between process and reimbursement has resulted in an increasing volume of work associated with primary care visits relative to the allotted visit time duration.[106] For these reasons practice reform advocates have identified payment reform as a necessary component for the success of the PCMH.[105]

The initial capital costs of the transformation by the practices in upstate New York were covered by the health plan. In addition the health plan implemented payment reform that was expected to be sufficient to sustain the PCMH and reimburse providers for activities related to care management and coordination. The health plan implemented risk-adjusted base payments with additional outcomes-based bonuses following the Goroll et al's model for fundamental payment reform.[111-113] Goroll et al set out to design a payment model that was different from previous attempts at primary care capitation and improved on the match between payment and care burden. Goroll et al characterized previous attempts as consolidations of fee-for-service payments in a manner that was inadequate[111] and set out to design a risk-adjusted comprehensive payment for the care of each patient that replaced all encounter-based payment made under the resource-based relative-value scale (RBRVS) system.

The model has two parts both of which are risk-adjusted: 1) a comprehensive payment and 2) a performance bonus. This payment would also cover implementation and maintenance of infrastructures and systems necessary to provide comprehensive, coordinated and patient-centered care. The performance and outcomes-based payment portion is intended to encourage delivery of safe and high-quality health care.

The providers continue to utilize fee for service billing for services rendered, with a pre-selected portion of these services covered under the capitation fee. Practices billing less than what the model predicted received the savings. The payments are risk-adjusted so as to not penalize practice for high-need and high-cost patients.

Ash and Ellis developed a formula to address the need for a primary care centered adjustment called the primary care activity levels (PCAL) outcome, for calculating bundled payments and bonuses.[112] This model goes beyond standard capitation payments where a model is fit to predict total cost from patient demographics and diagnoses and attempts to model money spent on the provision of comprehensive and coordinating services which are not directly available or known. Ash and Ellis model the PCAL outcome taking into account primary care activity time allocations as reported by primary care clinicians into their model.

The health plan leveraged this model in order to determine risk-adjustment for the PCMHs. In the case of the health plan, the model was used to calculate risk-adjusted case-management supplements to FFS. Payment for inpatient or specialist services would remain the responsibility of payer and were not the responsibility of the practice.

It is vital to demonstrate whether a payment models is successful and what the attributes of these practices that adopt it might be. There have been reviews on the effectiveness of financial incentives in changing healthcare professional behaviors and health outcomes.[114] However, there is a paucity of evaluations of PCMH with payment reform. Some studies evaluating PCMHs with payment reform find improved patient experience and reductions to ED visits yet they still perceived limitations in successful support of

population health interventions that were considered necessary.[115-116] These studies however, have not been able to observe effects on outcomes in programs which do not have payment reform simultaneously to PCMH programs that do adopt payment reform.

This research is significant because it evaluates two types of implementations of PCMH; one implementation of the PCMH only undergoes practice transformation and the second implementation of PCMH undergoes the same practice transformation with the additional adoption of the payment model with partial capitation described previously.

The objective of this research is to assess how expenditure and utilization are affected among a primary care patient population by PCMH with two different payment models within a single commercial payer. Given the dearth of evaluations of the impact of payment reform it is not known how primary care patients receiving care from a PCMH with partial capitation fare differently from primary care patients receiving care from a PCMH with no payment reform or from standard care from a primary care provider not delivering care in a PCMH.

3.3 Setting

The health plan facilitated transformation by paying for implementation costs of the PCMH. This included the use of transformation consulting services through TransforMed. Once clinical process transformation was over, and NCQA level 3 attained, practices could self-select into adopting payment reform. This consisted of a PMPM payment to support the clinic's medical home efforts (partial capitation). The PMPM payment replaced traditional fee-for-service reimbursement for a pre-defined list of

services and was expected to cover care management and care coordination activities. These services are listed in Table 3.10.1 and includes activities such as outpatient office visits, evaluation and management visits, preventive visits and immunizations. For services not on the list to be covered by the PMPM fee, the practice continued being reimbursed in the traditional fee-for-service manner. Clinics received risk-adjusted payments in quarterly payments.

[Table 3.10.1 CPT codes and descriptions of services included in capitated payment for PCMH adopting payment reform.]

The comprehensive, risk adjusted payment model, intended to restructure primary care for the provision of comprehensive and patient-centered care, partially replaces fee for service with a risk-adjusted base payment PMPM. This capitated payment is intended to support services listed in table 3.10.1 provided to the patients, as well as the infrastructure required to support the delivery of comprehensive patient centered care.

3.4 Data and Population

Data used for this analysis consists of pharmacy and medical claims from a single health plan in New York from January 2008 to January 2013. These are medical claims submitted for billing for services rendered by health care providers as well as drug prescriptions to members of the health plan during this period. A structured and subsidized implementation of a PCMH among 22 practices began in July 2010 and

completed in December 2011. 13 of these practices adopted partial capitation in addition to the clinical practice transformation.

The population is comprised by the set of adult patients (115,306) treated by one of the 22 practices or their matched controls between January 2008 and January 2010. Table 3.10.2 shows the breakdown of patients by group.

[Table 3.10.2 Breakdown of members per type of site; intervention and controls.]

3.5 Analysis

We use a segmented, interrupted time series design already described in chapter 2. The key variables of interest are expenditures, standardized costs and healthcare services utilization. The null hypotheses are that no difference in the types of effect on healthcare expenditures between the two programs as compared to the control and that no difference in the types of effect on healthcare utilization between the two programs as compared to the control.

An interrupted time series segmented generalized linear regression model with patient-level data is used to estimate changes over time in the outcome variables of interest to assess the effect of PCMH with and without payment reform relative to a control. We evaluate whether there are differences in the effects on outcomes across time periods attributable to PCMH transformation with FFS or PCMH transformation with partial capitation between these groups.

The time periods considered for our analyses are discussed and illustrated in Chapter 2 and include a pre-intervention period consisting of 30 months (from January 2008

through June 2010) and a post-intervention period consisting of 13 months (from January 2012 through January 2013). In this study, we evaluate the impact of the PCMH transformation on per member per month (PMPM) health care and pharmacy expenditures, and PMPM utilization of services. For utilization we include the PMPM likelihood of having any ambulatory office visits, hospitalizations, and emergency room visits and then the number of visits for those with a visit. For expenditures, we include PMPM total medical, inpatient, ambulatory and outpatient pharmacy expenditures.

To adjust for differences between intervention and control group that may be attributable to differences in other characteristics we adjust for patient and provider characteristics over time including patient age, gender, and risk scores in the regression model. The risk scores consisted of primary care activity level (PCAL) scores calculated by the health plan. These risk scores were developed so as to establish appropriate payment rates for the delivery of primary care.[112]

We used PMPM observations to establish a trend in the baseline time period and trends in the post transformation time period. Three populations are compared over the study time period: patients who received usual care under providers not affiliated with PCMH-transformed sites (the control group), patients who received care under providers affiliated with PCMH-transformed sites which retained fee-for-service reimbursement and patient who received care under providers affiliated with PCMH-transformed sites which adopted partial capitation with bonuses.

The dependent variables (described in Section 2.5.1) include dichotomous measures and continuous measures. The same statistical model is used with all but adjusted according

to the outcome measure. As estimates for these outcomes can be skewed due to the non-normality of the data (outliers of rare and extremely high cost events lead to distributions that have a long right tail and a mean that differs from the median) estimation problems would arise in common parametric tests such as OLS regression. Thus we use Generalized Linear Models (GLMs). GLMs allow for the specification of the family and link functions for the mean. We used the Box-Cox test to find optimal nonlinear transformations for the dependent variable and test the fit of the most appropriate link function to specify in the GLM. As suggested by Manning and Mullahy the Modified[106] the Modified Park Test was used on continuous outcomes to estimate the relationship between the mean and the variance and determine the distribution.

Expenditures outcome distributions were right-skewed with a substantial fraction of observations at zero. In these cases the standard OLS model may predict negative and nonsensical values. It is also possible that the zero mass is an indication of different modalities of health care use as compared to those with any use and thus respond differently to covariates in the regression. In these cases alternative estimators are used. We employ a two-part model which splits consumption into two parts: the probability of any expenditures and the level of expenditures. To model the probability of any expenditures we use GLM with a logit link. To model the level of use we use GLM on a log transformed data.

The outcomes were modeled as follows: expenditures (total medical, inpatient, ambulatory, and pharmacy) were modeled with log links to normalize the data distribution, and Gaussian distribution family. The binary outcomes representative of probability of admission or visit (ED visits, ambulatory office visits and inpatient admissions) were modeled using models with logit link and the binary distribution.

Analyses were completed using a p value < 0.05 was considered statistically significant. All analysis was completed using SAS/STAT 9.0 (SAS Institute, Cary, NC, 2011). The Johns Hopkins Bloomberg School of Public Health's Institutional Review Board approved this study.

3.6 Results

Tables 3.10.1 through 3.10.4 show the results for the segmented generalized linear regression estimation controlling for time trends, gender, age, and PCAL score. Age, gender and PCAL scores are significant predictors of expenditures and health care utilization. Across the entire population served by the primary care sites, age is associated with an increase in the predicted odds of having any medical or drug expenditures (both intensive and extensive), inpatient admissions and office visits. However, it is associated with a decrease in the predicted odds of having an ED visit. Being female is associated with an overall decrease in the predicted odds of having a health care expenditure for total medical, inpatient and drug expenditures with an associated decrease in log expenditures in these three domains. Being female is associated with increases in the predicted odds of having ambulatory expenditures and increases in the log dollars

associated with ambulatory expenditures. Higher PCAL scores are associated with higher predicted probabilities of having any health care and drug expenditures as well as with increases in the log dollars associated with all medical expenditures.

3.6.1 Health Care Utilization

We explore statistically significant effects on the monthly predicted odds for emergency room visits, office visits and inpatient admissions that can be attributed to PCMH with FFS and PCMH with partial capitation relative to the matched controls.

Emergency room visits

Compared with the control group of members not receiving care in a PCMH, and contrary to our hypothesis, we show a modest monthly increase in the likelihood of having an ED visit (1.0113 95% CI, 1.1002-1.2070) among those members treated in PCMH with no payment reform and no statistically significant effect among those treated in PCMH with payment reform. The unadjusted values monthly mean PMPM values shown in Figure 3.11.1 illustrate the values starting at nearly the same place for all three groups, and although they all trend towards an increase, both intervention groups end up at higher monthly averages than the control.

[Figure 3.11.1 Average unadjusted ED visits (loess) PMPM for all patients]

Office visits

Members enrolled in PCMH with FFS show a modest decrease in the monthly trend for the predicted odds of having an office visit (0.9964, 95% C.I. 0.9928, 0.9999) relative to members treated in sites that did not transform to PCMH. Members enrolled in PCMH

with payment reform show also show a statistically non-significant modest decrease in the monthly trend for the predicted odds of having an office visit (0.9991, 95% C.I. (0.9961, 1.0022)).

[Figure 3.11.2 Average unadjusted ambulatory office visits (loess) PMPM for all patients]

Inpatient admissions

Members not receiving care in a PCMH show no statistically significant results in the monthly likelihood of having an inpatient admission in both type of PCMH; 1.0066, 95% CI (0.9898, 1.0237) and 1.0104 95% CI (0.7222, 1.4136) for PCMH with FFS and PCMH with partial capitation respectively.

[Figure 3.11.3 Average unadjusted inpatient admissions (loess) PMPM for all patients]

[Table 3.8.1 Regression results for predicted odds of health care utilization for all patients, odds ratios with 95% confidence intervals.]

3.6.2 Health Care Expenditures

Both PCMH with FFS and PCMH with partial capitation are associated with modest decreases in the monthly likelihood of having inpatient (0.93, 95% C.I. 0.90, 0.96 and 0.93, 95% C.I. 0.90, 0.96 respectively) and ambulatory expenditures (0.99 95% C.I. 0.99,0.99 and 0.99, 95%C.I. 0.998, 0.99). No statistically significant effects on the

monthly predicted odds of having overall medical or drug expenditures were evident in either PCMH (Table 3.8.2).

In addition, among those with any spending, both types of PCMH show a decrease in the monthly log of inpatient expenditures (-0.074, 95% C.I. -0.103, -0.045 and -0.052, 95% C.I. -0.076, -0.027 respectively) and the monthly log of ambulatory expenditures (-0.009, 95% C.I. -0.012, -0.005 and -0.012, 95% C.I -0.015, -0.010 respectively) relative to their matched controls (Table 2.8.3). Statistically insignificant decreases are seen in the monthly log total medical expenditures in PCMH with FFS (-0.003, 95% C.I (-0.0006, 0.000)) and PCMH with partial capitation (-0.002, C.I (-0.005, 0.000)), but no statistically significant effect is evident in log drug expenditures for either group (0.000, 95% CI (-0.004, 0.049) and 0.001 95% CI (-0.002, 0.004) respectively).

[Table 3.8.2 Regression results for predicted odds of health care expenditures for all patients, odds ratios with 95% confidence intervals.]

[Table 3.8.3 Regression results for log(medical expenditures) for those with any health care expenditures for all patients, odds ratios with 95% confidence intervals.]

3.6.3 Standardized Costs

No statistically significant effect is seen across any of the standardized cost outcomes measures indicative of intensity of inpatient, prescription, or ambulatory use (Table 3.8.4, 3.8.5).

[Table 3.8.4 Regression results for predicted odds of having health care costs for all patients, odds ratios with 95% confidence intervals.]

[Table 3.8.5 Regression results for those with any health care costs for all patients, log($cost) with 95% confidence intervals.]

3.7 Discussion

This study found that PCMH, regardless of payment method, was associated with decreases in the likelihood of having inpatient and ambulatory expenditures, as well as in the amount of inpatient and ambulatory expenditures among those with any expenditure. The reduction in expenditures consistent with the mixed evidence yielded by other PCMH evaluations[43].

PCMH with FFS only reimbursement had a modest but statistically significant increase in monthly ED visits. We did not detect a significant change in ED visits among those treated in PCMH with partial capitation although the trend indicates a reduction in the rate of ED visits. These results are contrary to expectations as reduced emergency department use is often seen in PCMH evaluations. [117-119] However, these evaluations tend to have longer follow-up periods or be PCMHs in integrated delivery systems such as the VA. The results of this study might be an indication that 1) single commercial payer initiatives that cover less than half of a practice's panel size may not be sufficient to impact the fundamental way a practice operates despite attainment of PCMH certification or incentives, or 2) a 13 month post-implementation follow-up period may not be sufficient time to allow for the necessary time to fundamentally re-orient a practice towards more efficient care.

We did not detect significant changes in inpatient or ambulatory utilization. Other studies have generally not found PCMH to have an impact on hospital admissions unless

it is for ambulatory sensitive conditions.[120,122] However, other efforts have found PCMH to have had an impact to outpatient care utilization [122-123] but in mixed ways; one study found the reduction in outpatient care was as a result of a decrease in the rate of specialist visits[124] while another study found that what decreased were primary care visits and that greater care coordination was associated with more specialty care visits.[125]

We did not detect significant changes in monthly trends of ED, inpatient or ambulatory intensity of use (as seen through standardized costs). This study found that although utilization is not affected, the likelihood of having ambulatory and inpatient expenditures decreases, as does the amount spent when there is utilization in both ambulatory and inpatient services. Also, PCMH with partial capitation did not affect the population in ways that were notably different from those of PCMH with FFS.

One possible explanation for these results is that PCMH has different impacts on different subpopulations. This will be examined in the next two chapters. For instance, adults with multiple chronic conditions who see multiple physicians, consume more prescription drugs, and experience more care transitions are more likely to need constant management to reduce their propensity for re-hospitalizations and frequent emergency room visits than other adults.[126] In these cases it is important to consider targeting approaches that identify those most likely to benefit in a patient panel. In the second aim we will examine if the effectiveness of PCMH vary by number of chronic conditions and in the third aim we will focus on patients with mental illness.

3.8 Limitations

Several study limitations should be considered. Given that only one year of post-implementation data was available we can expect limited statistical power and perhaps insufficient time for the full effect to be realized. In addition, the commercial payer only comprises approximately 40% of the panel so that the incentives to fully incorporate changes might be compromised. Also, there are known to be differences in the way providers code their billing data introducing heterogeneity into the code. When claims codes are used to identify procedures, there will inevitably be variability with the codes selected for the definitions. As with any natural experiment, we rely on linear component analysis and matching to approximate randomization and cannot account for unobservable influences (such as those from other programs a practice may have adopted that would have the effect we note).

Second, this study was limited to members served by one commercial payer in upstate New York and may limit generalizability of the results. Third, this study is focused on practices that underwent PCMH transformation to attain NCQA recognition; it is not clear how other certifications would impact outcomes.

Fourth, each site adopts different approaches to attaining patient-centered, coordinated and accessible care. As such it is difficult to generalize these practices to one single intervention.

Finally, all practices that achieved PCMH transformation, as well as those that went on to adopt payment reform, self-selected and were not randomized. This self-selection might

suggest common attributes endogenous to these practices that were not adjusted for and thus further limit its generalizability.

3.9 Conclusions

The results of this study show that PCMH has the greatest impact in inpatient and ambulatory expenditures, although the magnitude of the impact was relatively small. The reduction in ambulatory expenditures is consistent with the expectation that increased care coordination would lead to reduced expenditures.

Payment transformation did not have a recognizably distinct effect on the pattern of outcomes 13 months out. This is consistent with analysis that find little to no effects when conducting PCMH evaluation on the entire primary care population one year out. Other studies evaluating single commercial payer initiatives one year out also uncover conflicting and mixed results in comparison to studies evaluating integrated systems at the longer term. Future policy development in the PCMH and payment reform field should take into account the length of time expected for payment reform to effect change, and how the percentage composition of the covered patients within a site's panel impacts effectiveness of the model.

3.10 Tables

Table 3.10.1 CPT codes and descriptions of services included in capitated amount for PCMH adopting payment reform

Code	Description
11055	Paring/Cutting, Benign Hyperkeratotic Lesion; Single Lesion
11056	Trim Skin Lesions 2 To 4
11200	Removal, Skin Tags, Multiple Fibrocutaneous Tags, Any Area; Up To & Incl 15 Lesions
11201	Removal, Skin Tags, Multiple Fibrocutaneous Tags, Any Area; Add'l 10 Lesions
11719	Trimming, Nondystrophic Nails, Any Number
11720	Debride Nail 1-5
11721	Debride Nail 6 Or More
11900	Injection, Intralesional; Up To & Incl 7 Lesions
11901	Injection, Intralesional; > 7 Lesions
15851	Removal, Sutures Under Anesthesia (Other Than Local), Other Surgeon
36415	Collection, Venous Blood, Venipuncture
36416	Collection, Capillary Blood Specimen
57170	Diaphragm/Cervical Cap Fitting W/Instructions
69200	Removal Fb, Ext Auditory Canal; W/O General Anesthesia
69210	Removal Impacted Cerumen (Sep Proc), One/Both Ears
81000	Urinalysis Nonauto W/Scope
81001	Urinalysis Auto W/Scope
81002	Urinalysis, Dip Stick/Tablet Reagent; Non-Automated, W/O Microscopy
81003	Urinalysis Auto W/O Scope
81005	Urinalysis; Qualitative/Semiquantitative, Except Immunoassays
81015	Urinalysis; Microscopic Only
81020	Urinalysis Glass Test
81025	Urine Pregnancy Test, Visual Color Comparison Methods
82044	Microalbumin Semiquant
82270	Occult Blood Feces
82272	Occult Bld Feces 1-3 Tests
82947	Assay Glucose Blood Quant
82948	Glucose; Blood, Reagent Strip
82950	Glucose; Post Glucose Dose (Includes Glucose)
82962	Glucose, Blood, Glucose Monitoring Device(S) Cleared By Fda Specifically For Home Use
85013	Blood Count; Spun Microhematocrit
85014	Blood Count; Hematocrit
85018	Blood Count; Hemoglobin
86580	Skin Test; Tuberculosis, Intradermal

87205	Smear Gram Stain
90460	Immunization administration through 18 years of age via any route of administration, with counseling by physician or other qualified health care professional; first vaccine/toxoid component
90461	Immunization administration through 18 years of age via any route of administration, with counseling by physician or other qualified health care professional; each additional vaccine/toxoid component (List separately in addition to code for primary procedure)
90471	Immunization Administration; 1 Single/Combination Vaccine/Toxoid
90472	Immunization Admin Each Add
90473	Immunization Administration, Intranasal/Oral; 1 Single/Combination Vaccine/Toxoid
90474	Immunization Administration, Intranasal/Oral; Ea Add'l Single/Combination Vaccine/Toxoid
92551	Pure Tone Hearing Test Air
92567	Tympanometry (Impedance Testing)
93000	Electrocardiogram Complete
93005	Electrocardiogram Tracing
93010	Electrocardiogram, Routine W/At Least 12 Leads; Interpretation & Report Only
93040	Rhythm Ecg, 1-3 Leads; W/Interpretation & Report
93268	Ecg Record/Review
93270	Remote 30 Day Ecg Rev/Report
93272	Ecg/Review Interpret Only
93784	Ambulatory Bp, 24+ Hr, Monitoring; W/Recording, Scan Analysis, Interpretation & Report
94760	Measure Blood Oxygen Level
94761	Measure Blood Oxygen Level
95115	Immunotherapy One Injection
95117	Professional Svc, Allergen Immunotherapy Non-Provision Extracts; 2+ Injections
96110	Developmental Test Lim
98925	Osteopathic Manipulative Treatment (Omt); 1-2 Body Regions Involved
98926	Osteopathic Manipulative Treatment (Omt); 3-4 Body Regions Involved
98927	Osteopathic Manipulative Treatment (Omt); 5-6 Body Regions Involved
99000	Handling &/Or Conveyance, Specimen Transfer, Physician's Office To Lab
99050	Services provided in office at times other than regularly scheduled office hours, + Basic Service
99051	Services provided in office during regularly scheduled evening, weekend, or holiday office hours, +Basic Service
99058	Office Services, Emergency Basis
99173	Screening, Visual Acuity, Quantitative, Bilat
99201	Office/Outpatient Visit New
99202	Office/Outpatient Visit New
99203	Office/Outpatient Visit New

99204	Office/Outpatient Visit New
99205	Office/Outpatient Visit New
99211	Office/Outpatient Visit Est
99212	Office/Outpatient Visit Est
99213	Office/Outpatient Visit Est
99214	Office/Outpatient Visit Est
99215	Office/Outpatient Visit Est
99339	Individual physician supervision of a patient in home, domiciliary or rest home; 15-29 minutes within a calendar month
99340	Individual physician supervision of a patient in home, domiciliary or rest home; 30 minutes or more within a calendar month
99354	Prolonged Service Office
99355	Prolonged Service Office
99374	Physician supervision of a patient under care of home health agency; 15-29 minutes within a calandar month
99375	Physician supervision of a patient under care of home health agency; 30 minutes or more within a calandar month
99381	Init Pm E/M New Pat Inf
99382	Init Pm E/M New Pat 1-4 Yrs
99383	Prev Visit New Age 5-11
99384	Prev Visit New Age 12-17
99385	Prev Visit New Age 18-39
99386	Prev Visit New Age 40-64
99387	Init Pm E/M New Pat 65+ Yrs
99391	Per Pm Reeval Est Pat Inf
99392	Prev Visit Est Age 1-4
99393	Prev Visit Est Age 5-11
99394	Prev Visit Est Age 12-17
99395	Prev Visit Est Age 18-39
99396	Prev Visit Est Age 40-64
99397	Periodic Comprehensive Preventive Medicine E&M W/Hx/Exam, Est Pt; 65+ Yr
G0179	Physician re-certification for Medicare-covered home health services under a home health plan of care
G0180	Physician certification for Medicare-covered home health services under a home health plan of care
G0181	Phsician supervision of a patient receiving Medicare-covered services provided by a participating home health agency; 30 minutes or more within a calendar month
G0182	Physician supervision of a patient under a Medicare-approved hospice; 30 minutes or more within a calandar month
G0402	Initial preventive physical examination; face-to-face visit, services limited to new beneficiary during the first 12 months of Medicare enrollment
G0438	Annual wellness visit; includes a personalized prevention plan of service (pps), initial visit

G0439	Annual wellness visit, includes a personalized prevention plan of service (pps), subsequent visit
99401	Preventive Counseling Indiv
99402	Preventive Counseling Indiv
99406	Smoking and Tobacco Use Cessation Counseling Visit; Intermediate, Greater than 3 Minutes up to 10 Minutes
99407	Smoking and Tobacco Use Cessation Counseling Visit; Intensive, Greater than 10 Minutes
99441	Telephone E/M provided by physician to established patient… 5 - 10 minutes of medical discussion
99442	Telephone E/M provided by physician to established patient…11 - 20 minutes of medical discussion
99443	Telephone E/M provided by physician to established patient…21 - 30 minutes of medical discussion
99444	Online E/M provided by physician to established patient
98966	Telephone E/M provided by qualified nonphysician to established patient… 5 - 10 minutes of medical discussion
98967	Telephone E/M provided by qualified nonphysician to established patient…11 - 20 minutes of medical discussion
98968	Telephone E/M provided by qualified nonphysician to established patient…21 - 30 minutes of medical discussion
98969	Online E/M provided by qualified nonphysician to established patient
G0436	Smoking and tobacco cessation counseling visit for the asymptomatic patient; intermediate, greater than 3 minutes, up to 10 minutes
G0437	Smoking and tobacco cessation counseling visit for the asymptomatic patient; intermediate, greater than 10 minutes
A6448	Light compression bandage, elastic, knitted/woven, width less than 3 in. per yard
A6449	Light compression bandage, elastic, knitted/woven, width 3-5 in. per yard
A7003	Nebulizer Administration Set
A7015	Aerosol Mask Used W Nebulize
G0008	Admin Influenza Virus Vac
G0009	Admin Pneumococcal Vaccine
G0010	Admin Hepatitis B Vaccine
G0101	Ca Screen;Pelvic/Breast Exam
G0102	Prostate Ca Screening; Dre
G0179	Phys Re-Cert MCR-Covr Hom Hlth Srvc
G0180	Md Certification Hha Patient
G0402	Electrocardiogram, routine ECG with 12 leads; performed as a screening for the initial preventive physical examination with interpretation and report
G0403	Electrocardiogram, routine ECG with 12 leads; tracing only, without interpretation and report, performed as a screening for the initial preventive physical examination
G0404	Electrocardiogram, routine ECG with 12 leads; tracing only, without interpretation and report, performed as a screening for the initial preventive physical examination

Q0091	Obtaining Screen Pap Smear
S8100	Holding chamber or spacer for use with an inhaler or nebulizer; without mask
S8101	Holding chamber or spacer for use with an inhaler or nebulizer; with mask

Table 3.10.2 Breakdown of members per type of site; intervention and controls.

Site	All Members
Control	63,209
PCMH FFS	16,284
PCMH partial capitation	35,813
Total	115,306

Table 3.10.3 Regression results for odds of having health care utilization for all patients, odds ratios with 95% confidence intervals.

Dependent Variable	ED visit	Office visits	Inpatient admissions
Constant	0.0301****	0.1609***	0.0046***
	[0.0282, 0.0322]	[0.1571, 0.1649]	[0.0042, 0.0050]
Time trend	1.012***	1.0001*	1.0260***
	[1.0106, 1.0138]	[1.0000, 1.0011]	[1.0232, 1.0287]
Time trend PCMH, NR	0.9878***	0.9994	1.0131***
	[0.9850, 0.9906]	[0.9984, 1.0004]	[1.0079, 1.0183]
Time trend PCMH. PR	0.9979	0.9991	0.9949*
	[0.9949, 1.0002]	[0.9983, 1.0000]	[0.9903, 0.9996]
Implementation change	0.9551*	0.9667***	0.8604***
	[0.9169, 0.9949]	[0.9531, 0.9804]	[0.8054, 0.9191]
Implementation trend	0.9901***	1.0012~	0.9762***
	[0.9864, 0.9938]	[0.9999, 1.0025]	[0.9703, 0.9822]
Implementation change PCMH,NR	1.1235**	0.9939	0.5689***
	[1.0450, 1.2079]	[0.9675, 1.0210]	[0.5023, 0.6442]
Implementation trend PCMH,NR	1.0182***	1.0016	0.9837**
	[1.0116, 1.0247]	[0.9993, 1.0040]	[0.9723, 0.9953]
Implementation change PCMH,PR	1.005	0.9815	1.0247
	[0.9420, 1.0722]	[0.9589, 1.0047]	[0.9159, 1.1464]
Implementation trend PMCH,PR	1.0025	1.0022*	1.0031
	[0.9968, 1.0083]	[1.000, 1.004]	[0.9930, 1.0133]
Post implementation change	0.9052	1.0344	1.109
	[0.7868, 1.0415]	[0.9853, 1.0860]	[0.8841, 1.3911]
Post implementation trend	0.9924*	0.9974**	0.9647***
	[0.9866, 0.9983]	[0.9954, 0.9995]	[0.9554, 0.9740]
Post implementation change PCMH,NR	1.2060~	1.1221**	0.3594***
	[0.9708, 1.4982]	[1.0324, 1.2195]	[0.2426, 0.5324]
Post implementation trend PCMH,NR	1.0113*	0.9964*	1.0066
	[1.0020, 1.0207]	[0.9928, 0.9999]	[0.9898, 1.0237]
Post implementation change PCMH,PR	0.9687	1.027	1.0104
	[0.7954, 1.1798]	[0.9567, 1.1033]	[0.7222, 1.4136]
Post implementation trend PCMH,PR	1.0031	0.9991	1.0082
	[0.9947, 1.0115]	[0.9961, 1.0022]	[0.9939, 1.0228]
Age	0.9962***	1.0185***	1.0176***
	[0.9957, 0.9966]	[1.0182, 1.0187]	[1.0168, 1.0183]
Gender (male reference)	1.3052***	1.4535***	1.4734***
	[1.2868, 1.3239]	[1.4463, 1.4606]	[1.4370, 1.5107]
Observations (member-months)	3,472,285	3,472,285	3,472,285

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 3.10.4 Regression results for odds of having health care expenditures for all patients, odds ratios with 95% confidence intervals.

Variable	Total	Prescription	Inpatient	Ambulatory
Constant	91.86***	38.90***	745.55***	135.05***
	[89,54, 94.25]	[37.30, 40.58]	[638.22, 870.92]	[131.81, 138.37]
PCMH NR	1.13***	1.10***	7.90***	1.16***
	[1.09, 1.17]	[1.06, 1.15]	[6.32, 9.87]	[1.12, 1.20]
PCMH PR	0.77***	0.99	2.86***	0.77***
	[0.74, 0.81]	[0.94, 1.05]	[2.22, 3.69]	[0.74, 0.80]
Time Trend	1.00***	1.00***	0.96***	1.00
	[1.00, 1.00]	[0.99, 1.00]	[0.96, 0.96]	[1.00, 1.00]
Time Trend PCMH NR	1.00	1.00	1.03***	1.00
	[1.00, 1.00]	[1.00, 1.00]	[1.02, 1.04]	[1.00, 1.00]
Time Trend PCMH PR	1.00	1.00	1.02***	1.00*
	[1.00, 1.00]	[1.00, 1.00]	[1.01, 1.03]	[1.00, 1.00]
Implementation Level	0.95***	0.89***	1.30***	1.02**
	[0.94, 0.96]	[0.88, 0.91]	[1.16, 1.46]	[1.01, 1.03]
Implementation Trend	1.00*	1.00	1.05***	1.00
	[1.00, 1.00]	[1.00, 1.00]	[1.04, 1.06]	[1.00, 1.00]
Implementation Level PCMH NR	0.93***	0.95**	0.84	0.92***
	[0.91, 0.96]	[0.92, 0.98]	[0.66, 1.08]	[0.90, 0.94]
Implementation Trend PCMH NR	1.00	1.00	0.96**	1.00
	[1.00, 1.00]	[1.00, 1.00]	[0.94, 0.98]	[1.00, 1.00]
Implementation Level PCMH PR	0.94***	0.99	0.87	0.94***
	[0.92, 0.96]	[0.96, 1.01]	[0.71, 1.06]	[0.92, 0.96]
Implementation Trend PCMH PR	1.00	1.00*	0.97**	1.00*
	[1.00, 1.00]	[1.00, 1.00]	[0.95, 0.99]	[1.00, 1.00]
Post Implementation Level	1.25***	1.11***	0.84	1.19***
	[1.20, 1.30]	[1.06, 1.16]	[0.57, 1.22]	[1.14, 1.24]
Post Implementation Trend	0.99***	0.99***	1.06***	0.99***
	[0.98, 0.99]	[0.99, 0.99]	[1.04, 1.07]	[0.99, 1.00]
Post Implementation Level PCMH NR	0.96	0.97	2.16*	1.13**
	[0.89, 1.03]	[0.90, 1.05]	[1.10, 4.21]	[1.05, 1.22]
Post Implementation Trend PCMH NR	1.00	1.00	0.93***	0.99***
	[0.99, 1.00]	[1.00, 1.00]	[0.90, 0.96]	]0.99, 0.99]
Post Implementation Level PCMH PR	0.97	0.99	1.22	1.11**
	[0.92, 1.04]	[0.93, 1.06]	[0.70, 2.14]	[1.04, 1.18]
Post Implementation Trend PCMH PR	1.00	1.00	0.95***	0.99***
	[1.00, 1.00]	[1.00, 1.00]	[0.93, 0.97]	[0.98, 0.99]
Age	1.01***	1.01***	1.01***	1.00***
	[1.01, 1.01]	[1.01, 1.01]	[1.01, 1.01]	[1.00, 1.00]
Female	0.99***	0.89***	0.74***	1.04***
	[0.98, 0.99]	[0.88, 0.89]	[0.71, 0.77]	[1.03, 1.04]
PCAL	1.21***	1.14***	1.07***	1.11***
	[1.21, 1.21]	[1.13, 1.14]	[1.07, 1.07]	[1.11, 1.11]
Observations (member-months)	1,978,869	1,513,798	30,277	1,352,814

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 3.10.5 Regression results for log(medical expenditures) for those with any health care expenditures for all patients, odds ratios with 95% confidence intervals.

Variable	log(total exp)	log (prescription exp)	log(inpatient exp)	log(ambulatory exp)
Constant	4.520***	3.661***	6.614***	4.906***
	[4.495, 4.546]	[3.619, 3.703]	[6.459, 6.770]	[4.881, 4.930]
PCMH NR	0.122***	0.097***	2.067***	0.149***
	[0.090, 0.154]	[0.056, 0.138]	[1.844, 2.289]	[0.117, 0.181]
PCMH PR	-0.257***	-0.007	1.051***	-0.260***
	[-0.297, -0.217]	[-0.063, 0050]	[0.797, 1.305]	[-0.300, -0.220]
Time Trend	-0.001***	-0.005***	-0.041***	0
	[-0.002, -0.001]	[-0.005, -0.004]	[-0.046, -0.036]	[0.000, 0.001]
Time Trend PCMH NR	0	0	0.027***	0.001
	[-0.001, 0.001]	[-0.001, 0.002]	[0.016, 0.038]	[0.000, 0.002]
Time Trend PCMH PR	-0.001	0	0.021***	-0.001*
	[-0.002, 0.000]	[-0.001, 0.001]	[0.012, 0.030]	[-0.002, 0.000]
Implementation Level	-0.054***	-0.113***	0.261***	0.017**
	[-0.066, -0.042]	[-0.127, -0.099]	[0.147, 0.376]	[0.005, 0.029]
Implementation Trend	-0.001*	-0.001	0.046***	0.001
	[-0.002, 0.000]	[-0.002, 0.001]	[0.036, 0.057]	[0.000, 0.002]
Implementation Level PCMH NR	-0.070***	-0.053**	-0.171	-0.084***
	[-0.096, -0.045]	[-0.082, -0.024]	[-0.416, 0.075]	[-0.111, -0.058]
Implementation Trend PCMH NR	-0.001	0.001	-0.037**	0
	[-0.003, 0.001]	[-0.001, 0.004]	[-0.058, -0.017]	[-0.002, 0.002]
Implementation Level PCMH PR	-0.057***	-0.013	-0.139	-0.064***
	[-0.079, -0.036]	[-0.038 ,0.012]	[-0.340, 0.062]	[-0.087, -0.042]
Implementation Trend PCMH PR	0.001	0.003*	-0.031**	-0.002*
	[-0.001, 0.003]	[0.001, 0.005]	[-0.048, -0.013]	[-0.004, 0.000]
Post Implementation Level	0.225***	0.107***	-0.177	0.172***
	[0.184, 0.266]	[0.062, 0.152]	[-0.555, 0.200]	[0.131, 0.213]
Post Implementation Trend	-0.014***	-0.013***	0.055***	-0.005***
	[-0.015, -0.012]	[-0.015, -0.011]	[0.039, 0.071]	[-0.007, -0.003]
Post Implementation Level PCMH NR	-0.04	-0.03	0.768*	0.124**
	[-0.112, 0.033]	[-0.109, 0.049]	[0.098, 1.438]	[0.048, 0.200]
Post Implementation Trend PCMH NR	-0.003	0	-0.074***	-0.009***
	[-0.006, 0.000]	[-0.004, 0.003]	[-0.103, -0.045]	[-0.012, -0.005]
Post Implementation Level PCMH PR	-0.026	-0.006	0.198	0.104**
	[-0.088, 0.035]	[-0.074, 0.061]	[-0.363, 0.760]	[0.040, 0.168]
Post Implementation Trend PCMH PR	-0.002	0.001	-0.052***	-0.013***
	[-0.005, 0.000]	[-0.002, 0.004]	[-0.076, -0.027]	[-0.015, -0.010]
Age	0.005***	0.019***	0.007***	0.001***
	[0.005, 0.006]	[0.010, 0.010]	[0.006, 0.009]	[0.001, 0.001]
Female	-0.013***	-0.119***	-0.299***	0.038***
	[-0.017, -0.008]	[-0.124, -0.114]	[-0.341, -0.256]	[0.033, 0.042]
PCAL	0.194***	0.128***	0.067***	0.108***
	[0.193, 0.195]	[0.127, 0.129]	[0.063, 0.071]	[0.107, 0.109]
Observations (member-months)	1,978,869	1,513,798	30,277	1,352,814

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 3.10.6 Regression results for odds of having health care costs for all patients, odds ratios with 95% confidence intervals.

Variable	Prescription	Inpatient	Ambulatory
Constant	37.32***	59,488.70***	120.10***
	[35.64, 39.09]	[55,816.15, 63,402.89]	[118.58, 121.64]
PCMH NR	1.15***	0.95	1.09***
	[1.11, 1.20]	[0.85, 1.05]	[1.06, 1.11]
PCMH PR	1.00	0.98	0.99
	[0.94, 1.07]	[0.90, 1.06]	[0.97, 1.01]
Time Trend	1.00***	1.01***	1.00*
	[1.00, 1.00]	[1.01, 1.02]	[1.00, 1.00]
Time Trend PCMH NR	1.00	1.00	1.00
	[1.00, 1.00]	[0.99, 1.01]	[1.00, 1.00]
Time Trend PCMH PR	1.00	1.00	1.00
	[1.00, 1.00]	[1.00, 1.01]	[1.00, 1.00]
Implementation Level	0.92***	0.93*	0.99
	[0.91, 0.94]	[0.87, 0.99]	[0.98, 1.00]
Implementation Trend	0.99***	0.99***	1.00*
	[0.98, 0.99]	[0.98, 0.99]	[1.00, 1.00]
Implementation Level PCMH NR	0.97~	0.95	0.97**
	[0.94, 1.00]	[0.83, 1.09]	[0.95, 0.99]
Implementation Trend PCMH NR	1.00	1.00	1.00**
	[1.00, 1.00]	[0.99, 1.02]	[1.00, 1.00]
Implementation Level PCMH PR	0.98	0.89*	0.99
	[0.96, 1.01]	[0.79, 0.99]	[0.97, 1.01]
Implementation Trend PCMH PR	1.00	1.00	1.00*
	[1.00, 1.00]	[0.99, 1.01]	[1.00, 1.00]
Post Implementation Level	0.80***	1.10	1.16***
	[0.76, 0.84]	[0.88, 1.39]	[1.13, 1.20]
Post Implementation Trend	1.00*	0.98**	0.99***
	[0.99, 1.00]	[0.97, 0.99]	[0.99, 0.99]
Post Implementation Level PCMH NR	0.96	0.76	0.96
	[0.88, 1.05]	[0.51, 1.12]	[0.91, 1.02]
Post Implementation Trend PCMH NR	1.00	1.01	1.00
	[1.00, 1.00]	[1.00, 1.03]	[1.00, 1.00]
Post Implementation Level PCMH PR	1.01	1.04	1.01
	[0.93, 1.09]	[0.74, 1.45]	[0.96, 1.06]
Post Implementation Trend PCMH PR	1.00	0.99	1.00
	[0.99, 1.00]	[0.98, 1.01]	[1.00, 1.00]
Age	1.01***	1.01***	1.00***
	[1.01, 1.01]	[1.01, 1.01]	[1.00, 1.00]
Female	0.88***	0.80***	1.06***
	[0.87, 0.88]	[0.79, 0.82]	[1.06, 1.06]
PCAL	1.14***	1.03***	1.09***
	[1.14, 1.15]	[1.03, 1.03]	[1.09, 1.09]
Observations (member-months)	1,630,839	26,131	1,476,047

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 3.10.7 Regression results for those with any health care costs for all patients, log($cost) with 95% confidence intervals.

Variable	Prescription	Inpatient	Ambulatory
Constant	3.620***	10.994***	4.788***
	[3.573, 3.666]	[10.930, 11.057]	[4.776, 4.801]
PCMH NR	0.144***	-0.054	0.084***
	[0.104, 0.184]	[-0.160, 0.051]	[0.062, 0.106]
PCMH PR	0.004	-0.022	-0.015
	[-0.057, 0.064]	[-0.107, 0.062]	[-0.035, 0.006]
Time Trend	0.002***	0.013***	0.000*
	[0.001, 0.002]	[0.011, 0.016]	[-0.001, 0.000]
Time Trend PCMH NR	-0.001	-0.001	0.001
	[-0.002, 0.001]	[-0.006, 0.005]	[0.000, 0.001]
Time Trend PCMH PR	0.001	0.003	-0.001
	[0.000, 0.002]	[-0.002, 0.007]	[-0.001, 0.000]
Implementation Level	-0.080***	-0.074*	-0.007
	[-0.096, -0.065]	[-0.141, -0.007]	[-0.017, 0.003]
Implementation Trend	-0.014***	-0.015***	-0.001*
	[-0.016, -0.013]	[-0.021, -0.009]	[-0.002, 0.000]
Implementation Level PCMH NR	-0.031	-0.051	-0.029**
	[-0.063, 0.000]	[-0.187, 0.085]	[-0.048, -0.009]
Implementation Trend PCMH NR	0.001	0.004	0.003**
	[-0.002, 0.003]	[-0.007, 0.016]	[0.001, 0.004]
Implementation Level PCMH PR	-0.016	-0.119*	-0.010
	[-0.042, 0.010]	[-0.232, -0.006]	[-0.026, 0.007]
Implementation Trend PCMH PR	0.002	0.003	0.002*
	[-0.001, 0.004]	[-0.006, 0.013]	[0.000, 0.003]
Post Implementation Level	-0.223***	0.097	0.151***
	[-0.274, -0.172]	[-0.131, 0.326]	[0.119, 0.184]
Post Implementation Trend	-0.003*	-0.019**	-0.007***
	[-0.005, -0.001]	[-0.029, -0.010]	[-0.008, -0.005]
Post Implementation Level PCMH NR	-0.038	-0.279	-0.039
	[-0.127, 0.051]	[-0.670, 0.113]	[-0.096, 0.018]
Post Implementation Trend PCMH NR	0.001	0.013	0.001
	[-0.003, 0.004]	[-0.004, 0.030]	[-0.001, 0.003]
Post Implementation Level PCMH PR	0.008	0.040	0.010
	[-0.068, 0.084]	[-0.295, 0.375]	[-0.038, 0.059]
Post Implementation Trend PCMH PR	-0.002	-0.005	0.001
	[-0.005, 0.001]	[-0.020, 0.009]	[-0.001, 0.003]
Age	0.010***	0.011***	0.002***
	[0.010, 0.010]	[0.011, 0.012]	[0.002, 0.002]
Female	-0.132***	-0.218***	0.058***
	[-0.138, -0.127]	[-0.242, -0.194]	[0.055, 0.061]
PCAL	0.135***	0.030***	0.087***
	[0.134, 0.136]	[0.028, 0.033]	[0.086, 0.087]
Observations (member-months)	1,630,839	26,131	1,476,047

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

3.11 Figures

Figure 3.11.1 Average unadjusted ED visits (loess) PMPM for all patients

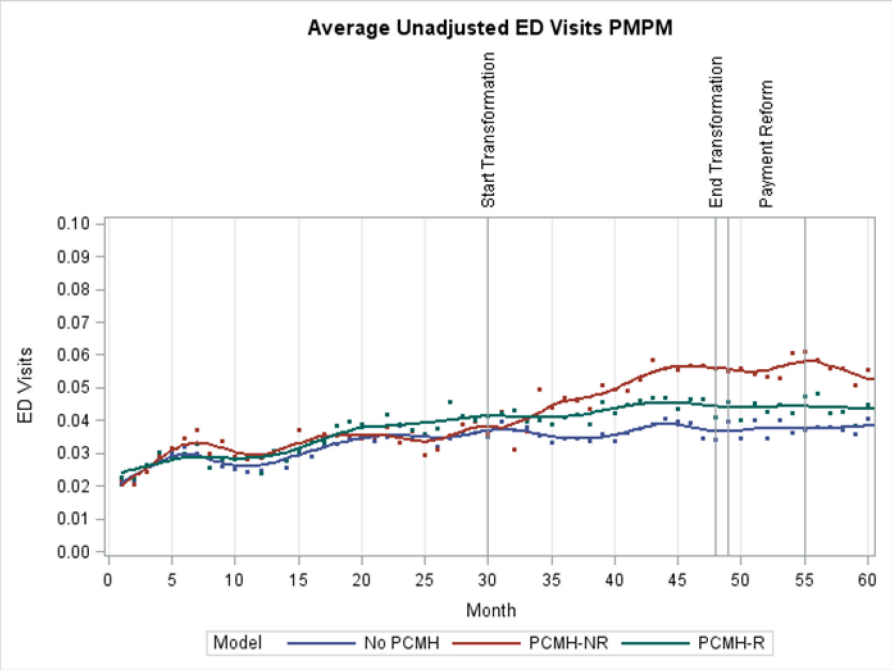
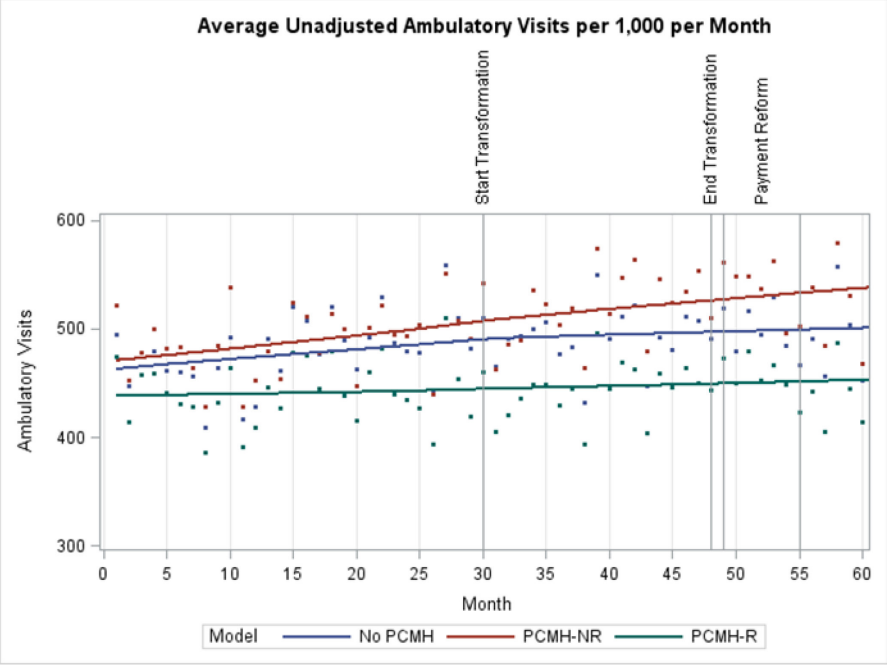


Figure 3.11.2 Average unadjusted ambulatory office visits (loess) PMPM for all patients.



4. THE PATIENT CENTERED MEDICAL HOME; DIFFERENTIAL IMPACT ADULT POPULATION WITH MULTIPLE CHRONIC CONDITIONS

4.1 Abstract

Objective: The objective of this chapter is to assess whether patients with at different numbers of chronic conditions experience changes in healthcare expenditures or changes to health care utilization when enrolled in either 1) PCMH with FFS or 2) PCMH with partial capitation, relative to matched members enrolled in practices not transforming to PCMH.

Data: This study uses claims data from one commercial payer from January 2008 through January 2013 for 115,306 members enrolled in PCMH and their controls. In July 2010, 22 practices transformed to PCMH and 13 subsequently enrolled in the partial capitation option.

Sample: The experimental and controls include adult enrollees of the commercial payer utilizing health care between January 2008 and January 2013 with at least one chronic condition, broken down into populations with 1-2, 3-4, and 5 or more chronic conditions.

Methods: An interrupted time-series model analyzing per member per month level data.

Results: Only the sickest members, those with 5 or more chronic conditions, experience decreases in the rate of monthly log total expenses among those who have any expenses (-0.0104, p=0.0003 and -0.0061, p=0.0172 in PCMH with fee-for-service and PCMH with partial capitation respectively.) There is no statistically significant effect on the odds of having a medical expenditure as a result of being enrolled in PCMH. Members

with 1-2, 3-4 and 5 or more chronic conditions enrolled in PCMH with partial capitation show similar and modest reductions in the monthly odds of having a drug expenditure (0.9880, p<0.0001; 0.9790, p<0.0001; and p=0.9815, p<0.0001 respectively). No statistically significant effect is seen in monthly log prescription expenditures among any of these subgroups. No effect in PCMH with fee-for-service except in monthly log drug expenditure reductions (-0.006, p=0.0487) among those with 5 or more chronic conditions. PCMH with partial capitation relative to usual source of care exhibits an inverse dose response effect on the increased monthly odds of having an ambulatory expenditure with 1.0237, p<0.0001; 1.0141, p<0.0001; 1.0119, p=0.0005; and 1.0043, p=0.2196 for those with zero, 1-2, 3-4 and 5 or more chronic conditions as well as an inverse dose response decrease in log ambulatory expenditures among those with any ambulatory expenditures; -0.018, p<0.0001; -0.014, p<0.0001; -0.012, p<0.0001 and -0.007, p=0.0057 for those with zero, 1-2, 3-4 and 5 or more chronic conditions. PCMH with FFS does not have a statistically significant effect on monthly odds for ambulatory expenditure but does decrease (no dose response) in log ambulatory expenditures among those with any ambulatory expenditures; -0.010, p=0.0004; -0.011, p=0.0013 and -0.009, p=0.0051 for those with 1-2, 3-4 and 5 or more chronic conditions.

No statistically significant effects are seen for ED visits. In PCMH with FFS only those with 1-2 and 3-4 chronic conditions see increases in the monthly odds of having an inpatient admission (1.0974, p=0.0509, and 1.0823, p=0.0003 respectively). Only the sickest members, those with 5 or more chronic conditions see modest reductions in the monthly probability of having an office visit in both PCMH with FFS (0.9904, p=0.0101) and partial capitation (0.9913, p=0.0090).

Conclusions: For most services there was not a dose response between the number of chronic conditions and the probability of an expenditure or the level of expenditure. This suggests that in these settings PCMH is not more effective in treating people with more chronic conditions. In general, PCMH with partial capitation had more impact among members with chronic conditions than PCMH with FFS. Increases in the monthly probability of incurring an ambulatory expenditure and reductions in the monthly probability of incurring a drug expenditure were seen with a dose response among members enrolled in PCMH with partial capitation. Both types of PCMH saw reductions in monthly log ambulatory expenditures relative to usual source of care. Only the sickest members saw decreases in the probability of having an office visit (both PCMHs), reductions in monthly log total medical expenditures (both PCMHs), and reductions in monthly ambulatory expenditures (FFS only). No effects were evident in the areas of high utilization; emergency room visits and inpatient admissions.

4.2 Introduction

Adults with multiple chronic conditions (MCC) account for more than two-thirds of health care spending.[15] More than 25 percent of Americans have been diagnosed with two or more chronic conditions.[127] In addition the rate of growth of this population is increasing, in particular among those aged 45 to 64.[128] Improving the health of this population is central to the goals of the National Strategy for Quality Improvement in Health Care and multiple federal initiatives such as the Strategic Framework on Multiple Chronic Conditions have been issued by the Department of Health and Human Services.[129]

Patients with MCCs see more physicians, consume more prescription drugs, experience more care transitions, and undergo more emergency department visits than patients without MCCs[130]. Multiple issues arise in the care of this population such as conflicting medication regimens and increasing disease burden.[131,132] Patients with MCCs may require more consistent health care management to reduce their propensity for re-hospitalizations and emergency room visits.[133] Older patients with MCCs experience greater morbidity associated from these higher rates of hospitalization, emergency service use and outpatient care.[134-137] As such, these populations have been recognized to be at greater risk of receiving inadequate care from disease-specific, segmented care and stand to benefit more from care coordination across providers over time that can reduce hospitalizations and emergency department visits.[141] As a result there is the expectation that entities such as PCMH will have a greater impact on people with MCC.

There is concern that patients with more co-morbidities will have difficulty finding the appropriate delivery system.[142,143] One possible approach that has received considerable

attention is PCMH. PCMH is thought to be particularly effective among the high need, high cost population, in particular those with MCC.[144] Despite this, many of the evaluations of medical homes and other similar programs have not appropriately considered multi-morbidity. Most assessments of PCMH impact on illness care are limited to evaluating the impact on patients with single chronic conditions or the general population of patients.[145-154] Given that most primary care evaluations center on providing care for the entire population and that clinical practice guidelines are dosed on the management of single diseases, it stands to reason that evaluations of PCMH would focus on this population.[155-156] However, this ignores the fact that people with different numbers of chronic conditions may have different responses to PCMH. Recent systematic reviews of the PCMH conclude that results are mixed among the general population and those with specific, single conditions with no indication of how PCMH is able to treat the multi-morbid population.[23,41-44]

The objective of this paper is to determine whether there is a response of PCMH in each outcome as a function of the number of chronic conditions a patient has. There is no consensus in the literature on how PCMH with or without partial capitation may affect treatment of those with varying numbers of chronic conditions.

4.3 Data and Population

Data used for this analysis consists of pharmacy and medical claims from a single health plan in New York from January 2008 to January 2013. These are medical claims submitted for billing for services rendered by health care providers as well as drug prescriptions to members of the health plan during this period. A structured and subsidized implementation of a PCMH among 22 practices began in July 2010 and

completed in December 2011. 13 of these practices adopted partial capitation in addition to the clinical practice transformation.

The population is comprised by the set of adult patients (115,306) treated by one of the 22 practices or their matched controls between January 2008 and January 2010. The population of patients treated by one of the 22 practices or their matched controls were assigned into categories based on their total number of mutually exclusive chronic conditions: 0, 1 or 2, 3 or 4, or 5 or more.

We employed a previously developed methodology for counting the number of chronic disease categories across the entire study period.[46] Using this method, a person is defined as having a chronic condition if the condition met two criteria: 1) the condition had lasted or was expected to last 12 or more months and 2) the condition resulted in functional limitations and/or the need for ongoing medical care. Two physician panels convened and were asked to judge all ICD-9 codes on whether or not they met the definition of chronic condition defined above. The AHRQ's clinical classification system (CCS) aggregates diagnosis codes into 259 mutually exclusive clinical categories. Out of the 259 categories 177 were classified as chronic conditions in adults by the panel. Medical claims were scanned for the ICD-9 codes judged by the panel to meet the definition of a chronic condition. Each member's claim was coded with a CCS aggregate diagnosis code that matched any of the available diagnosis ICD-9 codes on the claim. A chronic condition count was assigned to members based on the number of uniquely different CCS aggregate codes they were assigned. Table 4.8.1 shows the breakdown of members according to chronic condition counts.

4.4 Analysis

We use a segmented, interrupted time series design described in chapter 2. The key variables of interest are expenditures, standardized costs and healthcare services utilization. The null hypothesis is effect of PCMH with or without payment reform will be no different between members regardless of the counts of chronic conditions when compared to matched controls across any of the outcomes.

An interrupted time series segmented generalized linear regression model with patient-level data is used to estimate changes over time in the outcome variables of interest to compare the effect of PCMH relative to a control. We analyzed patients grouped by number of chronic conditions separately to determine whether there are differential effects across time periods attributable to PCMH transformation with FFS or PCMH transformation with payment reform between these groups.

The time periods considered for our analyses are discussed and illustrated in Section 2.8.1 and include; a pre-intervention period consisting of 30 months (from January 2008 through June 2010) and a post-intervention/post implementation period consisting of 13 months (from January 2012 through January 2013). In this study, we evaluate the impact of the PCMH transformation on the average per member per month (PMPM) health care expenditures to the health plan, and PMPM utilization of services. For utilization we include the PMPM likelihood of having ambulatory office visits, hospitalizations, and emergency room visits. For expenditures we include PMPM of total medical, inpatient, ambulatory and outpatient pharmacy expenditures. We will look at these across the categories of patients based on their total number of mutually exclusive chronic conditions as described (1 -2, 3-4 and 5 or more).

To adjust for differences between intervention and control group that may be attributable to differences in other characteristics we adjust for patient and provider characteristics over time including patient age, gender, and risk scores in the regression model. The risk scores consisted of primary care activity level (PCAL) scores calculated by the health plan. These risk scores were developed so as to establish appropriate payment rates for the delivery of primary care and were used to determine appropriate risk adjusted payments. We included the PCAL scores as risk scores to adjust for patient complexity in our models.

We used PMPM observations to establish a trend in the baseline time period and trends in the post transformation time period. Three populations are compared over the study time period: 1) patients who received usual care under providers not affiliated with PCMH-transformed sites (the control group), 2) patients who received care under providers affiliated with PCMH-transformed sites with no payment reform, and 3) patients who received care under providers affiliated with PCMH-transformed sites with partial capitation.

The dependent variables (described in Section 2.5.1) include dichotomous measures and continuous measures. The same statistical model is used with all but adjusted according to the outcome measure. As estimates for these outcomes can be skewed due to the non-normality of the data (outliers of rare and extremely high cost events lead to distributions that have a long right tail and a mean that differs from the median) estimation problems would arise in common parametric tests such as OLS regression. Thus we use Generalized Linear Models (GLMs). GLMs allow for the specification of the family and link functions for the mean. We used the Box-Cox test to find optimal nonlinear

transformations for the dependent variable and test the fit of the most appropriate link function to specify in the GLM. As suggested by Manning and Mullahy the Modified[106] the Modified Park Test was used on continuous outcomes to estimate the relationship between the mean and the variance and determine the distribution.

Expenditures outcome distributions were right-skewed with a substantial fraction of observations at zero. In these cases the standard OLS model may predict negative and nonsensical values. It is also possible that the zero mass is an indication of different modalities of health care use as compared to those with any use and thus may respond differently to covariates in the regression. In these cases alternative estimators are used. We employ a two-part model that splits consumption into two parts: the probability of any expenditures and the level of expenditures. To model the probability of any expenditures we use GLM with a logit link. To model the level of use we use GLM on a log transformed data.

Analyses were completed using a p value < 0.05 was considered statistically significant. All analysis was completed using SAS/STAT 9.0 (SAS Institute, Cary, NC, 2011). The Johns Hopkins Bloomberg School of Public Health's Institutional Review Board approved this study.

4.5 Results

Of the 115,306 members in this study 40,845 (35.4%) had 1-2 chronic conditions, 21,029 (18.2%) had 3-4, and 22,588 (19.6%) had 5 or more. Table 4.8.1 shows the breakdown of members by number of chronic conditions.

[Table 4.8.1 Number and percent of members assigned to categories based on their total number of mutually exclusive chronic conditions.]

In the next few sections we next describe the results for all outcomes - predicted probabilities of having an ED visit, office visit, inpatient admission; expenditures for ambulatory pharmacy, inpatient care, ambulatory care, and total medical care; standardized costs for ambulatory pharmacy, inpatient care, and ambulatory care.

Odds of having an ED visit

The effects on the monthly probability of having an ED visit were modest, mixed and statistically non-significant across all groups.

[Table 4.8.2 Regression results for odds of ED visit for all patients and categories of MCC, odds ratios with 95% confidence intervals.]

Predicted odds of having an office visit

The sickest members, those with 5 or more chronic conditions show evidence of small reductions in the monthly odds of having an office visit in PCMH with FFS 0.9904 (p=0.0101) and in PCMH with partial capitation 0.9913 (p=0.0010). No statistically significant impact is seen in the monthly trend of odds of having an office visit post implementation of PCMH although they all trend to modest decreases (not statistically significant); the members with more chronic conditions have the greater the reduction in odds of having an office visit. For instance, in PCMH with FFS the odds of having an office visit are 0.9972 (p=0.5503), 0.9942 (p=0.0747), 0.9937 (p=0.1157), and 0.9904 (p=0.0101) for members with zero, 1-2, 3-4, and 5 or more chronic conditions

respectively. Likewise, in PCMH with partial capitation the predicted probabilities post implementation are 0.9972 (p=0.7100), 0.9942 (p=0.2093), 0.9937 (p=0.0942) and 0.9904 (p=0.0101) respectively.

[Table 4.8.3 Regression results for odds of Office visit for all patients and categories of MCC, odds ratios with 95% confidence intervals.]

Odds of having an inpatient admission

Contrary to expectations, all statistically significant effects on inpatient admissions one year out are increases in the monthly odds of having an inpatient admission. For members enrolled in PCMH with FFS there is an inverse dose response in the magnitude of the increases with respect to number of chronic condition, but statistical significance is only reached among the groups of members with 1-2 and 3-4 chronic conditions; 1.0974 ($p<0.0509$) for members with 1-2 chronic conditions, 1.0824 (p=0.0003) for members with 3-4 and 1.0218, p=0.0754 for members with 5 or more chronic conditions. For members enrolled in PCMH with partial capitation the dose response does not exist. PCMH with partial capitation had no statistically significant effect on the odds of inpatient admissions

Note – the regression results for odds of inpatient admissions for those with no chronic conditions did not converge and is left blank in the table.

[Table 4.8.4 Regression results for odds of inpatient admissions for all patients and categories of MCC, odds ratios with 95% confidence intervals.]

Ambulatory Drug Expenditures

Those with 5 or more chronic conditions show statistically significant evidence of a modest decrease in the monthly likelihood of having a drug expenditure relative to the control (0.9940, p=0.0487). The groups with 1-2 or 3-4 chronic conditions show no evidence of a change in trend nor are the regression results statistically significant. For those enrolled in PCMH with payment reform there is no evident effect in the monthly trends nor are any of the regression results statistically significant.

[Table 4.8.5 Regression results for predicted odds of prescription drug expenditures for categories of MCC, odds ratios with 95% confidence intervals.]

Among those with multiple chronic conditions who had any drug expenditure and were enrolled in a PCMH with no payment reform, those with 3-4 and 5 or more chronic conditions show evidence of a monthly decrease in the log expenditures post implementation relative to the control with statistical significance being attained for those with 5 or more chronic conditions (-0.0022, p=0.5242; -0.0060, p=0.0488 respectively). Results among groups for those enrolled in PCMH with payment reform are statistically insignificant and mixed with only those with 3-4 chronic conditions showing a decreasing trend in log expenditures.

Table 4.8.6 Regression results log (drug expenditures) for those with any drug expenditures by categories of MCC, odds ratios with 95% confidence intervals.

The unadjusted averages for pharmacy expenditures PMPM also increase by number of chronic conditions regardless of intervention or control. Both interventions and controls exhibit a sudden increase in the steepness of the growth in expenditures around month 42. The adjusted analysis is able to account for this trend. For those with 5 or more chronic conditions a reduction is evident at the beginning of the post transformation period for all interventions and controls with the control and PCMH with payment reform trending again towards an increase after month 55 and PCMH with no payment reform continuing with a milder per month average decreasing trend.

[Figure 4.9.3 Average unadjusted pharmacy expenditures (loess) PMPM for categories of MCC]

Inpatient Expenditures

The predicted odds of having any inpatient expenditures for members treated in PCMH with no payment reform shows evidence of a statistically significant monthly increase among members with 1-2, and 3-4 (1.0977, $p<0.0001$; 1.0767, $p=0.0007$) respectively. The PCMH let to an increase in the predicted odds of having a monthly inpatient expenditure (1.0205, $p=0.0954$) among members with 5 or more chronic relative to the control that does not attain statistical significance. The same inverse dose response is evident with the results for the log expenditures of those with any inpatient expenditure with statistically significant monthly decreases in log dollars of 0.1971 ($p<0.0001$) and 0.1022 ($p=0.0050$) for those with 1-2 and 3-4 chronic conditions respectively. Those with 5 or more chronic conditions show a decreasing trend in the slope of monthly log

dollars of 0.0255 (p=0.1343) during the post implementation period but it is not statistically significant.

Results are mixed for members treated in PCMH with payment reform with a statistically significant increase in the monthly probability of having an inpatient expenditure visible for those with 1-2 (1.0932, p<0.0001) relative to the control. Those with 3-4 and 5 or more chronic conditions show a monthly trend that modestly decreases (0.9951, p=0.7958; 0.9943, p=0.5878) but is not statistically significant. Members with 1-2 and 5 or more chronic conditions who have any inpatient expenditure exhibit monthly decreases in the log expenditures of 0.1532 (p<0.0001) and 0.0305 (p=0.0444) respectively while those with 3-4 chronic conditions demonstrate an increasing monthly trend that is not statistically significant.

Table 4.8.7 Regression results for predicted odds of having any inpatient expenditures for categories of MCC, odds ratios with 95% confidence intervals.

Table 4.8.8 Regression results for log(inpatient expenditures) among those having any inpatient expenditures for categories of MCC with 95% confidence intervals.

Ambulatory Expenditures

The monthly predicted odds of having ambulatory expenditure is mixed. Among members enrolled in PCMH with partial capitation the probability of having a monthly ambulatory expenditure increases for all groups with only those having less than 5 chronic conditions attaining statistical significance; 1.0237 (p<0.0001), 1.0141 (p<0.0001), 1.0119 (p=0.0005) and 1.0043 (p=0.2196) for those with zero, 1-2, 3-4 and

5+ chronic conditions respectively. No statistically significant effect is seen among those members enrolled in PCMH with FFS.

Table 4.8.9 Regression results for predicted odds of having any ambulatory expenditure for categories of MCC, odds ratios with 95% confidence intervals.

Statistically significant monthly decreases in log expenditures are also evident across all three groups regardless of payment reform adoption in the PCMH; with decreases of 0.0101 ($p=0.0004$), 0.0109 ($p=0.0013$) and 0.0085 ($p=0.0051$) log dollars for those with 1-2, 3-4, and 5 or more chronic conditions in PMCH with no payment reform relative to the control and with monthly decreases of 0.0142 ($p<0.0001$), 0.0123 ($p<0.0001$) and 0.0075 ($p=0.0057$) log dollars respectively in PCMH with payment reform relative to the control.

Table 4.8.10 Regression results for log (ambulatory expenditures) among those having any ambulatory expenditure for categories of MCC, odds ratios with 95% confidence intervals.

Total Medical Expenditures

Only those with zero chronic conditions show any statistically significant effect in the monthly slope of the odds of having any medical expenditure. These members experience a modest monthly increase in the odds when enrolled in PCMH with partial capitation relative to the control (1.0089, $p=0.0066$).

[Table 4.8.11 Regression results for predicted odds of having any medical expenditure for categories of MCC, odds ratios with 95% confidence intervals]

Among those with any medical expenditure, members with 5 or more chronic conditions, show evidence of a statistically significant decrease in the monthly log dollars post implementation relative to the control (-0.0100 log dollars, p=0.0002, and -0.0060, p=0.0332 for PCMH with FFS and PCMH with partial capitation respectively).

[Table 4.8.12 Regression results for log (total expenditures) among those having any medical expenditure for categories of MCC, odds ratios with 95% confidence intervals]

Figure 4.9.1 shows the unadjusted averages for total medical expenditures over time. In the figure, the brown background indicated the months during which transformation to PCMH took place. The blue background indicates the period during which practices that adopted payment reform implemented it. Average PMPM medical expenditures show increasing average costs with increasing number of chronic conditions regardless of intervention. Trends indicate expenditures increasing over time, with steeper increases as the number of chronic condition rises. For those with 5 or more chronic conditions treated in PCMH with or without payment reform a decline in expenditures that is noticeable beginning midway through the post-transformation period (indicated by the time period after the brown background).

[Figure 4.9.1 Average unadjusted total medical expenditures (loess) PMPM for categories of MCC]

Drug Standardized Cost

When applying standardized drug fee schedules members enrolled in PCMH with partial capitation saw dose response decreases in the predicted odds of incurring a cost (filling any prescription) if they had 1-2, 3-4, and 5 or more chronic conditions proportional to the number of chronic conditions (0.9903, p=0.0001; 0.9843, p<0.0001; and 0.9828, p<0.0001 respectively). No statistically significant effects were seen among those with zero chronic conditions. No effects are statistically significant in members enrolled in PCMH with FFS.

Table 4.8.13 Regression results for predicted odds of having any drug costs for categories of MCC, odds ratios with 95% confidence intervals

Members with 3-4 chronic conditions enrolled in PCMH with partial capitation, with some drug cost, showed statistically significant evidence of a decrease in drug cost and thus intensity of utilization relative to the control; -0.0070 (p=0.0328). No other group had statistically significant differences.

Table 4.8.14 Regression results for log (drug cost) among those having any drug cost for categories of MCC, odds ratios with 95% confidence intervals

Inpatient Costs

The monthly post implementation trend for the predicted odds of having an inpatient cost for members treated in PCMH with no payment reform is modestly increasing for groups with 1-2, 3-4, and 5 or more chronic conditions, though without statistical significance (1.03, 1.03 and 1.01 respectively). For those receiving care from PCMH with no

payment reform with at least some incurred inpatient cost all three groups increase in the monthly log costs (0.032, 0.027, and 0.007 for those with 1-2, 3-4, and 5 or more chronic conditions respectively) with no statistical significance. For members receiving care in PCMH with payment reform the results are also modest and mixed with only those with 3-4 chronic conditions showing a statistically significant increase (1.05) while those with 1-2 and 5 or more having statistically insignificant decreases (0.99 for both). For those incurring some cost and receiving care in PCMH with payment reform, members with 3-4 chronic conditions again show a statistically significant increase whereas those with 1-2 and 5 or more show a statistically insignificant decrease.

Table 4.8.15 Regression results for predicted odds of having any inpatient costs for categories of MCC, odds ratios with 95% confidence intervals

Table 4.8.16 Regression results for log (inpatient cost) among those having any inpatient costs for categories of MCC, odds ratios with 95% confidence intervals

Ambulatory Costs

Members with 5 or more chronic conditions show evidence of a statistically significant reduction in the monthly likelihood of having an ambulatory cost in both types of PCMH relative to the control (0.09876, p=0.0017 and 0.09874, p=0.0013 for PCMH with FFS and PCMH with partial capitation respectively). No change is evident in the monthly predicted odds of having an ambulatory cost among any of the other groups enrolled in either PCMH.

Table 4.8.17 Regression results for predicted odds of having any ambulatory costs for categories of MCC, odds ratios with 95% confidence intervals

Among those having some ambulatory cost only members with zero chronic conditions enrolled in PCMH with FFS showed evidence of a statistically significant change in log dollars for ambulatory costs with an modest increase of 0.0061 log dollars (p=0.0405).

Table 4.8.18 Regression results for log (ambulatory cost) among those having any ambulatory costs for categories of MCC, log($cost) with 95% confidence intervals

4.5 Discussion

For most services, there was not a dose response between the number of chronic conditions and the probability of an expenditure or the level of expenditures. This suggests that in these setting PCMH is not consistently more effective in treating people with more chronic conditions.

This study found that only the sickest patients, those with 5 or more chronic conditions, benefitted from monthly reductions post PCMH implementation in log total medical expenditures in PCMH, both FFS and partial capitation, relative to the control. One possible explanation is that since sicker patients use more health services, there is more opportunity for reductions and efficiency once care is managed.

Across other outcomes, this study found that groups with different numbers of chronic conditions are affected in different ways by PCMH. Contrary to expectations the PCMHs included in this study did not lower hospital admission rates, and in fact raised them among members with 1-2 and 3-4 chronic conditions; though only for members enrolled in PCMH with FFS relative to usual source of care.

These findings are consistent with findings to date on the impact of PCMH and hospital use.[23,41-44] In keeping with this increase in the monthly rate of inpatient admissions post implementation, we observe an increase in the monthly predicted odds of having an inpatient expenditure among these same groups. However, among those who had any inpatient spending in these groups with multiple chronic conditions we found that there are reductions in monthly inpatient expenditures relative to usual source of care. It is possible that given the short follow-up of this study (13 months) increases in inpatient

utilization is more a reflection of unmet needs being discovered and addressed than inappropriate management of conditions. The savings in monthly log expenditures may be suggestive that there are changes in the way inpatient care is delivered as a result of PCMH. Further exploration as to the causes for this is warranted.

Also contrary to expectations, the rate of emergency room visits did not show statistically significant results. Although impact on the rate of emergency room visits in the literature is overall mixed[23,41], there have been indications of declining rates of emergency room visits reported.[42,120,156-157] Based on the design of the program we expected a dose response with greater reductions visible among those with greater numbers of chronic conditions. However, not all evaluations occurring in independent small practices are showing reductions in ED visits.[123] One possible explanation in this case is that the low number of patients with chronic conditions and ED use in the subgroup analysis makes these effects harder to detect due to lack of power.

This study also found that when is a difference between PCMH with partial capitation and PCMH with FFS, this effect applies to all subgroups, with and without multiple chronic conditions. For instance, the effect on office visits differed greatly between PCMH with FFS and PCMH with partial capitation. While both saw a dose response reduction in the monthly probability of having an office visit post PCMH implementation, only those with 5 or more chronic conditions achieved statistical significance. Also only PCMH with partial capitation showed evidence of a dose response increases in the monthly predicted odds of having an ambulatory expenditure which coincided with a monthly savings in the log expenditures among all subgroups. This is in keeping with the expectation that the global payment allows providers to

manage the care of their patients (potentially through an increase in ambulatory utilization) and reduce unnecessary services.

The effect of drug expenditures also differed between PCMH with FFS and PCMH with partial capitation. This study found that PCMH with partial capitation reduces the probability of having a drug expenditure per month post implementation among all groups, with or without MCC, whereas PCMH with FFS does not. Again, this could be explained as better drug management among patients as a result of global payments.

4.6 Limitations

Several study limitations should be considered. There are known to be differences in the way providers code their billing data introducing heterogeneity into the code. As with any natural experiment, we rely on linear component analysis and matching to approximate randomization and cannot account for unobservable influences (such as those from other programs a practice may have adopted that would have the effect we note).

Second, this study was limited to members served by one commercial payer in upstate New York and may limit generalizability of the results. Third, this study is focused on practices that underwent PCMH transformation to attain NCQA recognition; it is not clear how other certifications would impact outcomes. Fourth, each site adopts different approaches to attaining patient-centered, coordinated and accessible care. As such it is difficult to generalize these practices to other practices.

All practices that achieved PCMH transformation, as well as those that went on to adopt payment reform, self-selected and were not randomized. This self-selection might suggest common attributes endogenous to these practices that were not adjusted for and thus further limit its generalizability.

In addition, small sample sizes that result from segmenting the population into groups of members with different numbers of chronic conditions contribute to reduced analytical power and hence limit statistical significance.

Finally, it should be noted that operating costs associated with practice transformation and maintenance of PCMH status are not considered as these costs were absorbed by the health plan as an incentive to practice transformation. Further studies that consider these costs are warranted.

4.7 Conclusions

This study contributes to the growing body of evidence that PCMH reduces the cost of care among the sickest patients. Only the sickest members saw decreases in the probability of having an office visit, reductions in monthly log total medical expenditures, and reductions in monthly ambulatory expenditures.

This study also found that PCMH with partial capitation had more widespread effects among individuals with chronic conditions with dose response reductions in the monthly probability of incurring a drug expenditure and increases in the monthly probability of incurring an ambulatory expenditures among its members.

Savings were significant in monthly log ambulatory expenditure among users of ambulatory services across both types of PCMH relative to usual source of care, regardless of number of chronic conditions.

However, expected reductions in inpatient admissions and emergency room visits are not evident. The mix of results suggests that the heterogeneity of PCMHs must be considered in further evaluations in order to understand why evaluations are yielding improvements in different areas.

4.8 Tables

Table 4.8.1 Number and (row) percent of members with 0, 1-2, 3-4, and 5 or more chronic conditions (based on their total number of mutually exclusive chronic conditions) by type of treatment group and control.

Site	All Members	0 cc		1-2 cc		3-4 cc		5+ cc	
		N	%	N	%	N	%	N	%
Control	63,209	16,375	25.91	12,477	19.74	9,400	14.87	6,665	10.54
PCMH FFS	16,284	4,210	25.85	3,323	20.41	2,423	14.88	1,796	11.03
PCMH partial capitation	35,813	10,259	28.65	7,754	21.65	5,468	15.27	3,791	10.59

Table 4.8.2 Regression results for predicted odds of ED visit for categories of MCC, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant		0.0477***	0.0971***	0.1259***
		[0.0430, 0.0530]	[0.0869, 0.1085]	[0.1154, 0.1373]
PCMH NR		1.2852**	1.2429*	1.3763***
		[1.0939, 1.5099]	[1.0459, 1.4770]	[1.2154, 1.5586]
PCMH PR		1.1343	1.0614	1.0724
		[0.9676, 1.3296]	[0.8997, 1.2522]	[0.9376, 1.2265]
Time Trend		1.0045*	1.0064**	1.0126***
		[1.0011, 1.0080]	[1.0026, 1.0102]	[1.0100, 1.0153]
Time Trend PCMH NR		0.9978	0.9953	0.9969
		[0.9906, 1.0050]	[0.9874, 1.0032]	[0.9914, 1.0024]
Time Trend PCMH PR		1.0039	1.0009	0.9949*
		[0.9982, 1.0096]	[0.9944, 1.0074]	[0.9903, 0.9995]
Implementation Level		1.0821	0.967	0.9536
		[0.9894, 1.1836]	[0.8769, 1.0663]	[0.8961, 1.0148]
Implementation Trend		0.9962	0.9899*	0.9753***
		[0.9883, 1.0042]	[0.9812, 0.9987]	[0.9698, 0.9809]
Implementation Level PCMH NR		0.8190*	1.0337	0.9498
		[0.6887, 0.9739]	[0.8565, 1.2475]	[0.8373, 1.0773]
Implementation Trend PCMH NR		1.0148*	1.0099	1.0127*
		[1.0006, 1.0292]	[0.9942, 1.0257]	[1.0020, 1.0234]
Implementation Level PCMH PR	Did not converge	0.8690*	1.0528	1.0497
		[0.7577, 0.9966]	[0.9015, 1.2294]	[0.9446, 1.1666]
Implementation Trend PCMH PR		1.0014	0.9948	1.0096*
		[0.9896, 1.0133]	[0.9810, 1.0084]	[1.0002, 1.0190]
Post Implementation Level		0.9605	0.779	0.8276
		[0.7109, 1.2978]	[0.5596, 1.0844]	[0.6678, 1.0257]
Post Implementation Trend		1.0013	1.0047	0.9880**
		[0.9887, 1.0140]	[0.9909, 1.0188]	[0.9791, 0.9971]
Post Implementation Level PCMH NR		0.9631	1.4457	1.1711
		[0.6079, 1.5259]	[0.8756, 2.3870]	[0.8259, 1.6605]
Post Implementation Trend PCMH NR		**1.0003**	**0.9908**	**0.9969**
		[0.9808, 1.0200]	**[0.9698, 1.0123]**	**[0.9820, 1.0119]**
Post Implementation Level PCMH PR		1.0324	1.1088	1.0937
		[0.6901, 1.5445]	[0.6981, 1.7610]	[0.7932, 1.5081]
Post Implementation Trend PCMH PR		**0.993**	**0.9931**	**1.0019**
		[0.9762, 1.0101]	**[0.9738, 1.0127]**	**[0.9882, 1.0157]**
Age		0.9617***	0.9619***	0.9727***
		[0.9607, 0.9628]	[0.9608, 0.9630]	[0.9720, 0.9734]
Female		1.0896***	1.0425**	1.1895***
		[1.0571, 1.1231]	[1.0081, 1.0780]	[1.1635, 1.2165]
PCAL		1.4136***	1.2604***	1.1700***
		[1.4015, 1.4258]	[1.2514, 1.2695]	[1.1674, 1.1726]
Observations (member-months)	805,954	1,233,296	682,760	750,275

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 4.8.3 Regression results for predicted odds of Office visit for categories of MCC, odds ratios with 95% confidence intervals.

Variable	Zero	1-3	3-4	5+
Constant	0.1151***	0.1965***	0.3714***	0.6400***
	[0.1109, 1194]	[0.1906, 0.2025]	[0.3574, 0.3860]	[0.6148, 0.6662]
PCMH NR	1.0388	0.9565	0.9242*	0.9847
	[0.9699, 1.1126]	[0.9060, 1.0097]	[0.8664, 0.9859]	[0.9249, 1.0483]
PCMH PR	1.0412	0.9820	0.9287*	0.9508
	[0.9870, 1.0984]	[0.9381, 1.0280]	[0.8777, 0.9826]	[0.8940, 1.0113]
Time Trend	0.9949***	0.9980**	1.0014*	1.0019**
	[0.9935, 0.9962]	[0.9971, 0.9990]	[1.0002, 1.0026]	[1.0008, 1.0030]
Time Trend PCMH NR	1.0029	1.0008	0.9998	1.0006
	[1.0000, 1.0058]	[0.9988, 1.0029]	[0.9973, 1.0023]	[0.9982, 1.0029]
Time Trend PCMH PR	1.0006	1.0005	0.9987	1.0001
	[0.9983, 1.0029]	[0.9989, 1.0022]	[0.9966, 1.0007]	[0.9981, 1.0021]
Implementation Level	1.0367	0.9704*	0.9445**	0.9744
	[0.9977, 1.0773]	[0.9453, 0.9961]	[0.9150, 0.9749]	[0.9479, 1.0016]
Implementation Trend	1.0091***	1.0053***	0.9976	0.9924***
	[1.0057, 1.0125]	[1.0030, 1.0077]	[0.9948, 1.0005]	[0.9899, 0.9949]
Implementation Level PCMH NR	0.9758	0.9688	1.0143	0.9646
	[0.9052, 1.0519]	[0.9194, 1.0209]	[0.9521, 1.0806]	[0.9110, 1.0213]
Implementation Trend PCMH NR	0.9967	1.0028	1.0011	1.0012
	[0.9905, 1.0030]	[0.9984, 1.0072]	[0.9958, 1.0065]	[0.9964, 1.0062]
Implementation Level PCMH PR	0.9147**	0.9918	1.0189	0.9647
	[0.8601, 0.9727]	[0.9504, 1.0349]	[0.9664, 1.0741]	[0.9183, 1.0133]
Implementation Trend PCMH PR	1.0063*	1.0019	1.0041	1.0012
	[1.0011, 1.0115]	[0.9982, 1.0055]	[0.9996, 1.0087]	[0.9969, 1.0055]
Post Implementation Level	1.4264***	1.2133***	1.0618	0.9146
	[1.2595, 1.6154]	[1.1125, 1.3233]	[0.9525, 1.1823]	[0.8284, 1.0098]
Post Implementation Trend	0.9947*	0.9957*	0.9938**	0.9966
	[0.9895, 0.9999]	[0.9920, 0.9993]	[0.9893, 0.9984]	[0.9924, 1.0008]
Post Implementation Level PCMH NR	0.9524	1.1139	1.1654	1.2477*
	[0.7692, 1.1792]	[0.9587, 1.2943]	[0.9694, 1.4011]	[1.0488, 1.4843]
Post Implementation Trend PCMH NR	**0.9972**	**0.9942**	**0.9937**	**0.9904***
	[0.9983, 1.0063]	**[0.9879, 1.0006]**	**[0.9860, 1.0015]**	**[0.9831, 0.9977]**
Post Implementation Level PCMH PR	0.9675	1.0491	1.1902*	1.2232*
	[0.8121, 1.1525]	[0.9256, 1.1890]	[1.0148, 1.3960]	[1.0485, 1.4269]
Post Implementation Trend PCMH PR	**0.9986**	**0.9966**	**0.9942**	**0.9913****
	[0.9912, 1.0060]	**[0.9913, 1.0019]**	**[0.9876, 1.0010]**	**[0.9849, 0.9978]**
Age	0.9965***	0.9974***	0.9956***	0.9981***
	[0.9960, 0.9970]	[0.9971, 0.9977]	[0.9953, 0.9960]	[0.9977, 0.9984]
Female	1.4353***	1.2964***	1.2246***	1.1742***
	[1.4170, 1.4539]	[1.2847, 1.3082]	[1.2111, 1.2382]	[1.1626, 1.1859]
PCAL	1.7066***	1.4765***	1.3200***	1.1547***
	[1.6946, 1.7187]	[1.4707, 1.4823]	[1.3152, 1.3249]	[1.1527, 1.1567]
Observations (member-months)	805,954	1,233,296	682,760	750,275

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 4.8.4 Regression results for predicted odds of inpatient admissions for categories of MCC, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	Did Not Converge	0.0135***	0.0230***	0.0299***
		[0.0113, 0.0162]	[0.0191, 0.0276]	[0.0267, 0.0336]
PCMH NR		0.1842***	0.2300***	0.3382***
		[0.1351, 0.2512]	[0.1649, 0.3209]	[0.3203, 0.4568]
PCMH PR		0.3209***	0.4572***	0.6895***
		[0.2433, 0.42323]	[0.3458, 0.6044]	[0.5815, 0.8175]
Time Trend		1.0456***	1.0369***	1.0263***
		[1.0386, 1.0527]	[1.0293, 1.0447]	[1.0222, 1.0303]
Time Trend PCMH NR		0.9545***	0.9577***	0.9871*
		[0.9402, 0.9689]	[0.9418, 0.9738]	[0.9787, 0.9957]
Time Trend PCMH PR		0.9630***	0.9766**	0.9885**
		[0.9514, 0.9748]	[0.9634, 0.9900]	[0.9813, 0.9957]
Implementation Level		0.7310**	0.7898**	0.7858***
		[0.6229, 0.8579]	[0.6630, 0.9409]	[0.7186, 0.8593]
Implementation Trend		0.9534***	0.9563***	0.9562***
		[0.9393, 0.9677	[0.9410, 0.9719]	[0.9483, 0.9643]
Implementation Level PCMH NR		1.2919	1.3459	1.0191
		[0.8973, 1.8601]	[0.9015, 2.0094]	[0.8387, 1.2383]
Implementation Trend PCMH NR		1.0489**	1.0428*	1.0247**
		[1.0178, 1.0810]	[1.0088, 1.0779]	[1.0077, 1.0419]
Implementation Level PCMH PR		1.4096*	1.4047*	1.2651**
		[1.0593, 1.8757]	[1.0317, 1.9125]	[1.0762, 1.4871]
Implementation Trend PCMH PR		1.0518**	1.0246	1.0113
		[1.0262, 1.0780]	[0.9975, 1.0524]	[0.9969, 1.0258]
Post Implementation Level		1.7619*	1.0026	0.8042
		[1.0129, 3.0645]	[0.5658, 1.7764]	[0.5876, 1.1006]
Post Implementation Trend		0.9191***	0.9548**	0.9625***
		[0.8975, 0.9413]	[0.9318, 0.9784]	[0.9497, 0.9755]
Post Implementation Level PCMH NR		0.4606	0.6546	0.9619
		[0.1719, 1.2340]	[0.2410, 1.7780]	[0.5539, 1.6705]
Post Implementation Trend PCMH NR		**1.0974*** **	**1.0823** **	**1.0218**
		[1.0522, 1.1446]	**[1.0372, 1.1293]**	**[0.9978, 1.0463]**
Post Implementation Level PCMH PR		0.5593	2.5707*	1.9615**
		[0.2505, 1.2491]	[1.0930, 6.0464]	[1.2156, 3.1651]
Post Implementation Trend PCMH PR		**1.0949**	**0.9973**	**0.9939**
		[1.0578, 1.1333]	**[0.9610, 1.0350]**	**[0.9736, 1.0147]**
Age		0.9622***	0.9741***	0.9911***
		[0.9601, 0.9644]	[0.9720, 0.9761]	[0.9900, 0.9922]
Female		2.4195***	1.1361**	1.0126
		[2.2480, 2.604]	[1.0639, 1.2133]	[0.9800, 1.0463]
PCAL		1.4911***	1.3233***	1.1879***
		[1.4697, 1.5128]	[1.3082, 1.3386]	[1.1847, 1.1912]
Observations (member-months)	805,954	1,233,296	682,760	750,275

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 4.8.5 Regression results for predicted odds of having prescription drug expenditures for categories of MCC, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	0.1387***	0.2295***	0.3958***	0.5790***
	[0.1296, 0.1485]	[0.2170, 0.2427]	[0.3676, 0.4261]	[0.5296, 0.6329]
PCMH NR	1.0852	1.1052**	1.1816***	1.2486***
	[0.9821, 1.1991]	[1.0360, 1.1789]	[1.0929, 1.2775]	[1.1574, 1.3469]
PCMH PR	1.2069**	0.9517	1.025	0.9062
	[1.0926, 1.3332]	[0.8754, 1.0347]	[0.9211, 1.1406]	[0.7976, 1.0297]
Time Trend	0.9982*	0.9997	1.001	0.9948***
	[0.9968, 0.9995]	[0.9987, 1.0006]	[0.9997, 1.0022]	[0.9936, 0.9961]
Time Trend PCMH NR	1.0023	1.0015	1.0031*	0.9988
	[0.9995, 1.0051]	[0.9995, 1.0035]	[1.0005, 1.0057]	[0.9962, 1.0014]
Time Trend PCMH PR	1.0040**	1.0066***	1.0101***	1.0108***
	[1.0018, 1.0063]	[1.0050, 1.0082]	[1.0080, 1.0123]	[1.0086, 1.0130]
Implementation Level	0.9158***	0.8892***	0.8943***	0.9705
	[0.8826, 0.9502]	[0.8674, 0.9115]	[0.8660, 0.9235]	[0.9417, 1.0002]
Implementation Trend	1.0095***	1.0125***	1.0096***	1.0249***
	[1.0062, 1.0128]	[1.0103, 1.0147]	[1.0067, 1.0125]	[1.0221, 1.0278]
Implementation Level PCMH NR	0.9345	0.9446*	0.9204**	0.8209***
	[0.8682, 1.0059]	[0.8984, 0.9931]	[0.8627, 0.9820]	[0.7715, 0.8734]
Implementation Trend PCMH NR	1.001	1.0022	1.0027	1.0170***
	[0.9948, 1.0071]	[0.9980, 1.0064]	[0.9972, 1.0083]	[1.0115, 1.0225]
Implementation Level PCMH PR	0.8812***	0.9276**	0.8921***	0.7791***
	[0.8301, 0.9354]	[0.8907, 0.9661]	[0.8457, 0.9409]	[0.7387, 0.8218]
Implementation Trend PCMH PR	1.0059*	1.001	1.0005	1.0079**
	[1.0008, 1.0110]	[0.9976, 1.0045]	[0.9959, 1.0051]	[1.0031, 1.0127]
Post Implementation Level	0.9582	1.0003	1.0209	1.4168***
	[0.8528, 1.0765]	[0.9214, 1.0860]	[0.9104, 1.1447]	[1.2503, 1.6055]
Post Implementation Trend	1.0109***	1.0101***	1.0134***	1.0220***
	[1.0060, 1.0159]	[1.0066, 1.0136]	[1.0085, 1.0183]	[1.0166, 1.0274]
Post Implementation Level PCMH NR	0.9677	1.1869*	1.1717	1.2569*
	[0.7910, 1.1838]	[1.0287, 1.3694]	[0.9626, 1.4262]	[1.0088, 1.5660]
Post Implementation Trend PCMH NR	**0.9997**	**0.9945**	**0.9920**	**1.0002**
	[0.9912, 1.0083]	**[0.9885, 1.0006]**	**[0.9838, 1.0003]**	**[0.9909, 1.0096]**
Post Implementation Level PCMH PR	1.0928	1.2005**	1.3039**	1.4047**
	[0.9283, 1.2866]	[1.0666, 1.3513]	[1.1020, 1.5428]	[1.1564, 1.7062]
Post Implementation Trend PCMH PR	**0.9919***	**0.9880*****	**0.9790*****	**0.9815*****
	[0.9851, 0.9987]	**[0.9830, 0.9929]**	**[0.9720, 0.9860]**	**[0.9734, 0.9896]**
Age	0.9960***	1.0121***	1.0146***	1.0148***
	[0.9956, 0.9965]	[1.0118, 1.0124]	[1.0142, 1.0150]	[1.0144, 1.0152]
Female	2.1534***	1.3006***	1.1007***	1.0167**
	[2.1265, 2.1807]	[1.2895, 1.3118]	[1.0883, 1.1132]	[1.0054, 1.0281]
PCAL	1.5142***	1.3320***	1.1704***	1.0555***
	[1.5036, 1.5249]	[1.3268, 1.3373]	[1.1659, 1.1749]	[1.0535, 1.0574]
Observations (member-months)	719,681	1,128,138	633,271	704,828

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 4.8.6 Regression results log (drug expenditures) for those with any drug expenditures by categories of MCC, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	3.539***	3.788***	4.155***	4.620***
	[3.480, 3.599]	[3.733, 3.843]	[4.093, 4.217]	[4.559, 4.681]
PCMH NR	-0.085	0.018	0.073	0.045
	[-0.187, 0.016]	[-0.053, 0.089]	[-0.005, 0.151]	[-0.024, 0.114]
PCMH PR	-0.006	-0.032	-0.083	0.126*
	[-0.096, 0.084]	[-0.118, 0.054]	[-0.176, 0.009]	[0.032, 0.221]
Time Trend	-0.007***	-0.007***	-0.004***	-0.002***
	[-0.008, -0.006]	[-0.007, -0.006]	[-0.006, -0.003]	[-0.003, -0.001]
Time Trend PCMH NR	-0.001	-0.001	0.001	0.003*
	[-0.004, 0.002]	[-0.003, 0.001]	[-0.001, 0.004]	[0.001, 0.005]
Time Trend PCMH PR	-0.002	0.000	0.002	0.000
	[-0.004, 0.000]	[-0.002, 0.001]	[0.000, 0.004]	[-0.002, 0.002]
Implementation Level	-0.151***	-0.131***	-0.109***	-0.091***
	[-0.189, -0.114]	[-0.156, -0.106]	[-0.139, -0.079]	[-0.116, -0.066]
Implementation Trend	0.004*	0.005**	0.001	-0.002
	[0.000, 0.007]	[0.002, 0.007]	[-0.002, 0.004]	[-0.004, 0.000]
Implementation Level PCMH NR	-0.001	-0.036	-0.093**	-0.037
	[-0.075, 0.073]	[-0.087, 0.015]	[-0.153, -0.033]	[-0.088, 0.015]
Implementation Trend PCMH NR	-0.001	0.000	0.001	-0.001
	[-0.008, 0.005]	[-0.005, 0.004]	[-0.004, 0.006]	[-0.005, 0003]
Implementation Level PCMH PR	0.030	-0.004	-0.053*	0.013
	[-0.031, 0.091]	[-0.047, 0.038]	[-0.103, -0.002]	[-0.033, 0.058]
Implementation Trend PCMH PR	-0.001	0.000	0.003	0.003
	[-0.006, 0.004]	[-0.004, 0.003]	[-0.001, 0.008]	[-0.001, 0.006]
Post Implementation Level	-0.011	0.055	0.044	0.216***
	[-0.126, 0.105]	[-0.024, 0.134]	[-0.050, 0.138]	[0.136, 0.295]
Post Implementation Trend	-0.006*	-0.009***	-0.009***	-0.016***
	[-0.011, -0.001]	[-0.012, -0.006]	[-0.013, -0.005]	[-0.019, -0.013]
Post Implementation Level PCMH NR	-0.104	-0.131	-0.012	0.062
	[-0.303, 0.095]	[-0.269, 0.006]	[-0.174, 0.150]	[-0.078, 0.202]
Post Implementation Trend PCMH NR	**0.004**	**0.004**	**-0.002**	**-0.006***
	[-0.004, 0.012]	**[-0.002, 0.010]**	**[-0.009, 0.005]**	**[-0.012, 0.000]**
Post Implementation Level PCMH PR	-0.030	-0.057	0.075	-0.009
	[-0.193, 0.132]	[-0.172, 0.058]	[-0.064, 0.215]	[-0.133, 0.116]
Post Implementation Trend PCMH PR	**0.004**	**0.002**	**-0.005**	**0.002**
	[-0.003, 0.011]	**[-0.003, 0.007]**	**[-0.011, 0.001]**	**[-0.003, 0.007]**
Age	0.004***	0.003***	0.004***	0.001***
	[0.003, 0.004]	[0.003, 0.004]	[0.003, 0.004]	[0.001, 0.002]
Female	-0.029***	-0.096***	-0.127***	-0.103***
	[-0.042, -0.015]	[-0.105, -0.087]	[-0.138, -0.117]	[-0.112, -0.094]
PCAL	0.127***	0.146***	0.111***	0.071***
	[0.120, 0.134]	[0.142, 0.150]	[0.108 ,0.114]	[0.070, 0.072]
Observations (member-months)	185,749	487,588	364,210	477,027

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 4.8.7 Regression results for predicted odds of having any inpatient expenditures for categories of MCC, odds ratios with 95% confidence intervals.

Variable	Zero	1-3	3-4	5+
Constant		0.0134***	0.0244***	0.0289***
		[0.0112, 0.0160]	[0.0186, 0.0270]	[0.0257, 0.0324]
PCMH NR		0.1796***	0.2285***	0.3853***
		[0.1316, 0.2451]	[0.1637, 0.3189]	[0.3224, 0.4605]
PCMH PR		0.3195***	0.4508***	0.6939***
		[0.2421, 0.4217]	[0.3406, 0.5967]	[0.5848, 0.8235]
Time Trend		1.0459***	1.0369***	1.0255***
		[1.0388, 1.0530]	[1.0292, 1.0446]	[1.0215, 1.0296]
Time Trend PCMH NR		0.9538***	0.9576***	0.9874**
		[0.9395, 0.9682]	[0.9418, 0.9737]	[0.9789, 0.9960]
Time Trend PCMH PR		0.9625***	0.9760**	0.9884**
		[0.9509, 0.9743]	[0.9628, 0.9895]	[0.9812, 0.9957]
Implementation Level		0.7277***	0.7860**	0.7906***
		[0.6199, 0.8541]	[0.6592, 0.9372]	[0.7225, 0.8651]
Implementation Trend		0.9532***	0.9563***	0.9570***
		[0.9391, 0.9675]	[0.9409, 0.9719]	[0.9489, 0.9651]
Implementation Level PCMH NR		1.2937	1.3163	1.0063
		[0.8973, 1.8653]	[0.8792, 1.9708]	[0.8272, 1.2241]
Implementation Trend PCMH NR		1.0507**	1.0427*	1.0249**
		[1.0194, 1.0830]	[1.0084, 1.0782]	[1.0078, 1.0422]
Implementation Level PCMH PR	Did not converge	1.3910*	1.4149*	1.2610**
		[1.0440, 1.8534]	[1.0374, 1.9300]	[1.0713, 1.4843]
Implementation Trend PCMH PR		1.0542***	1.0237	1.0116
		[1.0285, 1.0806]	[0.9965, 1.0517]	[0.9971, 1.0263]
Post Implementation Level		1.7632*	0.9467	0.7945
		[1.0132, 3.0685]	[0.5323, 1. 6837]	[0.5796, 1.0891]
Post Implementation Trend		0.9188***	0.9569**	0.9643***
		[0.8971, 0.9410]	[0.9337, 0.9807]	[0.9514, 0.9773]
Post Implementation Level PCMH NR		0.473	0.7460	0.9729
		[0.1763, 1.2689]	[0.2742, 2.0298]	[0.5588, 1.6940]
Post Implementation Trend PCMH NR		**1.0977*** **	**1.0767** **	**1.0205**
		[1.0524, 1.1449]	**[1.0318, 1.1236]**	**[0.9964, 1.0451]**
Post Implementation Level PCMH PR		0.5884	2.7806*	1.9427
		[0.2631, 1.3161]	[1.1763, 6.5729]	[1.2005, 3.1440]
Post Implementation Trend PCMH PR		**1.0932*** **	**0.9951**	**0.9943**
		[1.0561, 1.1317]	**[0.9587, 1.0329]**	**[0.9738, 1.0152]**
Age		0.9623***	0.9744***	0.9913***
		[0.9602, 0.9644]	[0.9723, 0.9765]	[0.9902, 0.9924]
Female		2.4366***	1.1443**	1.0185
		[2.2632, 2.6232]	[1.0712, 1.2225]	[0.9855, 1.0526]
PCAL		1.4914***	1.3237***	1.1872***
		[1.4700, 1.5131]	[1.3086, 1.3391]	[1.1840, 1.1905]
Observations (member-months)	805,954	1,233,296	682,760	750,275

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 4.8.8 Regression results for log(inpatient expenditures) among those having any inpatient expenditures for categories of MCC with 95% confidence intervals.

Dependent Variable	Zero	1-2	3-4	5+
Constant	5.996***	6.501***	6.539***	7.582***
	[5.550, 6.443]	[6.187, 6.814]	[6.219, 6.859]	[7.405, 7.760]
PCMH NR	1.931***	1.986***	2.024***	1.566***
	[1.209, 2.653]	[.465, 2.506]	[1.474, 2.575]	[1.302, 1.830]
PCMH PR	1.261***	1.476***	1.336***	0.735***
	[0.740, 1.782]	[1.042, 1.909]	[0.870, 1.802]	[0.463, 1.008]
Time trend	-0.066	-0.061***	-0.047***	-0.027***
	[-0.083, -0.049]	[-0.073, -0.049]	[-0.060, -0.034]	[-0.033, -0.021]
Time Trend PCMH,NR	0.047*	0.043**	0.040**	0.013*
	[0.009, 0.085]	[0.017, 0.070]	[0.012, 0.068]	[0.000, 0.026]
Time Trend PCMH,NR	0.037*	0.049***	0.028*	0.010
	[0.008, 0.066]	[0.028, 0.070]	[0.006, 0.051]	[-0.001, 0.020]
Implementation change	0.566*	0.203	0.509**	0.187*
	[0.133, 0.999]	[-0.088, 0.494]	[0.196, 0.823]	[0.052, 0.321]
Implementation trend	0.073**	0.081***	0.030*	0.038***
	[0.034, 0.122]	[0.055, 0.108]	[0.001, 0.059]	[0.026, 0.050]
Implementation Level PCMH NR	-1.218**	-0.014	-0.270	-0.036
	[-2.123, -0.313]	[-0.668, 0.640]	[-0.946, 0.405]	[-0.321, 0.249]
Implementation Trend PCMH NR	0.025	-0.082**	-0.063*	-0.025*
	[-0.048, 0.098]	[-0.136, -0.028]	[-0.119, -0.007]	[-0.049, -0.001]
Implementation Level PCMH PR	-0.507	-0.267	-0.484	-0.028
	[-1.221, 0.207]	[-0.779, 0.245]	[-1.012, 0.045]	[-0.269, 0.213]
Implementation Trend PCMH PR	-0.004	-0.074**	-0.011	-0.021*
	[-0.066, 0.057]	[-0.118, -0.030]	[-0.057, 0.035]	[-0.043, 0.000]
Post implementation level	0.986	-1.368**	0.418	0.039
	[-0.305, 2.277]	[-2.338, -0.397]	[-0.563, 1.399]	[-0.418, 0.496]
Post implementation trend	0.041	0.126***	0.041	0.035**
	[-0.013, 0.096]	[0.084, 0.168]	[-0.001, 0.082]	[0.016, 0.055]
Post Implementation Level PCMH NR	-1.098	3.285**	0.813	0.071
	[-3.454, 1.258]	[1.487, 5.083]	[-0.855, 2.480]	[-0.735, 0.876]
Post Implementation Trend PCMH NI	**-0.025**	**-0.197*** **	**-0.102** **	**-0.026**
	[-0.127, 0.076]	**[-0.274, -0.120]**	**[-0.174, -0.031]**	**[-0.061, 0.008]**
Post Implementation Level PCMH PR	-1.113	1.436*	-1.854*	0.254
	[-2.954, 0.728]	[0.021, 2.851]	[-3.326, -0.381]	[-0.434, 0.943]
Post Implementation Trend PCMH PI	**-0.031**	**-0.153*** **	**0.024**	**-0.031***
	[-0.109, 0.047]	**[-0.214, -0.092]**	**[-0.039, 0.088]**	**[-0.060, -0.001]**
Age	-0.025***	-0.007**	0.006**	0.001
	[-0.032, -0.017]	[-0.011, -0.003]	[-.003, 0.010]	[0.000, 0.003]
Gender (male reference)	0.104	-0.393***	-0.339***	-0.196***
	[-0.128, 0.336]	[-0.528, -0.258]	[-0.453, -0.226]	[-0.244, -0.148]
PCAL	0.373***	0.204***	0.095***	0.041***
	[0.304, 0.442]	[0.173, 0.235]	[0.072, 0.118]	[0.037, 0.045]
Observations (member-months)	2,861	5,451	4,632	17,346

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 4.8.9 Regression results for predicted odds of having any ambulatory expenditure for categories of MCC, odds ratios with 95% confidence intervals.

Variable	Zero	1-3	3-4	5+
Constant	0.1124***	0.2441***	0.4813***	0.7959***
	[0.1070, 0.1181]	[0.2340, 0.2546]	[0.4580, 0.5057]	[0.7548, 0.8393]
PCMH NR	0.8835**	0.8672***	0.8038***	0.9411
	[0.8108, 0.9627]	[0.8158, 0.9218]	[0.7480, 0.8637]	[0.8772, 1.0096]
PCMH PR	0.5633***	0.5551***	0.4849***	0.4927***
	[0.5199, 0.6104]	[0.5181, 0.5984]	[0.4482, 0.5245]	[0.4527, 0.5361]
Time Trend	0.9974***	1.0006	1.0035***	1.0061***
	[0.9961, 0.9987]	[0.9997, 1.0016]	[1.0023, 1.0047]	[1.0049, 1.0073]
Time Trend PCMH NR	1.0046**	0.9996	0.9981	0.9994
	[1.0017, 1.0075]	[0.9976, 1.0016]	[0.9956, 1.0006]	[0.9970, 1.0019]
Time Trend PCMH PR	1.0022	1.0011	0.999	0.9986
	[0.9999, 1.0045]	[0.9994, 1.0027]	[0.9969, 1.0011]	[0.9965, 1.0007]
Implementation Level	1.001	0.9738*	0.9372***	0.9787
	[0.9764, 1.0468]	[0.9505, 0.9978]	[0.9087, 0.9666]	[0.9505, 1.0079]
Implementation Trend	1.0069***	1.0003	0.9955**	0.9853***
	[1.0039, 1.0100]	[0.9982, 1.0025]	[0.9927, 0.9982]	[0.9827, 0.9880]
Implementation Level PCMH NR	0.9113*	0.9808	0.994	0.9457
	[0.8463, 0.9813]	[0.9320, 1.0322]	[0.9335, 1.0584]	[0.8915, 1.0033]
Implementation Trend PCMH NR	0.9983	1.0043	1.0049	1.0048
	[0.9922, 1.0045]	[1.0000, 1.0086]	[0.9996, 1.0103]	[0.9997, 1.0099]
Implementation Level PCMH PR	0.8740***	0.9263**	0.9658	0.9141**
	[0.8218, 0.9295]	[0.8882, 0.9660]	[0.9161, 1.0182]	[0.8688, 0.9618]
Implementation Trend PCMH PR	1.0072**	1.0052**	1.0086**	1.0055*
	[1.0019, 1.0124]	[1.0016, 1.0088]	[1.0040, 1.0132]	[1.0011, 1.0101]
Post Implementation Level	1.2575**	1.0826	1.039	0.7986***
	[1.1226, 1.4087]	[0.9981, 1.1743]	[0.9349, 1.1548]	[0.7183, 0.8880]
Post Implementation Trend	0.9964	0.9963*	0.9923**	0.9963
	[0.9917, 1.0012]	[0.9929, 0.9997]	[0.9879, 0.9968]	[0.9918, 1.0008]
Post Implementation Level PCMH NR	0.8249	0.9207	1.0672	1.1927
	[0.6697, 1.0161]	[0.7956, 1.0654]	[0.8891, 1.2809]	[0.9946, 1.4302]
Post Implementation Trend PCMH NR	**1.0000**	**1.0042**	**0.9984**	**0.993**
	[0.9912, 1.0089]	**[0.9980, 1.0104]**	**[0.9907, 1.0062]**	**[0.9853, 1.0007]**
Post Implementation Level PCMH PR	0.7485**	0.9092	1.0026	1.1577
	[0.6346, 0.8828]	[0.8062, 1.0253]	[0.8563, 1.1738]	[0.9849, 1.3608]
Post Implementation Trend PCMH PR	**1.0237*** **	**1.0141*** **	**1.0119** **	**1.0043**
	[1.0166, 1.0308]	**[1.0090, 1.0193]**	**[1.0052, 1.0187]**	**[0.9974, 1.0112]**
Age	1.0038***	1.0005	0.9985***	1.0008***
	[1.0034, 1.0043]	[1.0002, 1.0008]	[0.9982, 0.9989]	[1.0004, 1.0012]
Female	1.4663***	1.3402***	1.3026***	1.2645***
	[1.4482, 1.4846]	[1.3285, 1.3519]	[1.2884, 1.3169]	[1.2516, 1.2777]
PCAL	1.9310***	1.5868***	1.3799***	1.2145***
	[1.9173, 1.9448]	[1.5805, 1.5932]	[1.3745, 1.3852]	[1.2120, 1.2170]
Observations (member-months)	805,954	1,233,296	682,760	750,275

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 4.8.10 Regression results for log (ambulatory expenditures) among those having any ambulatory expenditure for categories of MCC, odds ratios with 95% confidence

intervals.

Dependent Variable	Zero	1-3	3-4	5+
Constant	4.591***	4.705***	4.965***	5.457***
	[4.442, 4.639]	[4.674, 4.737]	[4.928, 5.002]	[5.422, 5.493]
PCMH NR	0.026	0.077**	0.100**	0.101***
	[-0.047, 0.099]	[0.025, 0.130]	[0.040, 0.160]	[0.048, 0.154]
PCMH PR	-0.333***	-0.243***	-0.306***	-0.285***
	[-0.395, -0.270]	[-0.294, -0.191]	[-0.366, -0.245]	[-0.343, -0.228]
Time trend	0.001	0.000	0.001	0.001*
	[0.000, 0.002]	[-0.001, 0.001]	[0.000, 0.002]	0.000, 0.002]
Time Trend PCMH,NR	-0.001	0.000	0.002	0.003*
	[-0.003, 0.002]	[-0.001, 0.001]	[0.000, 0.004]	[0.001 ,0.005]
Time Trend PCMH,NR	-0.002	-0.001	0.000	-0.002*
	[-0.004, 0.000]	[-0.003, 0.001]	[-0.002, 0.002]	[-0.004, 0.000]
Implementation change	0.013	0.018	0.018	0.017
	[-0.019, 0.044]	[-0.003, 0.039]	[-0.007, 0.044]	[-0.004, 0.038]
Implementation trend	0.006**	0.005***	0.002	-0.004**
	[0.003, 0.008]	[0.003, 0.007]	[0.000, 0.004]	[-0.006, -0.002]
Implementation Level PCMH NR	-0.037	-0.074**	-0.093**	-0.104***
	[-0.106, 0.033]	[-0.121, -0.027]	[-0.148, -0.037]	[-0.151, -0.057]
Implementation Trend PCMH NR	0.001	0.002	0.000	-0.002
	[-0.004, 0.007]	[-0.002, 0.006]	[-0.004, 0.005]	[-0.006, 0.002]
Implementation Level PCMH PR	-0.046	-0.054**	-0.094**	-0.063**
	[-0.105, 0.012]	[-0.093, -0.016]	[-0.141, -0.047]	[-0.105, -0.021]
Implementation Trend PCMH PR	-0.003	-0.004*	-0.002	0.000
	[-0.008, 0.001]	[-0.008, -0.001]	[-0.006, 0.002]	[-0.004, 0.003]
Post implementation level	0.312***	0.195***	0.187***	0.140**
	[0.209, 0.415]	[0.125, 0.265]	[0.102, 0.272]	[0.065, 0.216]
Post implementation trend	-0.008**	-0.003	-0.005*	-0.007***
	[-0.012, -0.003]	[-0.006, 0.000]	[-0.009, -0.001]	[-0.010, -0.004]
Post Implementation Level PCMH NR	0.044	0.237**	0.115	0.067
	[-0.149, 0.238]	[0.106, 0.368]	[-0.041, 0.271]	[-0.072, 0.207]
Post Implementation Trend PCMH NR	**-0.003**	**-0.010****	**-0.011****	**-0.009****
	[-0.011, 0.005]	**[-0.016, -0.005]**	**[-0.018, -0.004]**	**[-0.014, -0.003]**
Post Implementation Level PCMH PR	0.160*	0.089	0.127	0.054
	[0.008, 0.312]	[-0.018, 0.196]	[-0.006, 0.260]	[-0.071, 0.178]
Post Implementation Trend PCMH PR	**-0.018*****	**-0.014*****	**-0.012*****	**-0.007***
	[-0.025, -0.012]	**[-0.019, -0.010]**	**[-0.018, -0.007]**	**[-0.013, -0.002]**
Age	0.006***	0.003***	-0.001***	-0.006***
	[0.005, 0.006]	[0.003, 0.003]	[-0.001, -0.001]	[-0.006, -0.006]
Gender (male reference)	-0.001	0.016**	0.031***	0.040***
	[-0.013, 0.011]	[0.008, 0.024]	[0.021, 0.040]	[0.032, 0.048]
PCAL	0.171***	0.151***	0.136***	0.094***
	[0.165, 0.177]	[0.148, 0.155]	[0.133, 0.138]	[0.093, 0.095]
Observations (member-months)	179,507	414,564	306,753	452,676

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 4.8.11 Regression results for predicted odds of having any medical expenditure for categories of MCC, odds ratios with 95% confidence intervals

Variable	Zero	1-3	3-4	5+
Constant	0.2198***	0.3945***	0.7437***	1.2551***
	[0.2081, 0.2322]	[0.3773, 0.4143]	[0.6985, 0.7917]	[1.1646, 1.3526]
PCMH NR	0.9271	0.9344*	0.9014*	0.9684
	[0.8518, 1.0094]	[0.8790, 0.9933]	[0.8311, 0.9776]	[0.8850, 1.0596]
PCMH PR	0.9048*	0.7366***	0.7100***	0.5996***
	[0.8319, 0.9842]	[0.6844, 0.7929]	[0.6442, 0.7825]	[0.5333, 0.6740]
Time Trend	0.9981**	1.0012*	1.0045***	1.0054***
	[0.9969, 0.9993]	[1.0003, 1.0022]	[1.0031, 1.0059]	[1.0038, 1.0070]
Time Trend PCMH NR	1.0034*	1.001	0.9996	0.9956**
	[1.0008, 1.0060]	[0.9990, 1.0031]	[0.9968, 1.0025]	[0.9925, 0.9988]
Time Trend PCMH PR	1.0036**	1.0037***	1.0049***	1.0007
	[1.0016, 1.0057]	[1.0021, 1.0053]	[1.0026, 1.0072]	[0.9981, 1.0034]
Implementation Level	0.9642*	0.9242***	0.8984***	0.9802
	[0.9327, 0.9968]	[0.9012, 0.9478]	[0.8662, 0.9317]	[0.9411, 1.0208]
Implementation Trend	1.0067***	1.0049***	0.9992	0.9985
	[1.0037, 1.0096]	[1.0027, 1.0072]	[0.9959, 1.0025]	[0.9947, 1.0023]
Implementation Level PCMH NR	0.9178*	0.9419*	0.9552	0.8848**
	[0.8581, 0.9817]	[0.8956, 0.9907]	[0.8895, 1.0257]	[0.8178, 0.9573]
Implementation Trend PCMH NR	0.9996	1.0042	1.0061*	1.0194***
	[0.9940, 1.0052]	[0.9999, 1.0085]	[1.0000, 1.0122]	[1.0124, 1.0265]
Implementation Level PCMH PR	0.8521***	0.9165***	0.9008**	0.7938***
	[0.8071, 0.8997]	[0.8801, 0.9545]	[0.8497, 0.9550]	[0.7438, 0.8470]
Implementation Trend PCMH PR	1.0078**	1.0060**	1.0097**	1.0198***
	[1.0032, 1.0125]	[1.0025, 1.0096]	[1.0045, 1.0148]	[1.0138, 1.0258]
Post Implementation Level	1.0321	0.9842	0.9732	0.9551
	[0.9263, 1.1499]	[0.9031, 1.0726]	[0.8514, 1.1125]	[0.8062, 1.1316]
Post Implementation Trend	1.0051*	1.0045*	1.0029	1.0075*
	[1.0005, 1.0087]	[1.0009, 1.0081]	[0.9973, 1.0086]	[1.0003, 1.0147]
Post Implementation Level PCMH NR	0.9069	1.1036	1.1812	1.2281
	[0.7514, 1.0947]	[0.9518, 1.2795]	[0.9461, 1.4747]	[0.9248, 1.6307]
Post Implementation Trend PCMH NR	**1.0000**	**0.9965**	**0.9945**	**1.0042**
	[0.9920, 1.0080]	**[0.9903, 1.0028]**	**[0.9852, 1.0040]**	**[0.9922, 1.0164]**
Post Implementation Level PCMH PR	0.8797	1.1013	1.2961**	1.5973**
	[0.7558, 1.0240]	[0.9738, 1.2454]	[1.0674, 1.5739]	[1.2380, 2.0609]
Post Implementation Trend PCMH PR	**1.0089****	**1.0006**	**0.993**	**0.9975**
	[1.0025, 1.0154]	**[0.9954, 1.0058]**	**[0.9848, 1.0012]**	**[0.9868, 1.0084]**
Age	0.9995*	1.0098***	1.0117***	1.0124***
	[0.9991, 0.9999]	[1.0095, 1.0101]	[1.0112, 1.0121]	[1.0119, 1.0129]
Female	2.0133***	1.3885***	1.2262***	1.1844***
	[1.9909, 2.0360]	[1.3766, 1.4005]	[1.2110, 1.2417]	[1.1678, 1.2013]
PCAL	1.9182***	1.6307***	1.4066***	1.2315***
	[1.9043, 1.9322]	[1.6234, 1.6381]	[1.3996, 1.4137]	[1.2274, 1.2355]
Observations (member-months)	719,681	1,128,138	633,271	704,828

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 4.8.12 Regression results for log (total expenditures) among those having any medical expenditure for categories of MCC, odds ratios with 95% confidence intervals

Dependent Variable	Zero	1-2	3-4	5+
Constant	4.258***	4.51***	4.863***	5.418***
	[4.22, 4.30]	[4.47, 4.54]	[4.82, 4.90]	[5.379, 5.458]
PCMH NR	-0.004	0.06*	0.072*	0.087**
	[-0.08, 0.07]	[0.00, 0.11]	[0.011, 0.133]	[0.033, 0.141]
PCMH PR	-0.345***	-0.28***	-0.290***	-0.166***
	[-0.41, -0.28]	[-0.34, -0.23]	[-0.35, 0.23]	[-0.230, -0.101]
Time Trend	-0.002	0.00***	-0.001	0.000
	[0.00, 0.00]	[0.00, 0.00]	[-0.002, 0.000]	[-0.001, 0.001]
Time Trend PCMH NR	0.00	0.00*	0.000	0.003**
	[0.00, 0.00]	[0.00, 0.00]	[-0.002, 0.002]	[0.002, 0.005]
Time Trend PCMH PR	-0.002	0.00	0.000	0.001
	[0.00, 0.00]	[0.00, 0.00]	[-0.001, 0.002]	[-0.001, 0.002]
Implementation Level	-0.051**	-0.07***	-0.059***	-0.040**
	[-0.08 -0.02]	[-0.09, -0.05]	[-0.085, -0.033]	[-0.062, -0.019]
Implementation Trend	0.005**	0.00***	0.001	-0.004***
	[0.00, 0.01]	[0.00, 0.00]	[-0.002, 0.003]	[-0.006, -0.002]
Implementation Level PCMH NR	-0.052	-0.04	-0.084*	-0.093**
	[-0.12, 0.01]	[-0.09, 0.00]	[-0.137, -0.030]	[-0.139, -0.048]
Implementation Trend PCMH NR	0.002	0.00	0.000	-0.003
	[-0.01, 0.00]	[0.00, 0.00]	[-0.005, 0.004]	[-0.007, 0.001]
Implementation Level PCMH PR	-0.052	-0.03	-0.095***	-0.052*
	[-0.11, 0.00]	[-0.07, 0.00]	[-0.139, -0.050]	[-0.092, -0.012]
Implementation Trend PCMH PR	0.002	0.00	0.003	0.002
	[-0.01, 0.00]	[0.00, 0.00]	[-0.001, 0.007]	[-0.002, 0.005]
Post Implementation Level	0.343***	0.22***	0.245***	0.227***
	[0.24, 0.45]	[0.15, 0.29]	[0.160, 0.330]	[0.153, 0.302]
Post Implementation Trend	-0.014***	-0.01***	-0.014***	-0.013***
	[-0.02, -0.01]	[-0.02, -0.01]	[-0.017, -0.010]	[-0.017, -0.010]
Post Implementation Level PCMH NR	-0.211*	-0.08	-0.061	0.078
	[-0.40, -0.03]	[-0.20 0.05]	[-0.210, 0.088]	[-0.054, 0.210]
Post Implementation Trend PCMH NR	**0.003**	**0.00**	**-0.003**	**-0.010****
	[0.00, 0.01]	**[0.00, 0.01]**	**[-0.010, 0.003]**	**[-0.016, -0.005]**
Post Implementation Level PCMH PR	-0.169*	-0.09	-0.001	0.094
	[-0.31, -0.02]	[-0.20, 0.01]	[-0.129, 0.126]	[-0.023, 0.211]
Post Implementation Trend PCMH PR	**0.002**	**0.00**	**-0.003**	**-0.006***
	[0.00, 0.01]	**[0.00, 0.01]**	**[-0.009, 0.002]**	**[-0.011, -0.001]**
Age	0.005***	0.00***	-0.001***	-0.003***
	[0.00, 0.01]	[0.00, 0.00]	[-0.001, -0.001]	[-0.003, -0.002]
Female	-0.076***	0.00	-0.006	-0.015**
	[-0.09, -0.06]	[-0.01, 0.01]	[-0.015, 0.003]	[-0.022, -0.007]
PCAL	0.295***	0.27***	0.211***	0.137***
	[0.29, 0.30]	[0.26, 0.27]	[0.209,0.214]	[0.136, 0.138]
Observations (member-months)	275,786	650,303	460,407	592,373

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 4.8.13 Regression results for predicted odds of having any drug costs for categories of MCC, odds ratios with 95% confidence intervals

Variable	Zero	1-3	3-4	5+
Constant	0.1893***	0.3817***	0.9866	3.1364***
	[0.1784, 0.2009]	[0.3642, 0.3999]	[0.9290, 1.0477]	[2.9234, 3.3648]
PCMH NR	1.0425	0.9842	0.9482	1.0569
	[0.9501, 1.1438]	[0.9264, 1.0455]	[0.8787, 1.0232]	[0.9754, 1.1452]
PCMH PR	1.1851**	0.9202*	0.9353	0.9855
	[1.0828, 1.2972]	[0.8549, 0.9905]	[0.8524, 1.0264]	[0.8820, 1.1012]
Time Trend	1.0087***	1.0104***	1.0150***	1.0136***
	[1.0073, 1.0100]	[1.0095, 1.0114]	[1.0137, 1.0160]	[1.0123, 1.0149]
Time Trend PCMH NR	0.9996	1.0003	1.0001	0.9975
	[0.9968, 1.0024]	[0.9984, 1.0023]	[0.9975, 1.0027]	[0.9949, 1.0002]
Time Trend PCMH PR	1.0033**	1.0073***	1.0089***	1.0148***
	[1.0011, 1.0056]	[1.0057, 1.0089]	[1.0068, 1.0111]	[1.0125, 1.0171]
Implementation Level	0.9279***	0.9122***	0.9017***	0.9831
	[0.8952, 0.9619]	[0.8902, 0.9348]	[0.8727, 0.9317]	[0.9519, 1.0153]
Implementation Trend	0.9935**	0.9936***	0.9834***	0.9875***
	[0.9903, 0.9966]	[0.9914, 0.9958]	[0.9805, 0.9863]	[0.9846, 0.9904]
Implementation Level PCMH NR	1.0069	1.0057	1.0554	0.9712
	[0.9370, 1.0820]	[0.9573, 1.0565]	[0.9884, 1.1270]	[0.9084, 1.0383]
Implementation Trend PCMH NR	1.0028	1.0006	1.0026	1.0086**
	[0.9968, 1.0089]	[0.9964, 1.0047]	[0.9971, 1.0082]	[1.0028, 1.0145]
Implementation Level PCMH PR	0.9246**	0.9498*	0.9292**	0.8315***
	[0.8729, 0.9793]	[0.9128, 0.9884]	[0.8802, 0.9810]	[0.7849, 0.8809]
Implementation Trend PCMH PR	1.0023	0.9969	0.9984	0.9898**
	[0.9974, 1.0072]	[0.9935, 1.0003]	[0.9938, 1.0032]	[0.9848, 0.9949]
Post Implementation Level	1.0092	0.9323	0.8248**	0.9201
	[0.8984, 1.1337]	[0.8588, 1.0120]	[0.7355, 0.9249]	[0.8118, 1.0429]
Post Implementation Trend	0.9916**	0.9937**	0.9943*	0.9997
	[0.9868, 0.9965]	[0.9903, 0.9972]	[0.9895, 0.9992]	[0.9944, 1.0050]
Post Implementation Level PCMH NR	0.9572	1.0904	1.0413	0.9538
	[0.7826, 1.1707]	[0.9458, 1.2570]	[0.8570, 1.2653]	[0.7669, 1.1863]
Post Implementation Trend PCMH NR	**1.0037**	**0.9966**	**0.998**	**1.0029**
	[0.9952, 1.0123]	**[0.9906, 1.0026]**	**[0.9897, 1.0063]**	**0.9936, 1.0122]**
Post Implementation Level PCMH PR	0.947	1.0299	1.1001	0.8703
	[0.8047, 1.1145]	[0.9153, 1.1588]	[0.9300, 1.3013]	[0.7170, 1.0564]
Post Implementation Trend PCMH PR	**0.9964**	**0.9903****	**0.9843*****	**0.9828*****
	[0.9895, 1.0033]	**[0.9854, 0.9953]**	**[0.9773, 0.9913]**	**0.9748, 0.9909]**
Age	0.9928***	1.0060***	1.0035***	0.9946***
	[0.9923, 0.9932]	[1.0057, 1.0063]	[1.0031, 1.0039]	[0.9941, 0.9950]
Female	2.1834***	1.3428***	1.1502***	1.1295***
	[2.1564, 2.2107]	[1.3315, 1.3542]	[1.1373, 1.1634]	[1.164, 1.1427]
PCAL	1.5802***	1.3989***	1.2342***	1.0983***
	[1.5691, 1.5914]	[1.3934, 1.4045]	[1.2292, 1.2392]	[1.0960, 1.1006]
Observations (member-months)	719,681	1,128,138	633,271	704,828

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 4.8.14 Regression results for log (drug cost) among those having any drug cost for categories of MCC, odds ratios with 95% confidence intervals

Variable	Zero	1-3	3-4	5+
Constant	3.362***	3.698***	4.121***	4.712***
	[3.298, 3.425]	[3.638, 3.758]	[4.055, 4.186]	[4.648, 4.776]
PCMH NR	0.021	0.150***	0.122*	0.144**
	[-0.085, 0.126]	[0.079, 0.221]	[0.044, 0.200]	[0.048, 0.180]
PCMH PR	-0.002	-0.001	-0.038	0.079
	[-0.098, 0.094]	[-0.094, 0.092]	[-0.138, 0.061]	[-0.019, 0.177]
Time Trend	-0.002	0.000	0.001	0.004***
	[-0.003, 0.000]	[-0.001, 0.001]	[0.000, 0.002]	[0.002, 0.005]
Time Trend PCMH NR	0.000	-0.002	0.000	0.003*
	[-0.004, 0.003]	[-0.004, 0.001]	[-0.002, 0.003]	[0.000, 0.005]
Time Trend PCMH PR	-0.002	0.001	0.004*	0.002
	[-0.005, 0.000]	[-0.001, 0.003]	[0.001, 0.006]	[0.000, 0.004]
Implementation Level	-0.069**	-0.074***	-0.095***	-0.076***
	[-0.110, -0.028]	[-0.101, -0.046]	[-0.127, -0.062]	[-0.102, -0.050]
Implementation Trend	-0.005*	-0.008***	-0.010***	-0.016***
	[-0.009, -0.002]	[-0.010, -0.005]	[-0.013, -0.008]	[-0.019, -0.014]
Implementation Level PCMH NR	0.013	-0.029	-0.031	-0.047
	[-0.068, 0.095]	[-0.084, 0.027]	[-0.095, 0.034]	[-0.201, 0.007]
Implementation Trend PCMH NR	-0.003	-0.001	-0.002	0.002
	[-0.009, 0.004]	[-0.006, 0.003]	[-0.008, 0.003]	[-0.003, 0.007]
Implementation Level PCMH PR	0.020	-0.034	-0.054*	0.024
	[-0.046, 0.085]	[-0.079, 0.012]	[-0.108, 0.000]	[-0.023, 0.070]
Implementation Trend PCMH PR	0.003	-0.001	0.001	0.001
	[-0.003, 0.008]	[-0.004, 0.003]	[-0.003, 0.006]	[-0.003, 0.005]
Post Implementation Level	-0.168*	-0.186***	-0.267***	-0.194***
	[-0.298, -0.038]	[-0.275, -0.097]	[-0.372, -0.161]	[-0.283, -0.105]
Post Implementation Trend	0.001	0.000	0.002	-0.004*
	[-0.004, 0.006]	[-0.003, 0.004]	[-0.003, 0.006]	[-0.008, 0.000]
Post Implementation Level PCMH NR	-0.111	-0.149	-0.054	0.091
	[-0.335, 0.114]	[-0.304, 0.007]	[-0.236, 0.129]	[-0.066, 0.249]
Post Implementation Trend PCMH NR	**0.005**	**0.005**	**-0.001**	**-0.007**
	[-0.005, 0.014]	**[-0.002, 0.011]**	**[-0.009, 0.007]**	**[-0.013, 0.000]**
Post Implementation Level PCMH PR	0.007	-0.057	0.071	0.009
	[-0.175, 0.190]	[-0.187, 0.072]	[-0.086, 0.228]	[-0.131, 0.149]
Post Implementation Trend PCMH PR	**0.002**	**-0.001**	**-0.007***	**-0.001**
	[-0.006, 0.010]	**[-0.006, 0.005]**	**[-0.014, -0.001]**	**[-0.007, 0.005]**
Age	0.004***	0.003***	0.003***	0.000
	[0.003, 0.004]	[0.003, 0.003]	[0.003, 0.003]	[0.000, 0.000]
Female	-0.008	-0.110***	-0.161***	-0.108***
	[-0.023, 0.007]	[-0.120, -0.100]	[-0.173, -0.150]	[-0.117, -0.098]
PCAL	0.123***	0.144***	0.115***	0.074***
	[0.115, 0.130]	[0.140, 0.148]	[0.111, 0.118]	[0.073, 0.075]
Observations (member-months)	192,985	517,742	392,709	527,403

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 4.8.15 Regression results for predicted odds of having any inpatient costs for categories of MCC, odds ratios with 95% confidence intervals

Dependent Variable	Zero	1-2	3-4	5+
Constant	64,463.91***	35,684.72***	47146.76***	97,373.41***
	[54135.95, 76762.22	[31197.53, 40817.32	[40498.05, 55517.47	[89,087.93, 106,429.47
PCMH NR	1.09	0.99	1.07	0.90
	[0.88, 1.36]	[0.81, 1.20]	[0.83, 1.37]	[0.78, 1.03]
PCMH PR	0.87	1.18*	0.96	0.93
	[0.75, 1.02]	[1.01, 1.37]	[0.79, 1.17]	[0.83, 1.04]
Time Trend	1.02***	1.01***	1.01***	1.01***
	[1.01, 1.03]	[1.01, 1.02]	[1.01, 1.02]	[1.01, 1.02]
Time Trend PCMH NR	1.00	1.00	1.01	1.00
	[0.99, 1.02]	[0.99, 1.01]	[0.99, 1.02]	[0.99, 1.00]
Time Trend PCMH PR	1.00	1.01**	1.00	1.00
	[0.99, 1.01]	[1.00, 1.02]	[0.99, 1.01]	[0.99, 1.01]
Implementation Level	0.94	1.02	0.91	0.91*
	[0.79, 1.10]	[0.88, 1.18]	[0.76, 1.08]	[0.83, 0.99]
Implementation Trend	0.99	0.98**	0.98	0.99**
	[0.97, 1.00]	[0.97, 0.99]	[0.97, 1.00]	[0.98, 1.00]
Implementation Level PCMH NR	0.88	0.81	0.93	1.02
	[0.65, 1.20]	[0.61, 1.07]	[0.65, 1.32]	[0.85, 1.22]
Implementation Trend PCMH NR	0.99	1.03*	0.99	1.00
	[0.97, 1.02]	[1.00, 1.05]	[0.96, 1.02]	[0.99, 1.02]
Implementation Level PCMH PR	0.99	0.75*	0.86	0.93
	[0.78, 1.27]	[0.60, 0.95]	[0.65, 1.14]	[0.79, 1.08]
Implementation Trend PCMH PR	1.00	1.00	1.02	1.00
	[0.98, 1.02]	[0.98, 1.02]	[0.99, 1.04]	[0.99, 1.02]
Post Implementation Level	0.92	1.27	2.33**	0.94
	[0.54, 1.54]	[0.74, 2.16]	[1.30, 4.18]	[0.70, 1.26]
Post Implementation Trend	0.98	0.98*	0.95***	0.99
	[0.96, 1.00]	[0.95, 1.00]	[0.93, 0.97]	[0.98, 1.00]
Post Implementation Level PCMH NF	0.94	0.53	0.42	0.92
	[0.40, 2.21]	[0.22, 1.27]	[0.16, 1.11]	[0.55, 1.55]
Post Implementation Trend PCMH NF	1.00	1.03	1.03	1.01
	[0.96, 1.03]	[0.99, 1.07]	[0.99, 1.07]	[0.99, 1.03]
Post Implementation Level PCMH PR	1.62	0.89	0.31**	1.27
	[0.77, 3.43]	[0.43, 1.85]	[0.13, 0.71]	[0.81, 1.97]
Post Implementation Trend PCMH PF	0.99	0.99	1.05**	0.99
	[0.96, 1.02]	[0.96, 1.02]	[1.02, 1.09]	[0.97, 1.01]
Age	1.01***	1.02***	1.02***	1.00***
	[1.01, 1.01]	[1.02, 1.02]	[1.01, 1.02]	[1.00, 1.01]
Female	0.56***	0.76***	0.82***	0.87***
	[0.51, 0.61]	[0.71, 0.80]	[0.77, 0.87]	[0.85, 0.90]
PCAL	1.07***	1.08***	1.04***	1.02***
	[1.04, 1.10]	[1.07, 1.10]	[1.03, 1.05]	[1.02, 1.03]
Observations (member-months)	1,997	4,015	3,821	16,298

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 4.8.16 Regression results for log (inpatient cost) among those having any inpatient costs for categories of MCC, odds ratios with 95% confidence intervals

Variable	Zero	1-2	3-4	5+
Constant	11.074***	10.482***	10.767***	11.486***
	[10.899, 11.248]	[10.348, 10.617]	[10.609, 10.924]	[11.397, 11.575]
PCMH NR	0.090	-0.014	0.064	-0.109
	[-0.127, 0.307]	[-0.206, 0.178]	[-0.188, 0.317]	[-0.245, 0.028]
PCMH PR	-0.135	0.164*	-0.041	-0.068
	[-0.292, 0.023]	[0.012, 0.315]	[-0.237, 0.154]	[-0.181, 0.044]
Time Trend	0.020***	0.014***	0.015***	0.012***
	[0.014, 0.026]	[0.009, 0.019]	[0.008, 0.021]	[0.009, 0.016]
Time Trend PCMH NR	0.005	-0.004	0.007	-0.003
	[-0.007, 0.017]	[-0.014, 0.007]	[-0.007, 0.021]	[-0.011, 0.005]
Time Trend PCMH PR	-0.003	0.011*	0.000	0.001
	[-0.012, 0.006]	[0.003, 0.020]	[-0.011, 0.011]	[-0.005, 0.008]
Implementation Level	-0.067	0.022	-0.097	-0.099*
	[-0.232, 0.098]	[-0.125, 0.168]	[-0.275, 0.081]	[-0.186, -0.012]
Implementation Trend	-0.013	-0.020*	-0.016	-0.012**
	[-0.028, 0.001]	[-0.033, -0.007]	[-0.031, 0.000]	[-0.020, -0.005]
Implementation Level PCMH NR	-0.123	-0.216	-0.077	0.018
	[-0.426, 0.179]	[-0.500, 0.067]	[-0.436, 0.281]	[-0.164, 0.199]
Implementation Trend PCMH NR	-0.009	0.025*	-0.009	0.003
	[-0.034, 0.015]	[0.001, 0.048]	[-0.039, 0.021]	[-0.013, 0.018]
Implementation Level PCMH PR	-0.006	-0.282*	-0.155	-0.076
	[-0.251, 0.238]	[-0.514, -0.050]	[-0.438, 0.128]	[-0.230, 0.078]
Implementation Trend PCMH PR	0.000	-0.004	0.018	0.002
	[-0.021, 0.021]	[-0.024, 0.015]	[-0.006, 0.042]	[-0.011, 0.016]
Post Implementation Level	-0.088	0.237	0.846*	-0.064
	[-0.610, 0.433]	[-0.299, 0.772]	[0.262, 1.430]	[-0.361, 0.233]
Post Implementation Trend	-0.019	-0.024*	-0.053***	-0.011
	[-0.041, 0.003]	[-0.047, -0.002]	[-0.078, -0.028]	[-0.024, 0.002]
Post Implementation Level PCMH NR	-0.059	-0.629	-0.863	-0.083
	[-0.909, 0.792]	[-1.497, 0.239]	[-1.830, 0.104]	[-0.604, 0.439]
Post Implementation Trend PCMH NR	-0.002	0.032	0.027	0.007
	[-0.039, 0.034]	[-0.005, 0.069]	[-0.015, 0.068]	[-0.015, 0.030]
Post Implementation Level PCMH PR	0.484	-0.115	-1.179**	0.235
	[-0.265, 1.233]	[-0.846, 0.616]	[-2.020, -0.339]	[-0.210, 0.680]
Post Implementation Trend PCMH PR	-0.012	-0.013	0.051*	-0.012
	[-0.044, 0.019]	[-0.044, 0.018]	[0.015, 0.087]	[-0.031, 0.007]
Age	0.010***	0.019***	0.016***	0.004***
	[0.007, 0.013]	[0.017, 0.021]	[0.014, 0.018]	[0.003, 0.005]
Female	-0.582***	-0.280***	-0.198***	-0.137***
	[-0.674, -0.489]	[-0.342, -0.219]	[-0.259, -0.138]	[-0.167, -0.106]
PCAL	0.068***	0.077***	0.041***	0.024***
	[0.044, 0.092]	[0.064, 0.091]	[0.029, 0.053]	[0.022, 0.027]
Observations (member-months)	1,997	4,015	3,821	16,298

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 4.8.17 Regression results for predicted odds of having any ambulatory costs for categories of MCC, odds ratios with 95% confidence intervals

Variable	Zero	1-3	3-4	5+
Constant	0.1219***	0.2577***	0.5109***	0.8461***
	[0.1174, 0.1266]	[0.2496, 0.2660]	[0.4907, 0.5319]	[0.8104, 0.8834]
PCMH NR	0.9868	0.9400*	0.8780***	1.0176
	[0.9195, 1.0592]	[0.8898, 0.9930]	[0.8219, 0.9379]	[0.9522, 1.0874]
PCMH PR	1.0329	0.9958	0.9007**	0.9387
	[0.9760, 1.0932]	[0.9471, 1.0470]	[0.8475, 0.9573]	[0.8782, 1.0033]
Time Trend	0.9965***	1.0001	1.0026***	1.0046***
	[0.9953, 0.9978]	[0.9992, 1.0011]	[1.0014, 1.0038]	[1.0035, 1.0058]
Time Trend PCMH NR	1.0030*	0.9999	0.9991	1.0006
	[1.0004, 1.0057]	[0.9980, 1.0019]	[0.9966, 1.0016]	[0.9981, 1.0030]
Time Trend PCMH PR	1.0006	1.0009	0.9992	0.9998
	[0.9985, 1.0027]	[0.9994, 1.0025]	[0.9971, 1.0012]	[0.9977, 1.0019]
Implementation Level	1.0158	0.9765	0.9441**	0.9854
	[0.9808, 1.0521]	[0.9529, 1.0006]	[0.9154, 0.9738]	[0.9572, 1.0144]
Implementation Trend	1.0087***	1.0016	0.9964*	0.9861***
	[1.0056, 1.0118]	[0.9995, 1.0038]	[0.9936, 0.9992]	[0.9835, 0.9887]
Implementation Level PCMH NR	0.9746	0.9913	1.0231	0.9599
	[0.9097, 1.0441]	[0.9439, 1.0411]	[0.9617, 1.0885]	[0.9038, 1.0195]
Implementation Trend PCMH NR	0.9971	1.0029	1.002	1.003
	[0.9914, 1.0029]	[0.9988, 1.0070]	[0.9967, 1.0072]	[0.9978, 1.0081]
Implementation Level PCMH PR	0.9474	0.9748	1.0074	0.9879
	[0.8957, 1.0021]	[0.9369, 1.0143]	[0.9569, 1.0607]	[0.9384, 1.0400]
Implementation Trend PCMH PR	1.0052*	1.0033	1.0067**	1.0022
	[1.0005, 1.0100]	[0.9999, 1.0067]	[1.0022, 1.0112]	[0.9977, 1.0067]
Post Implementation Level	1.3400***	1.1319**	1.0575	0.8298**
	[1.1957, 1.5016]	[1.0433, 1.2282]	[0.9513, 1.1755]	[0.7471, 0.9217]
Post Implementation Trend	0.9956	0.9955*	0.9929**	0.9961
	[0.9908, 1.0004]	[0.9921, 0.9989]	[0.9885, 0.9973]	[0.9917, 1.0006]
Post Implementation Level PCMH NR	0.9291	1.0522	1.2112*	1.3389**
	[0.7638, 1.1302]	[0.9134, 1.2122]	[1.0106, 1.4517]	[1.1135, 1.6100]
Post Implementation Trend PCMH NR	**0.9983**	**0.9979**	**0.9928**	**0.9876****
	[0.9901, 1.0066]	**[0.9919, 1.0039]**	**[0.9852, 1.0004]**	**[0.9799, 0.9953]**
Post Implementation Level PCMH PR	0.9832	1.0564	1.1536	1.3739**
	[0.8380, 1.1536]	[0.9394, 1.1881]	[0.9866, 1.3487]	[1.1676, 1.6166]
Post Implementation Trend PCMH PR	**0.9984**	**0.9964**	**0.9961**	**0.9874****
	[0.9917, 1.0051]	**[0.9915, 1.0014]**	**[0.9896, 1.0028]**	**[0.9806, 0.9942]**
Age	1.0008**	0.9979***	0.9952***	0.9978***
	[1.0004, 1.0012]	[0.9976, 0.9982]	[0.9948, 0.9956]	[0.9974, 0.9981]
Female	1.5191***	1.3675***	1.3309***	1.2867***
	[1.5013, 1.5370]	[1.3560, 1.3790]	[1.3167, 1.3453]	[1.2734, 1.3000]
PCAL	1.9388***	1.6132***	1.4063***	1.2257***
	[1.9253, 1.9523]	[1.6068, 1.6196]	[1.4008, 1.4118]	[1.2231, 1.2284]
Observations (member-months)	805,954	1,233,296	682,760	750,275

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 4.8.18 Regression results for log (ambulatory cost) among those having any ambulatory costs for categories of MCC, log($cost) with 95% confidence intervals

Variable	Zero	1-3	3-4	5+
Constant	4.5196***	4.6597***	4.8932***	5.3128***
	[4.4958, 4.5434]	[4.6412, 4.6782]	[4.8700, 4.9165]	[5.2909, 5.3348]
PCMH NR	0.0367	0.0408*	0.0646**	0.0725**
	[-0.0057, 0.0790]	[0.0078, 0.0739]	[0.0253, 0.1040]	[0.0371, 0.1080]
PCMH PR	-0.01	0.0118	-0.0123	-0.0233
	[-0.0429, 0.0230]	[-0.0149, 0.0385]	[-0.0451, 0.0204]	[-0.0545, 0.0079]
Time Trend	-0.0003	-0.0012**	-0.0009*	-0.0003
	[-0.0012, 0.0006]	[-0.0019, -0.0006]	[-0.0017, -0.0001]	[-0.0010, 0.0004]
Time Trend PCMH NR	-0.0006	0.0002	0.0014	0.0020**
	[-0.0024, 0.0013]	[-0.0011, 0.0016]	[-0.0003, 0.0031]	[0.0005, 0.0035]
Time Trend PCMH PR	-0.0008	-0.0002	-0.0001	-0.001
	[-0.0023, 0.0007]	[-0.0012, 0.0009]	[-0.0015, 0.0013]	[-0.0023, 0.0003]
Implementation Level	-0.0055	-0.0011	-0.0082	-0.0085
	[-0.0306, 0.0196]	[-0.0181, 0.0159]	[-0.0288, 0.0124]	[-0.0258, 0.0088]
Implementation Trend	0.0035**	0.0032***	0.0009	-0.0038***
	[0.0013, 0.0057]	[0.0017, 0.0047]	[-0.0010, 0.0027]	[-0.0054, -0.0023]
Implementation Level PCMH NR	0.0035	-0.0294	-0.0417*	-0.0339
	[-0.0454, 0.0523]	[-0.0633, 0.0044]	[-0.0829, -0.0005]	[-0.0697, 0.0019]
Implementation Trend PCMH NR	0.0035	0.0033*	0.0033	0.0003
	[-0.0005, 0.0076]	[0.0004, 0.0061]	[-0.0002, 0.0068]	[-0.0027, 0.0034]
Implementation Level PCMH PR	-0.0063	-0.0100	0.0033	-0.0240
	[-0.0465, 0.0339]	[-0.0378, 0.0177]	[-0.0312, 0.0378]	[-0.0552, 0.0073]
Implementation Trend PCMH PR	0.0019	0.0003	0.0000	0.0030*
	[-0.0015, 0.0053]	[-0.0021, 0.0027]	[-0.0029, 0.0030]	[0.0003, 0.0057]
Post Implementation Level	0.2799***	0.1730***	0.1728***	0.1154**
	[0.1990, 0.3608]	[0.1173, 0.2287]	[0.1041, 0.2415]	[0.0545, 0.1763]
Post Implementation Trend	-0.0095***	-0.0045**	-0.0059**	-0.0069***
	[-0.0129, -0.0061]	[-0.0069, -0.0022]	[-0.0088, -0.0030]	[-0.0095, -0.0044]
Post Implementation Level PCMH NR	-0.1327	-0.0322	-0.0943	0.0252
	[-0.2712, 0.0057]	[-0.1288, 0.0643]	[-0.2122, 0.0236]	[-0.0818, 0.1322]
Post Implementation Trend PCMH NR	**0.0061***	**0.0020**	**0.0018**	**-0.0035**
	[0.0003, 0.0120]	**[-0.0021, 0.0061]**	**[-0.0032, 0.0068]**	**[-0.0081, 0.0011]**
Post Implementation Level PCMH PR	-0.0121	0.0029	0.0085	0.0244
	[-0.1257, 0.1016]	[-0.0775, 0.0833]	[-0.0933, 0.1103]	[-0.0712, 0.1200]
Post Implementation Trend PCMH PR	**0.0022**	**0.0002**	**0.0001**	**0.0002**
	[-0.0026, 0.0070]	**[-0.0032, 0.0036]**	**[-0.0042, 0.0044]**	**[-0.0038, 0.0043]**
Age	0.0047***	0.0021***	-0.0007***	-0.0036***
	[0.0044, 0.0050]	[0.0019, 0.0023]	[-0.0009, -0.0004]	[-0.0038, -0.0034]
Female	0.0194***	0.0532***	0.0553***	0.0583***
	[0.0108, 0.0279]	[0.0472, 0.0591]	[0.0480, 0.0626]	[0.0520, 0.0645]
PCAL	0.1380***	0.1185***	0.1052***	0.0683***
	[0.1336, 0.1425]	[0.1162, 0.1208]	[0.1031, 0.1073]	[0.0675, 0.0692]
Observations (member-months)	203,670	461,075	333,775	478,364

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

4.9 Figures

Figure 4.9.1 Average unadjusted total medical expenditures (loess) PMPM for categories of MCC

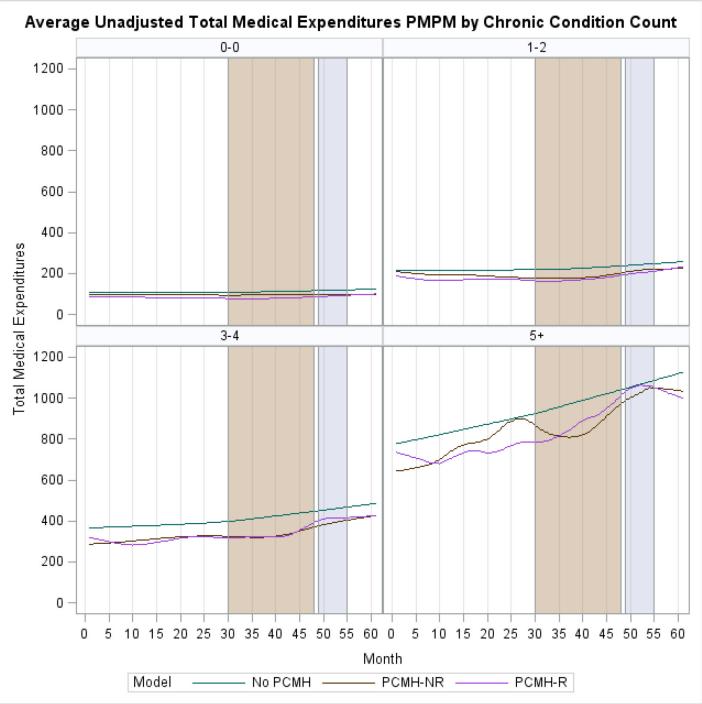
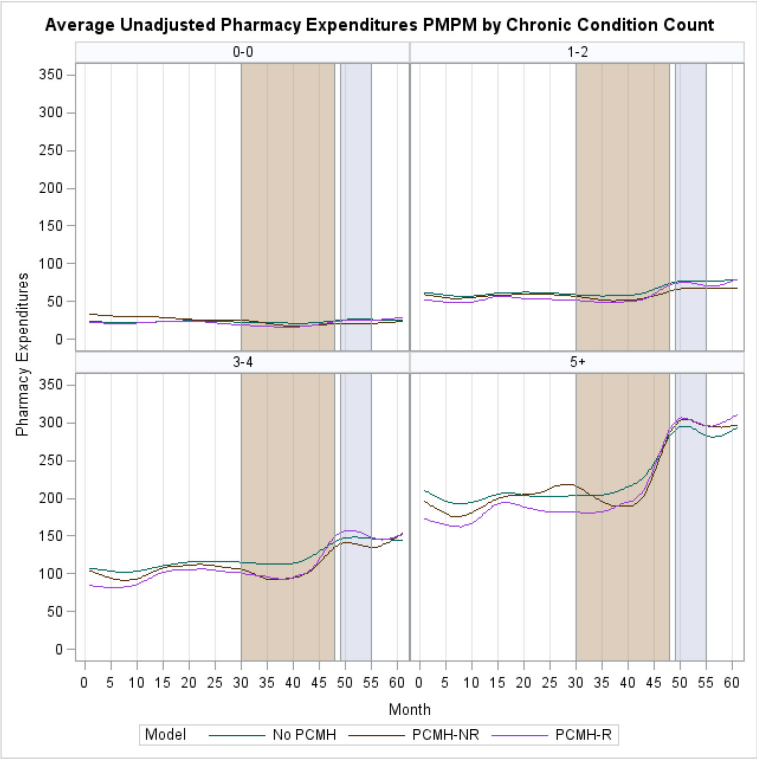


Figure 4.9.2 Average unadjusted pharmacy expenditures (loess) PMPM for categories of MCC



5. THE PATIENT CENTERED MEDICAL HOME; EFFECT ON PATIENTS WITH COMORBID DEPRESSION

5.1 Abstract

Objective: The objective of this paper is to assess whether patients with at least one chronic condition and prescribed an anti-depressant drug experience changes in healthcare expenditures or changes to health care utilization when enrolled in either 1) PCMH with FFS or 2) PCMH with partial capitation, relative to members enrolled in practices not transforming to PCMH.

Data: This study uses claims data from one commercial payer from January 2008 through January 2013. In July 2010, 22 practices serving 115,306 members transformed to PCMH.

Sample: The sample includes adult enrollees of the commercial payer utilizing health care between January 2008 and January 2013 with at least one chronic condition and prescribed an antidepressant drug.

Methods: An interrupted time-series model analyzing per member (individual) per month level data clustered by provider.

Results: PCMH with partial capitation has a dose response increase among members with no depression for both the monthly predicted odds of having an ambulatory expenditure (1.0242, $p<0.0001$, 1.0112, $p=0.0035$, 1.0130, $p=0.0031$, and 1.0159, $p=0.0020$ for those with zero, 1 to 2, 3 to 4 and 5 or more chronic conditions respectively) and in the amount of ambulatory expenditures among those who had some

(-0.0200, p<0.0001, -0.0182, p<0.0001, -0.0131, p=0.0011, and -0.0126, p=0.0057 for those with zero, 1 to 2, 3 to 4 and 5 or more chronic conditions respectively) . This is absent among members with co-morbid depression; monthly predicted odds of having an ambulatory expenditure is 1.0138, p=0.2647; 1.0215, p=0.0182; 1.0284, p=0.0088; and 1.0159, p=0.2583 for members with zero , 1 to 2, 3 to 4 and 5 or more chronic conditions respectively; and monthly log expenditures decrease for members with zero, 1 to 2, 3 to 4 and 5 or more chronic conditions with depression is -0.0061, p=0.5593; -0.0070, p=0.3423; -0.0180, p=0.0079; -0.0227, p=0.0019 respectively. In contrast, PCMH with FFS had no effect on the predicted odds of having an ambulatory expenditure for groups with or without depression and no statistically significant dose response effect on ambulatory expenditures for either group. PCMH with partial capitation also had statistically significant reductions on the monthly predicted odds of having a drug expenditure for all groups among those with no depression (0.9903, p=0.0090; 0.9866, p=0.0003; 0.9907, p=0.0332; 0.9765, p<0.0001 for those with zero, 1 or 2, 3 or 4, and 5 or more chronic conditions respectively). However, among those with no depression and some drug expenditure there was no statistically significant effect on the monthly log drug expenditures (0.0004, p=0.9185; 0.0026, p=0.4952; -0.0065, p=0.1182; and -0.0062, p=0.1815). In contrast, among those with depression, only those with 3 to 4 chronic conditions showed a statistically significant reduction in the monthly predicted odds of having a drug expenditure (0.9770, p=0.0097) and an increase in the monthly log expenditures (0.0177, p=0.0098) as compared to the other groups with zero (1.0039, p=0.9810), one to two (1.0034, p=0.7082) and 5 or more (0.9660, p=0.7120) chronic conditions.

Conclusions: PCMH with FFS had no effect among patients with co-morbid depression whereas PCMH with partial capitation has significant effects in ambulatory and drug expenditures. Stakeholders need to consider the importance of payment reform in the treatment of mental health conditions in primary care. In addition, depression does not behave as other chronic conditions and should be considered a modifier in addition to another chronic condition. This may partially explain the variability in care and lack of adequate depression care in persons with chronic illnesses further reinforcing the need for improvement of primary care depression treatment among those with multiple chronic conditions. PCMHs need increased training in evidence-based protocols for management of behavioral and mental health conditions.

5.2 Introduction

An estimated 26.2 percent of adult Americans suffer from diagnosable mental disorders per year.[159,160] Furthermore, studies have found correlations between physical and mental health conditions[161] and the prevalence of mental disorders is even greater among populations of patients with chronic conditions.[162,163] Individuals with one or more chronic conditions are at increased risk of having major depression[63,64] and the comorbid state of depression has been shown to incrementally worsen health as compared to any other combination of chronic diseases[66]. Physical chronic conditions with co-morbid mental disorders further exacerbate the burden of illness.[161] Having co-occurring physical and mental conditions increases the difficulty for an individual to maintain their health state leading to greater overall health care utilization,[63,64] unfavorable combinations of reduced utilization rates of disease-specific preventive services[71] and increased odds of acute medical service use.[72] Despite effective treatments being available the rate of treatment for these conditions is limited such that two thirds of patients with behavioral health conditions receive no or insufficient treatment from generalists.[161,164] Consequently, mental health disorders contribute to high costs of health care, poor health outcomes and premature mortality.[165,166]

Primary care is considered the setting where many behavioral health conditions are initially diagnosed and treated.[167,168] However, despite the high prevalence of these conditions, and the growing charge placed on primary care providers for screening and treating mental health disorders through the ACA,[59] primary care physicians fail to recognize depressive symptoms in 30% to 50% of patients with depression.[169] Furthermore, although less than 6% of all adult patients in a primary care population

consult for a psychiatric reason, a study detected that over 40% had a threshold or sub-threshold psychiatric disorder.[170] Even when recognized, treatment is often inadequate and failure to provide adequate follow-up contributes to low adherence rate to prescribed treatments.[171,172] With the high prevalence of mental health conditions, ensuing unfavorable outcomes and the important role primary health care plays in delivering mental health care it is important to understand if the patient-centered medical home (PCMH), with its focus on whole-person care, improves treatment thereby resulting in better health outcomes and lower costs.[173,177]

The PCMH provides primary care that is patient centered, comprehensive, coordinated, accessible and focused on quality and safety[1]. In the PCMH delivery of care pivots around an established partnership among a team of care providers, patients and their families that engages the patient and assumes accountability for all of a patient's physical and mental health care needs. PCMH has been shown to improve the treatment of chronic health disorders, through increases in patient satisfaction and reductions in ED use.[178] Other qualities of the PCMH, such as providing a usual source of care, being accessible, and providing comprehensive care have been associated with improved outcomes and reductions in health care expenditures.[178-182]

Although many studies conclude that care coordination between mental and physical teams working in primary care improve certain chronic conditions,[183-184] and that access to a usual source of care is associated with increased receipt of needed mental health care[182] the benefits of PCMH in the area of mental health treatment has been understudied.[187] A literature review uncovered no studies that evaluate how the PCMH model performs among the patient population with depression and co-morbid chronic

conditions despite the increased awareness that more mental health concerns are seen within primary care as compared to other healthcare settings.

This study uses administrative claims to assess the impact to health care utilization and expenditures, among those with depression and co-morbid chronic physical conditions, as a function of enrollment in PCMH with FFS and PCMH with partial capitation relative to usual source of care. Although there is evidence that certain aspects of the PCMH is associated with improvements in mental health care, there is also evidence that PCMH response to behavioral health issues is less well developed than somatic medical care.[188] Given this the direction of the expected effect is unclear.

5.3 Data and Population

Data used for this analysis consists of pharmacy and medical claims from a single health plan in New York from January 2008 to January 2013. These are medical claims submitted for billing for services rendered by health care providers as well as drug prescriptions to members of the health plan during this period. A structured and subsidized implementation of a PCMH among 22 practices began in July 2010 and completed in December 2011. 13 of these practices adopted partial capitation in addition to the clinical practice transformation.

The population is comprised by the set of adult patients (115,306) treated by one of the 22 practices or their matched controls between January 2008 and January 2010. For inclusion in the sample members had to be 18 and over, have at least one chronic condition and to have been prescribed an antidepressant during the baseline period. As the use of administrative claims for identifying depression diagnoses are not considered

an optimal means of validating diagnoses and are known to be underreported[188] we utilized the prescription of antidepressants as an indication of depression. Pharmacy claims with NDC codes for antidepressants prescribed during the baseline period (prior to July 1, 2010) were extracted to identify members with depression.

5.4 Analysis

An interrupted time series segmented generalized linear regression model with patient-level data is used to estimate changes over time in the outcome variables of interest to assess the effect of PCMH relative to a control. We analyzed patients with co-morbid mental health conditions grouped by number of chronic co-morbid conditions and presence or absence of depression separately to determine whether there are differential effects across time periods attributable to PCMH transformation with FFS or PCMH transformation with partial capitation between these groups.

The time periods considered for our analyses are discussed and illustrated in section 3.3.1 and include; for analysis 1) a pre-intervention period consisting of 30 months (from January 2008 through June 2010) and a post-intervention period consisting of 31 months (from July 2010 through January 2013), and for analysis 2) the same 30 month-long pre-intervention period and a post-intervention/post implementation period consisting of 13 months (from January 2012 through January 2013). In this study, we evaluate the impact of the PCMH transformation on per member per month (PMPM) health care and pharmacy expenditures to the health plan, and PMPM utilization of services. For utilization we include 1) the PMPM likelihood of having ambulatory office visits, hospitalizations, and emergency room visits. For expenditures we include PMPM 2) total medical, inpatient, ambulatory and outpatient pharmacy expenditures. We will look at

these across the categories of patients based on their total number of mutually exclusive chronic conditions as described in Section 4.3 (1-2, 3-4, and 5 or more).

To adjust for differences between intervention and control group that may be attributable to differences in other characteristics we adjust for patient and provider characteristics over time including patient age, gender, and risk scores in the regression model. Sensitivity analyses were run with number of chronic conditions but this did not noticeably impact the estimates and was dropped to simplify the model. The risk scores consisted of primary care activity level (PCAL) scores calculated by the health plan. These risk scores were developed so as to establish appropriate payment rates for the delivery of primary care.

We used PMPM observations to establish a trend in the baseline time period and trends in the post transformation time period. Three populations are compared over the study time period: patients who received usual care under providers not affiliated with PCMH-transformed sites (the control group), patients who received care under providers affiliated with PCMH-transformed sites with no payment reform, and patients who received care under providers affiliated with PCMH-transformed sites with partial capitation.

The dependent variables (described in Section 2.5.1) include dichotomous measures and continuous measures. The same statistical model is used with all but adjusted according to the outcome measure. As estimates for these outcomes can be skewed due to the non-normality of the data (outliers of rare and extremely high cost events lead to distributions that have a long right tail and a mean that differs from the median) estimation problems

would arise in common parametric tests such as OLS regression. Thus we use Generalized Linear Models (GLMs). GLMs allow for the specification of the family and link functions for the mean. We used the Box-Cox test to find optimal nonlinear transformations for the dependent variable and test the fit of the most appropriate link function to specify in the GLM. As suggested by Manning and Mullahy the Modified[106] the Modified Park Test was used on continuous outcomes to estimate the relationship between the mean and the variance and determine the distribution.

Expenditures outcome distributions were right-skewed with a substantial fraction of observations at zero. In these cases the standard OLS model may predict negative and nonsensical values. It is also possible that the zero mass is an indication of different modalities of health care use as compared to those with any use and thus respond differently to covariates in the regression. In these cases alternative estimators are used. We employ a two-part model which splits consumption into two parts: the probability of any expenditures and the level of expenditures. To model the probability of any expenditures we use GLM with a logit link. To model the level of use we use GLM on a log transformed data.

Analyses were completed using a p value < 0.05 was considered statistically significant. All analysis was completed using SAS/STAT 9.0 (SAS Institute, Cary, NC, 2011). The Johns Hopkins Bloomberg School of Public Health's Institutional Review Board approved this study.

5.5 Results

Table 5.9.1 shows the percent of patients for the three treatment groups (controls, PCMH with partial capitation and PCMH without partial capitation) associated with varying numbers of chronic conditions. In the three groups, healthy patients with zero chronic conditions comprise between 25 to 29 percent of the patient populations, those with 1 or 2 chronic conditions between 19 and 22 percent, those with 3 or 4 chronic conditions between 14 and 16 percent and those with five or more between 10 to 11 percent.

[Table 5.9.1 Number and (row) percent of members with 0, 1-2, 3-4, and 5 or more chronic conditions by type of treatment group and control.]

Table 5.9.2 shows the breakdown of members with depression in each intervention group and the control by gender and chronic condition count. The percentage of women on antidepressants ranged between 21 and 25 percent while the percentage of men on antidepressants was much lower and ranged between 12 and 13 percent. Among all three treatment groups the percent of individuals on antidepressants increases with the number of chronic conditions; among individuals with zero chronic conditions 6 to 8 percent are on antidepressants, with 1 to 2 chronic conditions 13 to 16 percent are on antidepressants, with 3 to 4 chronic conditions 19 to 21 percent are on antidepressants and with 5 or more chronic conditions 22 to 24 percent are on antidepressants.

[Table 5.9.2 Number and percent of members with depression by gender and chronic condition type per treatment group and control.]

Health Care Visits and Utilization

Office visits and emergency room visits and utilization

Members with chronic conditions, with and without depression, enrolled in PCMH see no effects in the predicted odds of having an emergency department or an office visit per month following the intervention (Table 5.9.3 - 5.9.6) in both PCMH with FFS and with capitation. Only members with zero chronic conditions and depression see an increase in the monthly rate of emergency department visits when enrolled in PCMH with FFS (1.1452, p=0.0042).

[Table 5.9.3 Regression results for predicted odds of having an office visit for categories of MCC with no antidepressant prescription, odds ratios with 95% confidence intervals.]

[Table 5.9.4 Regression results for predicted odds of having an office visit for categories of MCC with antidepressant prescription, odds ratios with 95% confidence intervals.]

[Table 5.9.5 Regression results for predicted odds of having an emergency department visit for categories of MCC with no antidepressant prescription, odds ratios with 95% confidence intervals.]

[Table 5.9.6 Regression results for predicted odds of having an emergency department visit for categories of MCC with antidepressant prescription, odds ratios with 95% confidence intervals.]

Inpatient visits and utilization

Members with 3 or 4 chronic conditions and depression see an increase in the predicted odds of having an inpatient admission (Tables 5.9.7 and 5.9.8) in both PCMH with FFS (1.1336, p=0.0173) and PCMH with partial capitation (1.1468, p=0.0170), but those with 1 or 2 chronic conditions only see an increase in the predicted odds of having an inpatient admission when enrolled in PCMH with partial capitation (1.1653, p=0.0055). No other groups see any statistically significant effect when enrolled in either PCMH relative to

usual source of care. There were not sufficient inpatient admissions among those without depression for the models to converge.

[Table 5.9.7 Regression results for predicted odds of having an inpatient admission for categories of MCC with antidepressant prescription, odds ratios with 95% confidence intervals.]

Total Expenditures

Only the sickest patients, those with 5 or more chronic conditions and depression saw a reduction in the monthly predicted odds of having a healthcare expenditure (0.9672, p=0.0145) when enrolled in PCMH with FFS relative to usual source of care. In patients with 3 to 4 chronic conditions who had some health care spending, there is a statistically significant increase in the monthly log expenditures for health care for those without depression (0.0111, p=0.0128). No other group saw a statistically significant effects.

Among those enrolled in PCMH with partial capitation the healthiest members, those with zero chronic conditions and no depression, saw a statistically significant increase in the monthly predicted odds of having a health care expenditure (1.0089, p=0.0094). Among those with depression only members with 1 to 2 chronic conditions saw a statistically significant increase (1.0297, p=0.0025) in the monthly predicted odds of having a health care expenditure relative to usual source of care. Among those with 3 to 4 chronic conditions who had some health care spending there is a statistically significant increase in the monthly log expenditures for health care for those with depression (0.0188, p=0.0052).

[Table 5.9.8 Regression results for predicted odds of having any health care expenditure for categories of MCC with antidepressant prescription, odds ratios with 95% confidence intervals.]

[Table 5.9.9 Regression results for predicted odds of having any health care expenditure for categories of MCC without antidepressant prescription, odds ratios with 95% confidence intervals.]

[Table 5.9.10 Regression results for log(health care expenditure) for categories of MCC with antidepressant prescription with any health care expenditure, odds ratios with 95% confidence intervals.]

[Table 5.9.11 Regression results for log(health care expenditure) for categories of MCC without antidepressant prescription, odds ratios with 95% confidence intervals.]

Ambulatory Expenditures

PCMH with FFS has no statistically significant effects on the monthly predicted odds of having an ambulatory care expenditure for any of the groups with varying numbers of chronic conditions regardless of the presence of depression (Tables 5.9.12 and 5.9.13). Among members with no depression and some ambulatory care expenditure (Tables 5.9.14 and 5.9.15), only those with 1 to 2 chronic conditions have a statistically significant decrease in monthly log expenditures (-0.0171, p=0.0001). Among members with depression and some ambulatory care expenditure, those with 3 to 4 and 5 or more have a statistically significant decrease in monthly log expenditures (-0.0207, p=0.0090 and -0.0241, p=0.0050 respectively).

PCMH with partial capitation has a statistically significant, dose response effect among members with no depression for both the monthly predicted odds of having an ambulatory expenditure and for the monthly log expenditures. In this group the monthly predicted odds of having an ambulatory expenditure increases for all groups with the

increases (1.0242, p<0.0001, 1.0112, p=0.0035, 1.0130, p=0.0031, and 1.0159, p=0.0020 for those with zero, 1 to 2, 3 to 4 and 5 or more chronic conditions respectively). Similarly, the monthly log expenditures for those having any ambulatory expenditure decreases (-0.0200, p<0.0001, -0.0182, p<0.0001, -0.0131, p=0.0011, and -0.0126, p=0.0057 for those with zero, 1 to 2, 3 to 4 and 5 or more chronic conditions respectively).

This dose response is not visible among those with depression in the monthly predicted odds effect among this group is statistically significant only for those with 1 to 2, and 3 to 4 chronic conditions (1.0215, p=0.0181; 1.0284, p=0.0009 respectively). There is a dose response visible in the log expenditures among those with some ambulatory expenditure, but statistical significance is only attained for the sicker patients; those with 3 to 4, or 5 or more chronic conditions. The effects are -0.0061, p=0.5593; -0.0070, p=0.3423; -0.0180, p=0.0079; -0.0227, p=0.0019 for those with zero, 1 to 2, 3 to 4, and 5 or more chronic conditions respectively.

[Table 5.9.12 Regression results for predicted odds of having any ambulatory expenditure for categories of MCC with antidepressant prescription, odds ratios with 95% confidence intervals.]

[Table 5.9.13 Regression results for predicted odds of having any ambulatory expenditure for categories of MCC without antidepressant prescription, odds ratios with 95% confidence intervals.]

[Table 5.9.14 Regression results for log(ambulatory expenditure) for categories of MCC with antidepressant prescription with any health care expenditure, odds ratios with 95% confidence intervals.]

[Table 5.9.15 Regression results for log(ambulatory expenditure) for categories of MCC without antidepressant prescription, odds ratios with 95% confidence intervals.]

Drug Expenditures

PCMH with FFS only had a statistically significant effect on patients with 5 or more chronic conditions with depression. For this group the monthly predicted odds of having a drug expenditure decreases (0.9705, p=0.0146). No other group had a statistically significant effect under PCMH with FFS relative to the control.

PCMH with partial capitation had statistically significant reductions on the monthly predicted odds of having a drug expenditure for all groups among those with no depression (0.9903, p=0.0090; 0.9866, p=0.0003; 0.9907, p=0.0332; 0.9765, p<0.0001 for those with zero, 1 or 2, 3 or 4, and 5 or more chronic conditions respectively). In contrast, among those with depression, only those with 3 to 4 chronic conditions showed a statistically significant reduction in the monthly predicted odds of having a drug expenditure (0.9770, p=0.0097). However, among those with no depression and some drug expenditure there was no statistically significant effect on the monthly log drug expenditures. Among those with depression, the same group of patients with 3 or 4 chronic conditions experienced and increase in the monthly log expenditures of 0.0177, p=0.0098).

[Table 5.9.16 Regression results for predicted odds of having any drug expenditure for categories of MCC with antidepressant prescription, odds ratios with 95% confidence intervals.]

[Table 5.9.17 Regression results for predicted odds of having any drug expenditure for categories of MCC without antidepressant prescription, odds ratios with 95% confidence intervals.]

[Table 5.9.18 Regression results for log(drug expenditure) for categories of MCC with antidepressant prescription with any health care expenditure, odds ratios with 95% confidence intervals.]

[Table 5.9.19 Regression results for log(drug expenditure) for categories of MCC without antidepressant prescription, odds ratios with 95% confidence intervals.]

Inpatient Expenditures

Among patients with depression PCMH with FFS had a statistically significant increase in the monthly predicted odds of having an inpatient expenditure among those with 3 to 4 chronic conditions only (1.1481, p=0.0164). However, the only group to see a statistically significant effect in log inpatient expenditures were those with 1 or 2 chronic conditions who saw a monthly reduction (-0.2052, p=0.0415).

PCMH with partial capitation had a statistically significant increase in the monthly predicted odds of having an inpatient expenditure among those with 1 or 2 and 3 or 4 chronic conditions and depression (1.1613, p=0.0070; 1.1265, p=0.0241 respectively). Among those with depression with some inpatient expenditure statistically significant effects were visible among those with 1 or 2 chronic conditions with a reduction (-0.3559, p<0.0001) and an increase among those with 5 or more chronic conditions (0.1906, p=0.0128).

The effects of inpatient expenditures among patients with no depression could not be determined as these models did not converge.

[Table 5.9.20 Regression results for predicted odds of having any inpatient related expenditure for categories of MCC with antidepressant prescription, odds ratios with 95% confidence intervals.]

[Table 5.9.21 Regression results for log inpatient expenditure for categories of MCC with antidepressant prescription among those with any inpatient expenditure, odds ratios with 95% confidence intervals.]

5.6 Discussion

This study found that PCMH with capitation affects those with and without depression differently in particular in ambulatory expenditures where those without co-morbid depression see an effect but those with tend to only see an effect on the sickest patients. PCMH with FFS has very few and mixed effects among either group with or without co-morbid depression; PCMH with FFS had no effect among patients with co-morbid depression whereas PCMH with partial capitation has significant effects in ambulatory and drug expenditures. This study also found that depression does not behave as other chronic conditions and should be considered a modifier in addition to another chronic condition.

In the analysis there was an absence of any statistically significant effects on emergency department visits or office visits among patients with different numbers of chronic conditions when modeled among those with and without co-morbid depression. Effects of PCMH on emergency department use are mixed, with some showing statistically insignificant effects or favorable statistically significant results. Particularly, recent evaluations that look at subgroups with chronic conditions have found favorable results and reduction in ED visits.[53] However, no study has looked specifically at the effect of PCMH on ED visits on patients with comorbid depression. However, given that our findings among the chronic subgroup differs from existing literature, it is possible that specific structural differences within this study might be accountable for this result.

This study found that PCMH with partial capitation has a dose response in the monthly predicted odds (ambulatory expenditures) among patients with multiple chronic conditions with no comorbid depression. This effect was lost when observing patients

with multiple chronic conditions with co-morbid depression. The effect is also not evident in PCMH with FFS. This suggests three things. The first is that even within the population of patients with chronic illness, effects are concentrated among certain subpopulations. The second is that although co-morbid symptoms are associated with increased illness burden and worse health outcomes, PCMH alone is not sufficient to address the issues of this population that would produce the warranted improvements to their care. Finally, depression, rather than being considered simply as another chronic condition should be considered as a modifier to other chronic conditions. Although effects were seen in the predicted monthly probability of having a drug expenditure, no dose response effect was seen in the monthly log expenditures. This suggests that effects might be occurring on extensive rather than intensive margins among those with chronic conditions with no-comorbid depression.

A similar dose response was found for patients with multiple chronic conditions and no co-morbid depression enrolled in PCMH with partial capitation for ambulatory expenditures. Among this group, a dose response increase is evident in the monthly predicted odds of having an ambulatory expenditure and an inverse dose response effect is evident in the monthly log expenditures among those with any ambulatory expenditure. This suggests the effects are both intensive and extensive with more patients receiving some ambulatory care, and more patients receiving reductions in the intensity of care received.

There is a difference in the nature of the dose response evident in log ambulatory expenditures. Among patients with multiple chronic conditions with no depression, the magnitude of the reductions in log ambulatory expenditures are inversely proportional to

the number of chronic conditions, whereas in the group of patients with co-morbid depression, the reductions are directly proportional to the number of chronic conditions.

Two findings are indicative of the nature of co-morbid depression as a modifier. The first is the loss of dose response effect when looking at the predicted probabilities of having drug and ambulatory expenditures. As mentioned, among those with no depression the effect is a statistically significant one, with increasing rates directly related to the number of chronic conditions.

This study also found that PCMH these two subgroups are more responsive to PCMH with payment reform than PCMH with FFS when compared to usual source of care. PCMH with FFS did have some effects among subgroups ambulatory and inpatient expenditures, but these did not display dose response in relation to number of chronic conditions, consistent significance among groups within each outcome, or even consistent direction of effect among subgroups within each outcome. PCMH with partial capitation, showed consistent and significant effects within both drug and ambulatory expenditures. A possible explanation for this finding is that the focus on coordination in a partially capitated environment would enable providers to recognize and address unmet needs among this population through increased outpatient services and therapeutic treatments. Increases in ambulatory expenditures might suggest an increase in the use of ambulatory services as gaps in health services rendered are identified from increased coordination of care and prevention focus as compared to FFS environments. These results are in keeping with the expectations of capitated financing schemes by providing incentives to integrate services such as mental and behavioral health.[198] However, it is not possible to

determine the plausibility of this explanation because of the lack of detailed information regarding the practice's protocols in treating mental health conditions.

5.7 Limitations

Several study limitations should be considered. There are known to be differences in the way providers code their billing data introducing heterogeneity into the code. As with any natural experiment, we rely on linear component analysis and matching to approximate randomization and cannot account for unobservable influences (such as those from other programs a practice may have adopted that would have the effect we note).

Second, this study was limited to members served by one commercial payer in upstate New York and may limit generalizability of the results. Third, this study is focused on practices that underwent PCMH transformation to attain NCQA recognition; it is not clear how other certifications would impact outcomes.

Fourth, each site adopts different approaches to attaining patient-centered, coordinated and accessible care. As such it is difficult to generalize these practices to other practices.

Fifth, all practices that achieved PCMH transformation, as well as those that went on to adopt payment reform, self-selected and were not randomized. This self-selection might suggest common attributes endogenous to these practices that were not adjusted for and thus further limit its generalizability.

Finally, members identified as having depression were selected based on the presence of claims indicating filled prescription for antidepressants. Although the percentages of members prescribed with anti-depressants matches the national average of people with

depression in the U.S. there are three possible reasons why this method might introduce a bias; 1) providers may have prescribed and anti-depressant for reasons other than treating depression, or without validating the presence of depression in the patient; 2) there may be depressed patients who were prescribed an antidepressant but never filled it; and 3) there may be depressed patient who were not prescribed anti-depressants.

5.8 Conclusions

This study found that PCMH with FFS had no effect among patients with co-morbid depression whereas PCMH with partial capitation has significant effects in ambulatory and drug expenditures suggesting that depression treatment is sensitive to care coordination and management. Stakeholders need to consider the importance of payment reform in the treatment of mental health conditions in primary care.

Another finding in this study is that depression does not behave as an additional chronic condition as the pattern of effects loses its dose response when members with multiple chronic conditions have co-morbid depression. Thus, depression should be considered a modifier in addition to another chronic condition. This may partially explain the variability in care and lack of adequate depression care in persons with chronic illnesses further reinforcing the need for improvement of primary care depression treatment among those with multiple chronic conditions.

The fact remains that these effects are not seen uniformly among all categories of multiple chronic conditions suggests that further integration of primary care and behavioral health that provide evidence-based training to primary care providers is necessary.

5.9 Tables

Table 5.9.1 Number and (row) percent of members with 0, 1-2, 3-4, and 5 or more chronic conditions by type of treatment group and control.

Site	All Members	0 cc		1-2 cc		3-4 cc		5+ cc	
		N	%	N	%	N	%	N	%
Control	63,209	16,375	25.91	12,477	19.74	9,400	14.87	6,665	10.54
PCMH FFS	16,284	4,210	25.85	3,323	20.41	2,423	14.88	1,796	11.03
PCMH partial capitation	35,813	10,259	28.65	7,754	21.65	5,468	15.27	3,791	10.59

Table 5.9.2 Number and percent of members with depression by gender and chronic condition type per treatment group and control.

	Control N= 63209		PCMH FFS N= 16284		PCMH PR N = 35813	
	N	**%**	**N**	**%**	**N**	**%**
Members on antidepressants	11,170	17.67	3,260	20.02	6,507	18.17
Gender						
Male	N = 26858		N = 6643		N = 15031	
Male members on antidepressants	3,391	12.63	883	13.29	1,944	12.93
Female	N = 36351		N = 9641		N = 20782	
Female members on antidepressants	7,779	21.40	2,385	24.74	4,563	21.96
Chronic condition count						
Members with zero cc	N= 16375		N= 4210		N = 10259	
Members with zero cc on antidepressants	1,094	6.68	316	7.51	628	6.12
Members with 1-2 cc	N = 12477		N = 3323		N = 7754	
Members with 1-2 cc on antidepressants	1,642	13.16	536	16.30	1,100	14.19
Members with 3-4 cc	N = 9400		N = 2423		N = 5468	
Members with 3-4 cc on antidepressants	1,840	19.57	514	21.21	1,165	21.31
Members with 5+ cc	N = 6665		N = 1796		N = 3791	
Members with 5+ cc on antidepressants	1,460	21.91	437	24.33	872	23.00

Table 5.9.3 Regression results for predicted odds of having an office visit for categories of MCC with no antidepressant prescription, odds ratios with 95% confidence intervals.

Variable	Zero	1-3	3-4	5+
Constant	0.1112***	0.1659***	0.2398***	0.3294***
	[0.1070, 0.1156]	[0.1596, 0.1725]	[0.2287, 0.2515]	[0.3123, 0.3475]
PCMH NR	1.0493	0.9759	0.8922**	0.9453
	[0.9780, 1.1257]	[0.9104, 1.0460]	[0.8195, 0.9713]	[0.8639, 1.0345]
PCMH PR	1.0542	1.0079	0.9535	0.9139*
	[0.9983, 1.1133]	[0.9549, 1.0638]	[0.8908, 1.0207]	[0.8498, 0.9828]
Time Trend	0.9943***	0.9965***	0.9989	1.0005
	[0.9929, 0.9957]	[0.9951, 0.9980]	[0.9973, 1.0005]	[0.9987, 1.0024]
Time Trend PCMH NR	1.0032*	1.0009	1.0002	1.002
	[1.0002, 1.0062]	[0.9979, 1.0040]	[0.9968, 1.0037]	[0.9982, 1.0059]
Time Trend PCMH PR	1.001	1.0016	0.9998	0.9984
	[0.9986, 1.0034]	[0.9992, 1.0041]	[0.9971, 1.0025]	[0.9953, 1.0015]
Implementation Level	1.0437*	0.9745	0.9802	0.9531*
	[1.0026, 1.0865]	[0.9369, 1.0136]	[0.9394, 1.0228]	[0.9084, 1.0000]
Implementation Trend	1.0089***	1.0071**	1.0037	0.9994
	[1.0054, 1.0125]	[1.0036, 1.0106]	[0.9999, 1.0075	[0.9951, 1.0037]
Implementation Level PCMH NR	0.9657	0.9499	1.0042	0.97727
	[0.8924, 1.0449]	[0.8776, 1.0282]	[0.9210, 1.0950]	[0.8832, 1.0714]
Implementation Trend PCMH NR	0.9970	1.0054	0.9994	0.9993
	[0.9905, 1.0036]	[0.9988, 1.0121]	[0.9921, 1.0067]	[0.9912, 1.0075]
Implementation Level PCMH PR	0.9034**	0.9780	0.9801	0.9835
	[0.8472, 0.9633]	[0.9177, 1.0423]	[0.9137, 1.0514]	[0.9080, 1.0653]
Implementation Trend PCMH PR	1.0063*	1.0022	1.0012	1.0068
	[1.0008, 1.0118]	[0.9968, 1.0076]	[0.9952, 1.0072]	[0.9999, 1.0138]
Post Implementation Level	1.4078***	1.2416**	1.2072**	1.1056
	[1.2354, 1.6043]	[1.0905, 1.4135]	[1.0480, 1.3906]	[0.9379, 1.3034]
Post Implementation Trend	0.9959	0.9967	0.9952	0.9941
	[0.9905, 1.0014]	[0.9913, 1.0021]	[0.9893, 1.0012]	[0.9872, 1.0010]
Post Implementation Level PCMH NR	0.9576	1.1297	1.0907	1.0564
	[0.7650, 1.1986]	[0.9011, 1.4165]	[0.8488, 1.4015]	[0.7953, 1.4031]
Post Implementation Trend PCMH NR	**0.9963**	**0.9939**	**0.9958**	**0.9953**
	[0.9869, 1.0059]	**[0.9844, 1.0035]**	**[0.9853, 1.0064]**	**[0.9834, 1.0074]**
Post Implementation Level PCMH PR	1.0052	1.014	1.0358	1.1667
	[0.8369, 1.2074]	[0.8420, 1.2211]	[0.8412, 1.2753]	[0.9162, 1.4856]
Post Implementation Trend PCMH PR	**0.9965**	**0.9970**	**0.9973**	**0.995**
	[0.9888, 1.0042]	**[0.9892, 1.0049]**	**[0.9885, 1.0061]**	**[0.9848, 1.0052]**
Age	0.9967***	0.9976***	0.9969***	0.9956***
	[0.9962, 0.9972]	[0.9971, 0.9981]	[0.9964, 0.9974]	[0.9950, 0.9962]
Female	1.4276***	1.3202***	1.2443***	1.2209***
	[1.4087, 1.4468]	[1.3026, 1.3380]	[1.2262, 1.2627]	[1.2008, 1.2413]
PCAL	1.7158***	1.5307***	1.4108***	1.3508***
	[1.7030, 1.7287]	[1.5201, 1.5406]	[1.4023, 1.4193]	[1.3426, 1.3589]
Observations (member-months)	751,571	596,477	430,851	307,219

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 5.9.4 Regression results for predicted odds of having an office visit for categories of MCC with antidepressant prescription, odds ratios with 95% confidence intervals.

Variable	Zero	1-3	3-4	5+
Constant	0.1773***	0.2061***	0.2906***	0.4165***
	[0.1573, 0.2000]	[0.1888, 0.2251]	[0.2677, 0.3155]	[0.3783, 0.4585]
PCMH NR	1.0004	1.054	1.0006	0.8729
	[0.8229, 1.2163]	[0.9184, 1.2096]	[0.8739, 1.1457]	[0.7472, 1.0199]
PCMH PR	0.9409	0.9742	0.9053	0.8698*
	[0.8013, 1.1047]	[0.8705, 1.0903]	[0.8124, 1.0088]	[0.7668, 0.9867]
Time Trend	0.9987	0.9981	0.9998	1.0033
	[0.9939, 1.0036]	[0.9946, 1.0017]	[0.9966, 1.0030]	[0.9997, 1.0069]
Time Trend PCMH NR	1.0016	1.0017	1.0017	0.996
	[0.9919, 1.0115]	[0.9946, 1.0088]	[0.9952, 1.0083]	[0.9888, 1.0033]
Time Trend PCMH PR	0.9985	1.0016	0.9978	0.9969
	[0.9900, 1.0070]	[0.9956, 1.0076]	[0.9925, 1.0032]	[0.9911, 1.0027]
Implementation Level	0.9711	0.9533	0.9394	0.9173
	[0.8534, 1.1051]	[0.8673, 1.0480]	[0.8648, 1.0207]	[0.8365, 1.0058]
Implementation Trend	1.0126*	1.0086*	1.0038	0.9985
	[1.0013, 1.0240]	[1.0003, 1.0169]	[0.9965, 1.0112]	[0.9905, 1.0066]
Implementation Level PCMH NR	1.0608	1.0019	0.8918	1.0161
	[0.8283, 1.3586]	[0.8407, 1.1941]	[0.7584, 1.0485]	[0.8511, 1.2132]
Implementation Trend PCMH NR	0.9925	0.9977	1.0062	1.0078
	[0.9721, 1.0134]	[0.9833, 1.0124]	[0.9926, 1.0199]	[0.9929, 1.0228]
Implementation Level PCMH PR	1.0296	1.033	1.0529	1.1042
	[0.8303, 1.2766]	[0.8897, 1.1992]	[0.9218, 1.2027]	[0.9549, 1.2769]
Implementation Trend PCMH PR	1.0033	1.0012	1.0022	1.0059
	[0.9855, 1.0213]	[0.9887, 1.0140]	[0.9908, 1.0137]	[0.9934, 1.0184]
Post Implementation Level	1.6210*	1.036	1.2133	1.1327
	[1.0770, 2.4396]	[0.7618, 1.4089]	[0.9184, 1.6028]	[0.8380, 1.5312]
Post Implementation Trend	0.9854	1.0016	0.9933	0.9908
	[0.9685, 1.0025]	[0.9887, 1.0147]	[0.9817, 1.0050]	[0.9783, 1.0035]
Post Implementation Level PCMH NR	0.8987	1.1248	1.0803	1.345
	[0.4476, 1.8043]	[0.6869, 1.8418]	[0.6809, 1.7140]	[0.8206, 2.2046]
Post Implementation Trend PCMH NR	**1.0038**	**0.9928**	**0.9925**	**0.9914**
	[0.9746, 1.0339]	**[0.9722, 1.0139]**	**[0.9732, 1.0122]**	**[0.9707, 1.0125]**
Post Implementation Level PCMH PR	0.6047	1.0358	1.2535	0.9499
	[0.3346, 1.0927]	[0.6721, 1.5964]	[0.8425, 1.8649]	[0.6158, 1.4650]
Post Implementation Trend PCMH PR	**1.0206**	**0.9985**	**0.9922**	**1.0065**
	[0.9953, 1.0466]	**[0.9804, 1.0170]**	**[0.9756, 1.0091]**	**[0.9881, 1.0251]**
Age	0.9958***	0.9970***	0.9966***	0.9949***
	[0.9941, 0.9976]	[0.9959, 0.9982]	[0.9956, 0.9976]	[0.9938, 0.9960]
Female	1.3888***	1.3167***	1.2358***	1.2617***
	[1.3193, 1.4619]	[1.2702, 1.3650]	[1.1968, 1.2760]	[1.2186, 1.3062]
PCAL	1.5233***	1.4631***	1.3794***	1.2890***
	[1.4897, 1.5576]	[1.4420, 1.4845]	[1.3634, 1.3957]	[1.2750, 1.3032]
Observations (member-months)	54,383	96,631	109,337	86,958

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 5.9.5 Regression results for predicted odds of having an emergency department visit for categories of MCC with no antidepressant prescription, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	0.0265***	0.0374***	0.0498***	0.0695***
	[0.0231, 0.0305]	[0.0322, 0.0434]	[0.0426, 0.0582]	[0.0587, 0.0824]
PCMH NR	1.1871	1.6070**	1.4063*	1.2125
	[0.9224, 1.5279]	[1.2506, 2.0651]	[1.0845, 1.8236]	[0.9173, 1.6027]
PCMH PR	1.0854	1.1880	1.1212	0.9535
	[0.8879, 1.3267]	[0.9587, 1.4721]	[0.9007, 1.3957]	[0.7510, 1.2106]
Time Trend	0.9976	0.9991	1.004	1.0086**
	[0.9925, 1.0028]	0.9936, 1.0046]	[0.9982, 1.0099]	[1.0022, 1.0151]
Time Trend PCMH NR	0.9977	0.9985	1.0035	0.9951
	[0.9863, 1.0092]	[0.9872, 1.0099]	[0.9913, 1.0157]	[0.9829, 1.0084]
Time Trend PCMH PR	1.0063	1.0056	1.0048	0.9945
	[0.9978, 1.0149]	[0.9967, 1.0146]	[0.9952, 1.0145]	[0.9834, 1.0056]
Implementation Level	1.2590**	1.1956*	1.0553	0.9243
	[1.0952, 1.4474]	[1.0350, 1.3810]	[0.9061, 1.2291]	[0.7830, 1.0911]
Implementation Trend	1.0011	1.0047	0.9902	0.987
	[0.9890, 1.0134]	[0.9921, 1.0175]	[0.9767, 1.0039]	[0.9721, 1.0021]
Implementation Level PCMH NR	0.9101	0.8122	0.8332	1.0973
	[0.6855, 1.2083]	[0.6145, 1.0735]	[0.6210, 1.1179]	[0.7982, 1.5085]
Implementation Trend PCMH NR	1.0129	1.004	1.0112	1.0116
	[0.9904, 1.0360]	[0.9816, 1.0269]	[0.9869, 1.0362]	[0.9851, 1.0390]
Implementation Level PCMH PR	0.7896*	0.8306	0.8725	1.1234
	[0.6399, 0.9744]	[0.6678, 1.0332]	[0.6893, 1.1043]	[0.8578, 1.4713]
Implementation Trend PCMH PR	1.0145	0.9981	1.0049	1.0129
	[0.9967, 1.0326]	[0.9798, 1.0168]	[0.9845, 1.0258]	[0.9893, 1.0370]
Post Implementation Level	1.7933*	1.0479	0.7658	0.7093
	[1.1493, 2.7981]	[0.6463, 1.6990]	[0.4521, 1.2971]	[0.4012, 1.2541]
Post Implementation Trend	0.989	1.0084	1.0071	1.0059
	[0.9706, 1.0078]	[0.9882, 1.0291]	[0.9851, 1.0295]	[0.9822, 1.0302]
Post Implementation Level PCMH NR	0.6886	0.7114	1.2866	2.2223
	[0.3381, 1.4015]	[0.3379, 1.4977]	[0.5704, 2.9019]	[0.9140, 5.4029]
Post Implementation Trend PCMH NR	**1.0203**	**1.0073**	**0.9835**	**0.9703**
	[0.9898, 1.0518]	**[0.9760, 1.0396]**	**[0.9501, 1.0181]**	**[0.9342, 1.0077]**
Post Implementation Level PCMH PR	0.9092	1.1415	1.2238	1.5202
	[0.5022, 1.6461]	[0.6057, 2.1512]	[0.5989, 2.5007]	[0.6874, 3.3634]
Post Implementation Trend PCMH PR	**0.9939**	**0.9866**	**0.9871**	**0.9933**
	[0.9690, 1.0194]	**[0.9605, 1.0135]**	**[0.9577, 1.0173]**	**[0.9604, 1.0272]**
Age	0.9626***	0.9608***	0.9639***	0.9657***
	[0.9607, 0.9644]	[0.9591, 0.9625]	[0.9622, 0.9657]	[0.9638, 0.9676]
Female	0.9271**	1.0371	1.0806**	0.9769
	[0.8866, 0.9694]	[0.9892, 1.0874]	[1.0269, 1.1372]	[0.9236, 1.0332]
PCAL	1.6993***	1.4476***	1.3395***	1.2692***
	[1.6684, 1.7307]	[1.4254, 1.4702]	[1.3211, 1.3582]	[1.2523, 1.2865]
Observations (member-months)	751,571	596,477	430,851	307,219

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 5.9.6 Regression results for predicted odds of having an emergency department visit for categories of MCC with antidepressant prescription, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	0.0576***	0.0527***	0.0882***	0.1142***
	[0.0390, 0.0849]	[0.0403, 0.0690]	[0.0703, 0.1108]	[0.0899, 0.1450]
PCMH NR	1.0757	0.8784	0.9196	1.5659*
	[0.5589, 2.0705]	[0.5697, 1.3545]	[0.6395, 1.3225]	[1.0864, 2.2571]
PCMH PR	1.3435	1.1476	1.0025	1.3205
	[0.8182, 2.2061]	[0.8155, 1.6150]	[0.7349, 1.3675]	[0.9684, 1.8007]
Time Trend	1.0147	1.0073	1.0149**	0.9972
	[0.9989, 1.0308]	[0.9964, 1.0182]	[1.0056, 1.0244]	[0.9878, 1.0067]
Time Trend PCMH NR	0.9805	0.9980	0.982	1.0106
	[0.9497, 1.0123]	[0.9754, 1.0210]	[0.9641, 1.0002]	[0.9915, 1.0301]
Time Trend PCMH PR	1.0133	1.0063	0.9977	1.0169*
	[0.9862, 1.0412]	[0.9890, 1.0240]	[0.9823, 1.0135]	[1.0012, 1.0329]
Implementation Level	0.7075	0.8825	1.0328	1.1733
	[0.4705, 1.0640]	[0.6662, 1.1691]	[0.8269, 1.2899]	[0.9213, 1.4944]
Implementation Trend	1.0197	1.004	0.9823	0.9976
	[0.9839, 1.0568]	[0.9796, 1.0290]	[0.9629, 1.0020]	[0.9767, 1.0190]
Implementation Level PCMH NR	1.8492	0.8408	0.8036	0.6583
	[0.8604, 3.9741]	[0.4920, 1.4368]	[0.5218, 1.2376]	[0.4252, 1.0192]
Implementation Trend PCMH NR	0.9763	1.0205	1.0556**	1.0161
	[0.9163, 1.0402]	[0.9775, 1.0654]	[1.0196, 1.0928]	[0.9804, 1.0531]
Implementation Level PCMH PR	1.1143	1.0738	0.8067	0.6984
	[0.5987, 2.0740]	[0.7161, 1.6102]	[0.5653, 1.1511]	[0.4800, 1.0056]
Implementation Trend PCMH PR	0.9415*	0.9819	1.0213	0.9929
	[0.8919, 0.9939]	[0.9479, 1.0172]	[0.9906, 1.0530]	[0.9618, 1.0250]
Post Implementation Level	2.8657	2.1945	0.6788	0.9147
	[0.9188, 8.9378]	[0.9193, 5.2386]	[0.3224, 1.4292]	[0.4028, 2.0775]
Post Implementation Trend	0.9542	0.9651	1.001	1.0099
	[0.9088, 1.0019]	[0.9298, 1.0017]	[0.9702, 1.0328]	[0.9757, 1.0453]
Post Implementation Level PCMH NR	0.0363**	1.3761	0.7993	1.1137
	[0.0039, 0.3415]	[0.3857, 4.9097]	[0.2544, 2.5115]	[0.3551, 3.4933]
Post Implementation Trend PCMH NR	**1.1452****	**0.9937**	**1.0307**	**0.9853**
	[0.1.0436, 1.2567]	**[0.9399, 1.0507]**	**[0.9818, 1.0819]**	**0.9380, 1.0350]**
Post Implementation Level PCMH PR	0.6066	0.2918*	1.4699	0.8016
	[0.01186, 3.1042]	[0.0926, 0.9190]	[0.5212, 4.1452]	[0.2640, 2.4343]
Post Implementation Trend PCMH PR	**0.9813**	**1.0476**	**0.9811**	**0.9842**
	[0.9138, 1.0537]	**[0.9972, 1.1005]**	**[0.9386, 1.0255]**	**0.9388, 1.0317]**
Age	0.9550***	0.9611***	0.9603***	0.9558***
	[0.9490, 0.9611]	[0.9574, 0.9647]	[0.9573, 0.9632]	[0.9529, 0.9588]
Female	0.8934	1.0766	1.0271	1.0084
	[0.7645, 1.0440]	[0.9709, 1.1939]	[0.9415, 1.1205]	[0.9229, 1.1018]
PCAL	1.6040***	1.5014***	1.3670***	1.2526***
	[1.5219, 1.6906]	[1.4572, 1.5469]	[1.3354, 1.3394]	[1.2276, 1.2781]
Observations (member-months)	54,383	96,631	109,337	86,958

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 5.9.7 Regression results for predicted odds of having an inpatient admission for categories of MCC with antidepressant prescription, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	0.0072***	0.0125***	0.0227***	0.0509***
	[0.0033, 0.0159]	[0.0074, 0.0212]	[0.0145, 0.0355]	[0.0336, 0.0770]
PCMH NR	0.4142	0.1151***	0.2085***	0.1640***
	[0.1296, 1.3239]	[0.0430, 0.3083]	[0.0979, 0.4439]	[0.0756, 0.3556]
PCMH PR	0.9988	0.2608**	0.4056**	0.3156**
	[0.4446, 2.2435]	[0.1311, 0.5187]	[0.2266, 0.7259]	[0.1787, 0.5577]
Time Trend	1.0366*	1.0154***	1.0559***	1.0640***
	[1.0042, 1.0701]	[1.0283, 1.0751]	[1.0350, 1.0773]	[1.0440, 1.0845]
Time Trend PCMH NR	0.9648	0.9179**	0.9329**	0.9405**
	[0.9036, 1.0301]	[0.8721, 0.9661]	[0.8951, 0.9723]	[0.8996, 0.9832]
Time Trend PCMH PR	1.0083	0.9332**	0.9615*	0.9693
	[0.9560, 1.0634]	[0.8980, 0.9698]	[0.9280, 0.9962]	[0.0355, 1.0044]
Implementation Level	0.4834	0.7298	0.8686	0.5686**
	[0.2164, 1.0802]	[0.4429, 1.2026]	[0.5702, 1.3232]	[0.3729, 0.8671]
Implementation Trend	1.0146	0.9461*	0.9282**	0.9412**
	[0.9475, 1.0865]	[0.9034, 0.9909]	[0.8915, 0.9665]	[0.9050, 0.9789]
Implementation Level PCMH NR	2.5385	2.5819	1.7784	1.6652
	[0.5312, 12.1321]	[0.7847, 8.4949]	[0.6994, 4.5220]	[0.6236, 4.4462]
Implementation Trend PCMH NR	0.9769	1.1058*	1.0418	1.0535
	[0.8578, 1.1125]	[1.0104, 1.2102]	[0.9626, 1.1275]	[0.9726, 1.1412]
Implementation Level PCMH PR	1.1404	1.909	1.3927	1.036
	[0.3300, 3.9407]	[0.7881, 4.6241]	[0.6566, 2.9541]	[0.4772, 2.2492]
Implementation Trend PCMH PR	0.9216	1.0790*	1.0383	1.0740*
	[0.8250, 1.0295]	[1.0009, 1.1633]	[0.9708, 1.1105]	[1.0051, 1.1475]
Post Implementation Level	0.0527	3.5235	3.0922	0.2526
	[0.0027, 1.0252]	[0.8042, 15.4373]	[0.6323, 15.1229]	[0.0480, 1.3295]
Post Implementation Trend	1.0662	0.8977**	0.8814***	0.9606
	[0.9469, 1.2006]	[0.8410, 0.9582]	[0.8220, 0.9451]	[0.8962, 1.0296]
Post Implementation Level PCMH NR	163.3808	2.9822	0.3673	1.6706
	[0.9543, 227,972.8]	[0.1782, 49.9166]	[0.0271, 4.9836]	[0.1351, 20.6508]
Post Implementation Trend PCMH NR	**0.8467**	**1.0736**	**1.1468***	**1.0875**
	[0.6781, 1.0573]	**[0.9483, 1.2154]**	**[1.0245, 1.2838]**	**[0.9768, 1.2108]**
Post Implementation Level PCMH PR	6.4021	0.1889	0.2095	16.0788*
	[0.1186, 345.50]	[0.0150, 2.3734]	[0.0195, 2.2546]	[1.6654, 155,23]
Post Implementation Trend PCMH PR	**0.9119**	**1.1653****	**1.1336***	**0.9491**
	[0.7734, 1.0752]	**[1.0459, 1.2982]**	**[1.0227, 1.2566]**	**[0.8602, 1.0472]**
Age	0.9486***	0.9545***	0.9565***	0.9624***
	[0.9360, 0.9613]	[0.9468, 0.9622]	[0.9500, 0.9630]	[0.9576, 0.9692]
Female	4.4700***	2.9288***	1.9600***	1.2411*
	[2.7550, 7.2525]	[2.1717, 3.9500]	[1.5565, 2.4681]	[1.0284, 1.4976]
PCAL	1.5520***	1.5411***	1.4021***	1.3086***
	[1.4136, 1.7039]	[1.4539, 1.6336]	[1.3372, 1.4701]	[1.2618, 1.3570]
Observations (member-months)	54,383	96,631	109,337	86,958

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 5.9.8 Regression results for predicted odds of having any health care expenditure for categories of MCC with antidepressant prescription, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	0.5307***	0.5700***	0.6532***	0.7074***
	[0.4564, 0.6171]	[0.5038, 0.6450]	[0.5803, 0.7352]	[0.6114, 0.8186]
PCMH NR	0.9307	0.9829	0.7842**	1.1484
	[0.6888, 1.1856]	[0.8139, 1.1871]	[0.6585, 0.9339]	[0.9362, 1.4088]
PCMH PR	0.856	0.6492***	0.5821***	0.5702***
	[0.6833, 1.0724]	[0.5396, 0.7811]	[0.4876, 0.6950]	[0.4623, 0.7033]
Time Trend	1.0085**	1.0029	1.0040*	1.0075**
	[1.0039, 1.0131]	[0.9992, 1.0065]	[1.0005, 1.0076]	1.0033, 1.0118]
Time Trend PCMH NR	0.9931	0.9989	0.9984	1.005
	[0.9841, 1.0022]	[0.9914, 1.0059]	[0.9914, 1.0054]	[0.9966, 1.0134]
Time Trend PCMH PR	0.9934	0.9952	1.0016	0.9910**
	[0.9855, 1.0013]	[0.9894, 1.0011]	[0.9960, 1.0072]	[0.9845, 0.9977]
Implementation Level	0.8864*	0.8037***	0.8934*	0.8508**
	[0.7877, 0.9974]	[0.7328, 0.8814]	[0.8165, 0.9777]	[0.7626, 0.9492]
Implementation Trend	1.0002	1.0133**	1.0072	1.0043
	[0.9898, 1.0107]	[1.0050, 1.0217]	[0.9990, 1.0154]	[0.9945, 1.0142]
Implementation Level PCMH NR	0.9841	1.0079	0.9186	0.9012
	[0.7824, 1.2378]	[0.8468, 1.1998]	[0.7747, 1.0891]	[0.7360, 1.1036]
Implementation Trend PCMH NR	1.0077	1.0074	1.0158*	1.0002
	[0.9884, 1.0274]	[0.9928, 1.0223]	[1.0012, 1.0307]	[0.9832, 1.0174]
Implementation Level PCMH PR	0.8121*	1.0562	0.9253	1.0547
	[0.6676, 0.9880]	[0.9156, 1.2184]	[0.8057, 1.0625]	[0.8947, 1.2432]
Implementation Trend PCMH PR	1.0274**	1.0129*	1.0155*	1.0233**
	[1.0105, 1.0445]	[1.0005, 1.0254]	[1.0033, 1.0278]	[1.0087, 1.0382]
Post Implementation Level	1.2138	1.2701	1.1707	1.0669
	[0.8181, 1.8008]	[0.9234, 1.7468]	[0.8385, 1.6346]	[0.7071, 1.6097]
Post Implementation Trend	0.995	0.994	1.0021	1.0036
	[0.9786, 1.0117]	[0.9807, 1.0074]	[0.9881, 1.0163]	[0.9863, 1.0211]
Post Implementation Level PCMH NR	0.905	1.1938	1.3985	1.711
	[0.4636, 1.7667]	[0.7083, 2.0119]	[0.8175, 2.3925]	[0.9109, 3.2140]
Post Implementation Trend PCMH NR	**1.0108**	**1.0068**	**0.9952**	**0.9672***
	[0.9825, 1.0399]	**[0.9847, 1.0295]**	**[0.9729, 1.0181]**	**[0.9416, 0.9934]**
Post Implementation Level PCMH PR	1.0197	0.8829	1.4238	2.0050*
	[0.5829, 1.7841]	[0.5652, 1.3794]	[0.8958, 2.2630]	[1.1314, 3.5533]
Post Implementation Trend PCMH PR	**1.0097**	**1.0297****	**0.9957**	**0.9968**
	[0.9859, 1.0340]	**[1.0104, 1.0494]**	**[0.9763, 1.0154]**	**[0.9729, 1.0212]**
Age	1.0061***	1.0148***	1.0180***	1.0205***
	[1.0044, 1.0078]	[1.0136, 1.0161]	[1.0168, 1.0192]	[1.0191, 1.0219]
Female	1.5903***	1.4150***	1.3563***	1.2233***
	[1.5175, 1.6665]	[1.3668, 1.4649]	[1.3115, 1.4025]	[1.1757, 1.2729]
PCAL	1.5976***	1.4924***	1.4208***	1.3609***
	[1.5585, 1.6377]	[1.4679, 1.5172]	[1.4005, 1.4415]	[1.3410, 1.3810]
Observations (member-months)	53,775	95,519	108,097	85,806

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 5.9.9 Regression results for predicted odds of having any health care expenditure for categories of MCC without antidepressant prescription, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	0.2075***	0.3147***	0.4972***	0.6695***
	[0.1963, 0.2194]	[0.2972, 0.3332]	[0.4648, 0.5319]	[0.6161, 0.7276]
PCMH NR	0.9378	0.9084*	0.8708**	0.8119**
	[0.8590, 1.0239]	[0.8322, 0.9916]	[0.7864, 0.9642]	[0.7194, 0.9163]
PCMH PR	0.9108*	0.7669***	0.7070***	0.7089***
	[0.8358, 0.9924]	[0.7006, 0.8395]	[0.6343, 0.7880]	[0.6230, 0.8066]
Time Trend	0.9967***	0.9997	1.0018*	1.0031**
	[0.9955, 0.9980]	[0.9984, 1.0011]	[1.0002, 1.0034]	[1.0011, 1.0052]
Time Trend PCMH NR	1.0046**	1.0031*	0.9983	1.0014
	[1.0018, 1.0073]	[1.0002, 1.0060]	[0.9949, 1.0018]	[0.9973, 1.0055]
Time Trend PCMH PR	1.0048***	1.0038**	1.0059***	1.0071***
	[1.0026, 1.0070]	[1.0015, 1.0061]	[1.0032, 1.0086]	[1.0037, 1.0105]
Implementation Level	0.9726	0.9553*	0.9190**	0.9214**
	[0.9393, 1.0072]	[0.9213, 0.9905]	[0.8804, 0.9592]	[0.8739, 0.9716]
Implementation Trend	1.0077***	1.0053**	1.0036	0.9985
	[1.0046, 1.0108]	[1.0021, 1.0086]	[0.9998, 1.0075]	[0.9937, 1.0033]
Implementation Level PCMH NR	0.9071**	0.8999**	1.0098	0.9125
	[0.8451, 0.9736]	[0.8361, 0.9685]	[0.9264, 1.1008]	[0.8220, 1.0129]
Implementation Trend PCMH NR	0.9987	1.0022	1.0042	1.0075
	[0.9928, 1.0046]	[0.9960, 1.0084]	[0.9969, 1.0115]	[0.9986, 1.0165]
Implementation Level PCMH PR	0.8499***	0.8913**	0.9220*	0.8830**
	[0.8029, 0.8996]	[0.8404, 0.9454]	[0.8601, 0.9884]	[0.8111, 0.9613]
Implementation Trend PCMH PR	1.0058*	1.0041	1.0044	1.0074
	[1.0009, 1.0106]	[0.9991, 1.0092]	[0.9984, 1.0105]	[1.0000, 1.0149]
Post Implementation Level	1.0169	0.9013	1.0173	0.951
	[0.9077, 1.1391]	[0.7983, 1.0174]	[0.8769, 1.1803]	[0.7849, 1.1523]
Post Implementation Trend	1.0068**	1.0099**	1.0015	1.0033
	[1.0020, 1.0116]	[1.0048, 1.0151]	[0.9952, 1.0078]	[0.9952, 1.0115]
Post Implementation Level PCMH NR	0.9016	1.0024	1.1412	1.2421
	[0.7398, 1.0988]	[0.8102, 1.2402]	[0.8834, 1.4744]	[0.8995, 1.7152]
Post Implementation Trend PCMH NR	**0.9988**	**0.9953**	**0.998**	**0.9905**
	[0.9905, 1.0072]	**[0.9864, 1.0043]**	**[0.9872, 1.0089]**	**[0.9770, 1.0041]**
Post Implementation Level PCMH PR	0.8535	1.1449	0.9845	1.1148
	[0.7279, 1.0007]	[0.9625, 1.3618]	[0.7937, 1.2213]	[0.8463, 1.4685]
Post Implementation Trend PCMH PR	**1.0089****	**0.998**	**1.0015**	**0.994**
	[1.0022, 1.0157]	**[0.9907, 1.0053]**	**[0.9924, 1.0107]**	**[0.9824, 1.0057]**
Age	0.9997	1.0090***	1.0105***	1.0121***
	[0.9992, 1.0001]	[1.0086, 1.0095]	[1.0099, 1.0110]	[1.0114, 1.0128]
Female	2.0077***	1.4084***	1.2409***	1.1796***
	[1.9843, 2.0313]	[1.3911, 1.4260]	[1.2228, 1.2592]	[1.1584, 1.2012]
PCAL	1.9156***	1.6973***	1.5281***	1.4318***
	[1.9010, 1.9304]	[1.6855, 1.7092]	[1.5170, 1.5391]	[1.4206, 1.4431]
Observations (member-months)	665,906	535,117	389,405	279,752

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 5.9.10 Regression results for log(medical expenditures) for those with any health care expenditures for categories of MCC with antidepressant prescription, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	4.0058***	4.2813***	4.5554***	4.6816***
	[3.8889, 4.1227]	[4.1905, 4.3722]	[4.4744, 4.6365]	[4.5970, 4.7661]
PCMH NR	0.1496	-0.0459	-0.1139	0.0310
	[-0.3606, 0.0614]	[-0.1987, 0.1069]	[-0.2493, 0.0215]	[-0.1067, 0.1688]
PCMH PR	-0.3583***	-0.2000**	-0.3544***	-0.2933***
	[-0.5278, -0.1888]	[-0.3339, -0.0661]	[-0.4750, -0.2339]	[-0.4105, -0.1761]
Time Trend	-0.0090***	-0.0059**	-0.0044**	-0.0013
	[-0.0129, -0.0050]	[-0.0088, -0.0029]	[-0.0070, -0.0018]	[-0.0042, 0.0016]
Time Trend PCMH NR	-0.0010	-0.0078**	0.0011	0.0021
	[-0.0093, 0.0072]	[-0.0137, -0.0019]	[-0.0043, 0.0065]	[-0.0039, 0.0081]
Time Trend PCMH PR	0.0038	-0.0007	-0.0045	-0.0030
	[-0.0034, 0.0110]	[-0.0058, 0.0043]	[-0.0090, 0.0000]	[-0.0079, 0.0018]
Implementation Level	-0.0622	-0.0120	-0.0734*	-0.1180**
	[-0.1653, 0.0408]	[-0.0881, 0.0641]	[-0.1396, -0.0072]	[-0.1915, -0.0445]
Implementation Trend	0.0178**	0.0052	0.0039	0.0040
	[0.0087, 0.0269]	[-0.0015, 0.0119]	[-0.0020, 0.0097]	[-0.0024, 0.0104]
Implementation Level PCMH NR	-0.0645	0.0247	0.0391	0.0081
	[-0.2687, 0.1397]	[-0.1187, 0.1681]	[-0.0942, 0.1723]	[-0.1352, 0.1514]
Implementation Trend PCMH NR	-0.0059	0.0125*	-0.0020	-0.0053
	[-0.0231, 0.0112]	[0.0005, 0.0244]	[-0.0131, 0.0091]	[-0.0172, 0.0067]
Implementation Level PCMH PR	-0.0995	-0.1318*	0.0741	-0.0724
	[-0.2794, 0.0805]	[-0.2571, -0.0065]	[-0.0360, 0.1843]	[-0.1916, 0.0469]
Implementation Trend PCMH PR	-0.0102	0.0023	-0.0023	0.0094
	[-0.0252, 0.0048]	[-0.0083, 0.0129]	[-0.0116, 0.0070]	[-0.0007, 0.0195]
Post Implementation Level	0.6406***	0.2985*	0.3384**	0.2727*
	[0.3247, 0.9566]	[0.0595, 0.5376]	[0.1245, 0.5523]	[0.0410, 0.5044]
Post Implementation Trend	-0.0250**	-0.0100	-0.0130**	-0.0149**
	[-0.0383, -0.0117]	[-0.0201, 0.0001]	[-0.0221, -0.0040]	[-0.0247, -0.0052]
Post Implementation Level PCMH NR	-0.0996	0.0741	-0.0913	-0.0267
	[-0.4545, 0.6538]	[-0.3085, 0.4566]	[-0.4536, 0.2711]	[-0.4125, 0.3590]
Post Implementation Trend PCMH NR	**-0.0018**	**0.0084**	**-0.0012**	**-0.0016**
	[-0.0254, 0.0217]	**[-0.0080, 0.0247]**	**[-0.0166, 0.0142]**	**[-0.182, 0.0149]**
Post Implementation Level PCMH PR	-0.5874*	-0.2217	-0.4493**	-0.0802
	[-1.0467, -0.1281]	[-0.5609, 0.1176]	[-0.7575, -0.1410]	[-0.4149, 0.2545]
Post Implementation Trend PCMH PR	**0.0187**	**0.0021**	**0.0188****	**0.0061**
	[-0.0009, 0.0383]	**[-0.0123, 0.0165]**	**[0.0056, 0.0319]**	**[-0.0082, 0.0204]**
Age	0.0024**	0.0018**	0.0012**	0.0022***
	[0.0009, 0.0039]	[0.0009, 0.0028]	[0.0004, 0.0020]	[0.0013, 0.0031]
Female	0.1552***	-0.0556**	0.0018	-0.0092
	[0.1114, 0.1990]	[-0.0857, -0.0254]	[-0.0248, 0.0283]	[-0.0375, 0.0190]
PCAL	0.2956***	0.2978***	0.2334***	0.2090***
	[0.2773, 0.3139]	[0.2859, 0.3097]	[0.2242, 0.2426]	[0.2006, 0.2173]
Observations (member-months)	31,753	62,639	76,578	64,949

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 5.9.11 Regression results for log(medical expenditures) for those with any health care expenditures for categories of MCC without antidepressant prescription, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	5.2572***	4.4676***	4.6066***	4.8526***
	[4.2149, 4.2994]	[4.4212, 4.5140]	[4.5550, 4.6583]	[4.7942, 4.9111]
PCMH NR	-0.0187	0.0151	0.006	0.0026
	[-0.0977, 0.0603]	[-0.0661, 0.0962]	[-0.0841, 0.0962]	[-0.0942, 0.0995]
PCMH PR	-0.3599***	-0.3312***	-0.3177***	-0.3825***
	[-0.4253, -0.2945]	[-0.4042, -0.2582]	[-0.3995, -0.2360]	[-0.4727, -0.2923]
Time Trend	-0.0016*	-0.0024**	-0.0013	0.0004
	[-0.0029, -0.0003]	[-0.0037, -0.0011]	[-0.0027, 0.0001]	[-0.0012, 0.0020]
Time Trend PCMH NR	-0.0004	-0.0011	-0.0025	0.0012
	[-0.0031, 0.0024]	[-0.0040, 0.0017]	[-0.0056, 0.0006]	[0.0022, 0.0046]
Time Trend PCMH PR	-0.0030**	-0.0024*	0.0000	0.0007
	[-0.0052, -0.0008]	[-0.0047, -0.0001]	[-0.0025, 0.0025]	[-0.0021, 0.0036]
Implementation Level	-0.0498**	-0.0921***	-0.0665**	-0.0610**
	[-0.0852, -0.0145]	[-0.1272, -0.0571]	[-0.1035, -0.0294]	[-0.1021, -0.0200]
Implementation Trend	0.0035*	0.0045**	0.0039*	-0.0014
	[0.0004, 0.0066]	[0.0014, 0.0076]	[0.0006, 0.0072]	[-0.0051, 0.0022]
Implementation Level PCMH NR	-0.0480	-0.0946*	-0.0338	-0.1149**
	[-0.1205, 0.0245]	[-0.1673, -0.0219]	[-0.1117, 0.0441]	[-0.2004, -0.0293]
Implementation Trend PCMH NR	-0.0016	0.0035	-0.0052	-0.0015
	[-0.0077, 0.0044]	[-0.0026, 0.0096]	[-0.0117, 0.0013]	[-0.0087, 0.0057]
Implementation Level PCMH PR	-0.0491	-0.0183	-0.0683*	-0.0783*
	[-0.1082, 0.0099]	[-0.0778, 0.0412]	[-0.1319, -0.0046]	[-0.1483, -0.0082]
Implementation Trend PCMH PR	0.0003	-0.0021	0.0009	0.0011
	[-0.0046, 0.0053]	[-0.0071, 0.0030]	[-0.0045, 0.0063]	[-0.0049, 0.0071]
Post Implementation Level	0.2931***	0.0620	0.2820***	0.2136**
	[0.1797, 0.4066]	[-0.0512, 0.1751]	[0.1607, 0.4033]	[0.0765, 0.3507]
Post Implementation Trend	-0.0129***	-0.0072**	-0.0168***	-0.0150***
	[-0.0176, -0.0081]	[-0.0119, -0.0024]	[-0.0219, -0.0117]	[-0.0208, -0.0093]
Post Implementation Level PCMH NR	-0.2665**	0.1077	-0.3490**	-0.0853
	[-0.4669, -0.0662]	[-0.0953, 0.3106]	[-0.5689, -0.1292]	[-0.3280, 0.1574]
Post Implementation Trend PCMH NR	**0.0044**	**-0.0069**	**0.0111***	**-0.0071**
	[-0.0041, 0.0128]	**[-0.0155, 0.0016]**	**[0.0018, 0.0205]**	**[-0.0174, 0.0032]**
Post Implementation Level PCMH PR	-0.1004	-0.0045	-0.0598	-0.0865
	[-0.2601, 0.0592]	[-0.1686, 0.1597]	[-0.2408, 0.1211]	[-0.2892, 0.1162]
Post Implementation Trend PCMH PR	**-0.0008**	**-0.0028**	**0.0000**	**-0.0024**
	[-0.0075, 0.0059]	**[-0.0098, 0.0041]**	**[0.9969, 0.0077]**	**[-0.0110, 0.0062]**
Age	0.0053***	-0.0003	-0.0005*	-0.0019***
	[0.0048, 0.0057]	[-0.0008, 0.0001]	[-0.0010, 0.0000]	[-0.0024, -0.0013]
Female	-0.0873***	0.0316***	-0.0190**	-0.0019
	[-0.0997, -0.0748]	[0.0192, 0.0440]	[-0.0321, -0.0059]	[-0.0164, 0.0127]
PCAL	0.3012***	0.2829***	0.2579***	0.2355***
	[0.2944, 0.3079]	[0.2771, 0.2886]	[0.2527, 0.2630]	[0.2306, 0.2405]
Observations (member-months)	244,283	272,712	238,769	193,205

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 5.9.12 Regression results for predicted odds of having any ambulatory care related expenditure for categories of MCC with antidepressant prescription, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	0.2123***	0.3062***	0.4680***	0.6451***
	[0.1867, 0.2415]	[0.2752, 0.3406]	[0.4267, 0.5132]	[0.5800, 0.7176]
PCMH NR	0.7031**	1.0036	0.6624***	0.6920***
	[0.5568, 0.8879]	[0.8420, 1.1961]	[0.5679, 0.7727]	[0.5842, 0.8198]
PCMH PR	0.6005***	0.5708***	0.4799***	0.4831***
	[0.4986, 0.7232]	[0.4868, 0.6691]	[0.4189, 0.5497]	[0.4162, 0.5608]
Time Trend	1.002	0.9999	1.0052**	1.0052**
	[0.9974, 1.0065]	[0.9965, 1.0034]	[1.0022, 1.0083]	[1.0016, 1.0087]
Time Trend PCMH NR	0.9962	1.003	0.9917*	0.9981
	[0.9866, 1.0059]	[0.9961, 1.0100]	[0.9853, 0.9981]	[0.9909, 1.0054]
Time Trend PCMH PR	1.0014	1.0015	0.9957	0.9947
	[0.9930, 1.0100]	[0.9955, 1.0075]	[0.9904, 1.0010]	[0.9889, 1.0006]
Implementation Level	0.9672	0.9705	0.9176*	0.9320
	[0.8581, 1.0900]	[0.8889, 1.0596]	[0.8476, 0.9933]	[0.1309, 0.8507]
Implementation Trend	1.0087	1.006	0.9943	0.9925
	[0.9982, 1.0194]	[0.9982, 1.0138]	[0.9873, 1.0014]	[0.9846, 1.0005]
Implementation Level PCMH NR	1.0338	1.0582	1.0952	1.1485
	[0.8089, 1.3212]	[0.8925, 1.2533]	[0.9346, 1.2835]	[0.9636, 1.3689]
Implementation Trend PCMH NR	0.99	0.9864	1.0158*	0.9999
	[0.9696, 1.0108]	[0.9725, 1.0004]	[1.0024, 1.0294]	[0.9853, 1.0147]
Implementation Level PCMH PR	0.8389	0.9159	1.0563	1.0043
	[0.6785, 1.0372]	[0.7912, 1.0602]	[0.9268, 1.2039]	[0.8687, 1.1611]
Implementation Trend PCMH PR	1.0065	0.9995	1.0120*	1.0172**
	[0.9888, 1.0246]	[0.9871, 1.0121]	[1.0007, 1.0235]	[1.0046, 1.0299]
Post Implementation Level	1.6896*	1.3610*	1.1529	1.0201
	[1.1554, 2.4710]	[1.0208, 1.8145]	[0.8809, 1.5090]	[0.7538, 1.3804]
Post Implementation Trend	0.9814*	0.9891	0.9873*	0.9927
	[0.9658, 0.9972]	[0.9772, 1.0012]	[0.9761, 0.9985]	[0.9801, 1.0054]
Post Implementation Level PCMH NR	0.6546	0.6201*	1.2095	1.3469
	[0.3280, 1.3064]	[0.3858, 0.9969]	[0.7697, 1.9006]	[0.8237, 2.2022]
Post Implementation Trend PCMH NR	**1.0196**	**1.0150**	**1.0061**	**0.9918**
	[0.9902, 1.0499]	**[0.9947, 1.0358]**	**[0.9869, 1.0256]**	**[0.9712, 1.0128]**
Post Implementation Level PCMH PR	0.7931	0.7464	0.7779	1.1929
	[0.4513, 1.3938]	[0.4928, 1.1306]	[0.5278, 1.1467]	[0.7749, 1.8365]
Post Implementation Trend PCMH PR	**1.0138**	**1.0215***	**1.0284****	**1.0106**
	[0.9897, 1.0385]	**[1.0036, 1.0397]**	**[1.0116, 1.0454]**	**[0.9923, 1.0293]**
Age	1.0000	1	0.9989*	0.9978**
	[0.9982, 1.0017]	[0.9988, 1.0012]	[0.9979, 1.000]	[0.9967, 0.9990]
Female	1.4683***	1.3004****	1.2619***	1.2282***
	[1.3950, 1.5454]	[1.2553, 1.3472]	[1.2229, 1.3021]	[1.1867, 1.2711]
PCAL	1.6401***	1.5385***	1.4410***	1.3398***
	[1.6030, 1.6780]	[1.5158, 1.5615]	[1.4237, 1.4585]	[1.3245, 1.3552]
Observations (member-months)	54,383	96,631	109,337	86,958

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 5.9.13 Regression results for predicted odds of having any ambulatory care related expenditure for categories of MCC without antidepressant prescription, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	0.1076***	0.1924***	0.2794***	0.3873***
	[0.1023, 0.1132]	[0.1828, 0.2025]	[0.2639, 0.2957]	[0.3629, 0.4133]
PCMH NR	0.8898**	0.8394**	0.7781***	0.8096***
	[0.8144, 0.9723]	[0.7695, 0.9156]	[0.7060, 0.8575]	[0.7279, 0.9006]
PCMH PR	0.5641***	0.5791***	0.5472***	0.4981***
	[0.5196, 0.6124]	[0.5332, 0.6290]	[0.4994, 0.5996]	[0.4503, 0.5509]
Time Trend	0.9968***	0.9995	1.0005	1.0023*
	[0.9955, 0.9981]	[0.9982, 1.0009]	[0.9990, 1.0020]	[1.0005, 1.0040]
Time Trend PCMH NR	1.0056**	1.001	0.9988	1.001
	[1.0026, 1.0087]	[0.9979, 1.0040]	[0.9954, 1.0022]	[0.9972, 1.0048]
Time Trend PCMH PR	1.0024*	1.0012	1.0021	0.9993
	[1.0000, 1.0049]	[0.9987, 1.0036]	[0.9994, 1.0048]	[0.9962, 1.0025]
Implementation Level	1.016	0.9746	0.995	0.9432*
	[0.9796, 1.0537]	[0.9401, 1.0140]	[0.9560, 1.0357]	[0.9006, 0.9878]
Implementation Trend	1.0069***	1.0017	0.9995	0.9982
	[1.0036, 1.0101]	[0.9985, 1.0049]	[0.9960, 1.0031]	[0.9941, 1.0024]
Implementation Level PCMH NR	0.8992**	0.9313	0.9949	0.9355
	[0.8320, 0.9718]	[0.8622, 1.0059]	[0.9138, 1.0831]	[0.8502, 1.0294]
Implementation Trend PCMH NR	0.9989	1.0084	1.0018	1.003
	[0.9924, 1.0054]	[1.0019, 1.0149]	[0.9947, 1.0090]	[0.9949, 1.0112]
Implementation Level PCMH PR	0.8752***	0.9113**	0.9061**	0.955
	[0.8206, 0.9334]	[0.8558, 0.9704]	[0.8451, 0.9715]	[0.8819, 1.0342]
Implementation Trend PCMH PR	1.0070*	1.0041	1.0062*	1.0096**
	[1.0015, 1.0125]	[0.9987, 1.0095]	[1.0002, 1.0122]	[1.0027, 1.0166]
Post Implementation Level	1.2205**	1.0096	1.1052	1.0544
	[1.0834, 1.3749]	[0.8954, 1.1384]	[0.9659, 1.2646]	[0.8990, 1.2367]
Post Implementation Trend	0.9982	1.0006	0.9959	0.9930*
	[0.9933, 1.0033]	[0.9956, 1.0057]	[0.9903, 1.0016]	[0.9864, 0.9997]
Post Implementation Level PCMH NR	0.8376	0.9661	0.8702	1.0483
	[0.6730, 1.0425]	[0.7753, 1.2039]	[0.6804, 1.1129]	[0.7918, 1.3878]
Post Implementation Trend PCMH NR	**0.9981**	**1.0005**	**1.0071**	**0.9949**
	[0.9889, 1.0074]	**[0.9912, 1.0098]**	**[0.9966, 1.0176]**	**[0.9831, 1.0068]**
Post Implementation Level PCMH PR	0.7436**	0.9851	0.8865	0.918
	[0.6256, 0.8838]	[0.8254, 1.1757]	[0.7244, 1.0851]	[0.7242, 1.1636]
Post Implementation Trend PCMH PR	**1.0242*** **	**1.0112** **	**1.0130** **	**1.0159** **
	[1.0168, 1.0317]	**[1.0037, 1.0188]**	**[1.0043, 1.0216]**	**[1.0058, 1.0262]**
Age	1.0043***	1.0019***	1.0003	0.9995
	[1.0038, 1.0048]	[1.0015, 1.0024]	[0.9998, 1.0009]	[0.9989, 1.0001]
Female	1.4573***	1.3321***	1.3051***	1.3224***
	[1.4386, 1.4762]	[1.3150, 1.3495]	[1.2866, 1.3239]	[1.3009, 1.3442]
PCAL	1.9473***	1.6649***	1.5112***	1.4126***
	[1.9327, 1.9621]	[1.6541, 1.6757]	[1.5018, 1.5206]	[1.4038, 1.4215]
Observations (member-months)	751,571	596,477	430,851	307,219

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 5.9.14 Regression results for log(outpatient expenditures) for those with any ambulatory expenditures for categories of MCC with antidepressant prescription, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	4.5759***	4.5403***	4.6359***	4.6843***
	[4.4713, 4.6804]	[4.4654, 4.6152]	[4.5678, 4.7040]	[4.6083, 4.7603]
PCMH NR	-0.2379*	-0.0972	-0.0095	0.2002**
	[-0.4237, -0.0522]	[-0.2234, 0.0290]	[-0.1270, 0.1080]	[0.0717, 0.3286]
PCMH PR	-0.2763**	-0.2519***	-0.2227***	-0.2295***
	[-0.4254, -0.1271]	[-0.3585, -0.1452]	[-0.3203, -0.1251]	[-0.3348, -0.1241]
Time Trend	0.0029	-0.0014	-0.0009	0.0013
	[-0.0009, 0.0068]	[-0.0041, 0.0013]	[-0.0033, 0.0015]	[-0.0014, 0.0040]
Time Trend PCMH NR	-0.0036	-0.0053	0.0034	0.0101**
	[-0.0121, 0.0049]	[-0.0111, 0.0005]	[-0.0020, 0.0087]	[0.0040, 0.0162]
Time Trend PCMH PR	-0.0007	-0.0009	0.0001	-0.0022
	[-0.0082, 0.0067]	[-0.0060, 0.0042]	[-0.0045, 0.0046]	[-0.0071, 0.0027]
Implementation Level	0.0316	0.0396	0.0397	0.0427
	[-0.0684, 0.1316]	[-0.0317, 0.1110]	[-0.0221, 0.1016]	[-0.0261, 0.1115]
Implementation Trend	0.0019	0.0080*	0.0034	-0.0016
	[-0.0069, 0.0107]	[0.0018, 0.0143]	[-0.0022, 0.0089]	[-0.0076, 0.0044]
Implementation Level PCMH NR	-0.0325	0.0115	-0.1077	-0.1813*
	[-0.2439, 0.1790]	[-0.1294, 0.1525]	[-0.2389, 0.0236]	[-0.3264, -0.0362]
Implementation Trend PCMH NR	0.0078	0.0039	0.0044	0.0001
	[-0.0100, 0.0257]	[-0.0079, 0.0157]	[-0.0065, 0.0153]	[-0.0120, 0.0121]
Implementation Level PCMH PR	-0.1741	-0.0262	0.0394	-0.1036
	[-0.3599, 0.0117]	[-0.1520, 0.0995]	[-0.0706, 0.1495]	[-0.2241, 0.0168]
Implementation Trend PCMH PR	-0.0012	-0.0086	-0.0135**	0.0030
	[-0.0167, 0.0143]	[-0.0194, 0.0021]	[-0.0228, -0.0041]	[-0.0072, 0.0132]
Post Implementation Level	0.2603	0.2302*	-0.0048	0.1797
	[-0.0523, 0.5730]	[0.0051, 0.4552]	[-0.2108, 0.2011]	[-0.0431, 0.4025]
Post Implementation Trend	-0.0089	-0.0010	0.0050	-0.0068
	[-0.0221, 0.0044]	[-0.0106, 0.0085]	[-0.0037, 0.0137]	[-0.0162, 0.0026]
Post Implementation Level PCMH NR	0.6759*	0.0660	0.3988*	0.2542
	[0.0882, 1.2635]	[-0.3185, 0.4505]	[0.0338, 0.7637]	[-0.1379, 0.6463]
Post Implementation Trend PCMH NR	**-0.0243**	**0.0046**	**-0.0207****	**-0.0241****
	[-0.0492, 0.0007]	**[-0.0118, 0.0210]**	**[-0.0363, -0.0052]**	**[-0.0408, -0.0073]**
Post Implementation Level PCMH PR	-0.2292	-0.1203	0.2304	0.4515*
	[-0.7063, 0.2479]	[-0.4587, 0.2182]	[-0.0817, 0.5425]	[0.1138, 0.7892]
Post Implementation Trend PCMH PR	**-0.0061**	**-0.0070**	**-0.0180****	**-0.0227****
	[-0.0265, 0.0143]	**[-0.0214, 0.0074]**	**[-0.0313, -0.0047]**	**[-0.0371, -0.0084]**
Age	0.0063***	0.0057***	0.0047***	0.0032***
	[0.0048, 0.0078]	[0.0048, 0.0067]	[0.0038, 0.0055]	[0.0023, 0.0041]
Female	0.0433	-0.0238	0.0033	0.0050
	[-0.0021, 0.0886]	[-0.0541, 0.0065]	[-0.0232, 0.0298]	[-0.0233, 0.0333]
PCAL	0.1461***	0.1582***	0.1268***	0.1385***
	[0.1284, 0.1638]	[0.1470, 0.1693]	[0.1182, 0.1355]	[0.1305, 0.1464]
Observations (member-months)	16,711	36,019	47,018	41,852

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 5.9.15 Regression results for log(outpatient expenditures) for those with any ambulatory expenditures for categories of MCC without antidepressant prescription, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	4.5700***	6.6614***	4.8024***	4.9785***
	[4.5295, 4.6105]	[4.6198, 4.7030]	[4.7574, 4.8474]	[4.9259, 5.0312]
PCMH NR	0.0279	0.0263	-0.0188	0.0188
	[-0.0492, 0.1050]	[-0.0499, 0.1025]	[-0.1023, 0.0646]	[-0.0728, 0.1104]
PCMH PR	-0.3668***	-0.2840***	-0.3029***	-0.3527***
	[-0.4322, -0.3013]	[-0.3501, -0.2180]	[-0.3725, -0.2333]	[-0.4339, -0.2715]
Time Trend	0.0005	-0.0002	-0.0002	0.0010
	[-0.0007, 0.0017]	[-0.0014, 0.0010]	[-0.0016, 0.0011]	[-0.0005, 0.0026]
Time Trend PCMH NR	-0.0003	-0.0011	-0.0006	0.0000
	[-0.0032, 0.0026]	[-0.0040, 0.0018]	[-0.0038, 0.0027]	[-0.0036, 0.0035]
Time Trend PCMH PR	-0.0025*	0.0001	-0.0015	-0.0007
	[-0.0048, -0.0001]	[-0.0022, 0.0025]	[-0.0042, 0.0011]	[-0.0037, 0.0023]
Implementation Level	0.0100	0.0115	0.0225	0.0079
	[-0.0242, 0.0442]	[-0.0217, 0.0447]	[-0.0136, 0.0586]	[-0.0323, 0.0482]
Implementation Trend	0.0060***	0.0060***	0.0051**	0.0033
	[0.0029, 0.0090]	[0.0031, 0.0090]	[0.0019, 0.0083]	[-0.0002, 0.0069]
Implementation Level PCMH NR	-0.0421	-0.1024**	-0.0742	-0.1121*
	[-0.1173, 0.0331]	[-0.1764, -0.0283]	[-0.1556, 0.0071]	[-0.2005, -0.0236]
Implementation Trend PCMH NR	0.0013	0.0033	0.0000	0.0000
	[-0.0049, 0.0076]	[-0.0029, 0.0095]	[-0.0068, 0.0068]	[-0.0074, 0.0075]
Implementation Level PCMH PR	-0.0286	-0.0428	-0.1115**	-0.0807*
	[-0.0914, 0.0342]	[-0.1035, 0.0180]	[-0.1784, -0.0445]	[-0.1550, -0.0064]
Implementation Trend PCMH PR	-0.0033	-0.0057*	0.0010	-0.0037
	[-0.0086, 0.0020]	[-0.0109, -0.0006]	[-0.0047, 0.0067]	[-0.0100, 0.0027]
Post Implementation Level	0.3240***	0.1607**	0.2843***	0.1760*
	[0.2122, 0.4358]	[0.0512, 0.2702]	[0.1654, 0.4032]	[0.0395, 0.3124]
Post Implementation Trend	-0.0076**	-0.0010	-0.0064*	-0.0052
	[-0.0123, -0.0029]	[-0.0056, 0.0036]	[-0.0114, -0.0014]	[-0.0109, 0.0006]
Post Implementation Level PCMH NR	-0.0188	0.4157**	0.1052	0.1552
	[-0.2291, 0.1915]	[0.2089, 0.6225]	[-0.1250, 0.3353]	[-0.0965, 0.4068]
Post Implementation Trend PCMH NR	**-0.0012**	**-0.0171****	**-0.0063**	**-0.0100**
	[-0.0101, 0.0077]	**[-0.0258, -0.0083]**	**[-0.0161, 0.0034]**	**[-0.0207, 0.0007]**
Post Implementation Level PCMH PR	0.2176**	0.1218	0.1143	0.1206
	[0.0531, 0.3822]	[-0.0436, 0.2871]	[-0.0717, 0.3002]	[-0.0901, 0.3312]
Post Implementation Trend PCMH PR	**-0.0200*****	**-0.0182*****	**-0.0131****	**-0.0126****
	[-0.0269, -0.0130]	**[-0.0252, -0.0112]**	**[-0.0209, -0.0052]**	**[-0.0215, -0.0037]**
Age	0.0059***	0.0038***	0.0012***	-0.0013***
	[0.0054, 0.0063]	[0.0033, 0.0042]	[0.0008, 0.0017]	[-0.0019, -0.0008]
Female	-0.0041	0.0213**	0.0168*	0.0450***
	[-0.0166, 0.0084]	[0.0089, 0.0337]	[0.0034, 0.0303]	[0.0299, 0.0600]
PCAL	0.1737***	0.1642***	0.1473***	0.1439***
	[0.1671, 0.1803]	[0.1587, 0.1696]	[0.1424, 0.1522]	[0.1391, 0.1486]
Observations (member-months)	162,796	177,488	154,039	126,896

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 5.9.16 Regression results for predicted odds of having any prescription expenditure for categories of MCC with antidepressant prescription, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	0.3276***	0.3145***	0.2915***	0.2234***
	[0.2762, 0.3887]	[0.2744, 0.3604]	[0.2551, 0.3332]	[0.1885, 0.2648]
PCMH NR	1.0735	1.0973	1.0735	2.1237***
	[0.7992, 1.4418]	[0.8978, 1.3412]	[0.8963, 1.2859]	[1.7275, 2.6107]
PCMH PR	1.0829	0.9219	0.7484**	0.9184
	[0.8360, 1.4026]	[0.7471, 1.1376]	[0.6095, 0.9189]	[0.7154, 1.1789]
Time Trend	1.0069**	0.9984	0.9976	1.0031
	[1.0024, 1.0115]	[0.9950, 1.0019]	[0.9944, 1.0008]	[0.9992, 1.0069]
Time Trend PCMH NR	0.9969	1.0017	1.0045	1.0082*
	[0.9879, 1.0059]	[0.9949, 1.0086]	[0.9979, 1.0111]	[1.0005, 1.0158]
Time Trend PCMH PR	0.9943	0.9986	1.005	0.996
	[0.9865, 1.0022]	[0.9930, 1.0043]	[0.9996, 1.0103]	[0.9900, 1.0022]
Implementation Level	0.897	0.7761***	0.8311***	0.8409**
	[0.7979, 1.0085]	[0.7106, 0.8476]	[0.7657, 0.9021]	[0.7631, 0.9267]
Implementation Trend	1.0047	1.0278***	1.0334***	1.0240***
	[0.9944, 1.0152]	[1.0198, 1.0358]	[1.0258, 1.0410]	[1.0152, 1.0329]
Implementation Level PCMH NR	0.8588	0.9413	0.8947	0.7742**
	[0.6848, 1.0771]	[0.7968, 1.1121]	[0.7616, 1.0510]	[0.6443, 0.9304]
Implementation Trend PCMH NR	1.0125	1.0112	1.0045	1.0016
	[0.9933, 1.0321]	[0.9972, 1.0255]	[0.9909, 1.0183]	[0.9862, 1.0172]
Implementation Level PCMH PR	0.7979*	1.054	0.9485	1.0055
	[0.6554, 0.9714]	[0.9166, 1.2119]	[0.8323, 1.0810]	[0.8646, 1.1694]
Implementation Trend PCMH PR	1.0278**	1.0073	1.0032	1.0129
	[1.0110, 1.0449]	[0.9954, 1.0194]	[0.9919, 1.0146]	[0.9998, 1.0263]
Post Implementation Level	1.204	1.2911	1.2869	1.4705*
	[0.8223, 1.7629]	[0.9610, 1.7347]	[0.9555, 1.7331]	[1.0308, 2.0976]
Post Implementation Trend	1.006	1.0079	1.0208**	1.0125
	[0.9899, 1.0223]	[0.9954, 1.0206]	[1.0080, 1.0337]	[0.9974, 1.0278]
Post Implementation Level PCMH NR	0.6792	1.4406	1.6766*	1.4628
	[0.3549, 1.2998]	[0.8841, 2.3475]	[1.0223, 2.7497]	[0.8312, 2.5741]
Post Implementation Trend PCMH NR	**1.0126**	**0.998**	**0.9795**	**0.9705***
	[0.9850, 1.0409]	**[0.9775, 1.0191]**	**[0.9592, 1.0003]**	**[0.9474, 0.9941]**
Post Implementation Level PCMH PR	0.9464	1.2744	1.6350*	1.3291
	[0.5508, 1.6262]	[0.8415, 1.9302]	[1.0789, 2.4779]	[0.8441, 2.2959]
Post Implementation Trend PCMH PR	**1.0039**	**1.0034**	**0.9770****	**0.996**
	[0.9810, 1.0274]	**[0.9858, 1.0212]**	**[0.9598, 0.9944]**	**[0.9751, 1.0174]**
Age	1.0082***	1.0185***	1.0233***	1.0290***
	[1.0065, 1.0098]	[1.0173, 1.0197]	[1.0222, 1.0244]	[1.0277, 1.0303]
Female	1.4845***	1.3218***	1.2112***	1.1530***
	[1.4159, 1.5565]	[1.2778, 1.3674]	[1.1731, 1.2505]	[1.1112, 1.1963]
PCAL	1.3150***	1.2094***	1.1914***	1.1614***
	[1.2860, 1.3448]	[1.1921, 1.2271]	[1.1770, 1.2060]	[1.1476, 1.1754]
Observations (member-months)	53,775	95,519	108,097	85,806

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 5.9.17 Regression results for predicted odds of having any prescription expenditure for categories of MCC without antidepressant prescription, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	0.1296***	0.1826***	0.2925***	0.4071***
	[0.1209, 0.1389]	[0.1703, 0.1957]	[0.2709, 0.3158]	[0.3714, 0.4461]
PCMH NR	1.1006	0.9879	1.1245*	0.9897
	[0.9910, 1.2223]	[0.8974, 1.0874]	[1.0103, 1.2517]	[0.8783, 1.1152]
PCMH PR	1.2295**	0.9687	0.8847	0.9109
	[1.1094, 1.3627]	[0.8700, 1.0785]	[0.7814, 1.0017]	[0.7908, 1.0493]
Time Trend	0.9965***	0.9989	1.001	1.001
	[0.9951, 0.9979]	[0.9975, 1.0003]	[0.9995, 1.0026]	[0.9991, 1.0028]
Time Trend PCMH NR	1.0033*	1.0016	0.9999	1.003
	[1.0003, 1.0063]	[0.9986, 1.0045]	[0.9965, 1.0032]	[0.9992, 1.0069]
Time Trend PCMH PR	1.0056***	1.0062***	1.0092***	1.0118***
	[1.0032, 1.0079]	[1.0039, 1.0087]	[1.0065, 1.0119]	[1.0086, 1.0150]
Implementation Level	0.9181***	0.9284**	0.8801***	0.9242**
	[0.8826, 0.9549]	[0.8945, 0.9636]	[0.8447, 0.9171]	[0.8807, 0.9699]
Implementation Trend	1.0108***	1.0109***	1.0078***	1.0024
	[1.0073, 1.0143]	[1.0076, 1.0142]	[1.0041, 1.0115]	[0.9980, 1.0067]
Implementation Level PCMH NR	0.9368	0.9292	0.9985	0.9072
	[0.8659, 1.0135]	[0.8615, 1.0023]	[0.9178, 1.0864]	[0.8228, 1.0001]
Implementation Trend PCMH NR	0.9996	0.9985	1.0036	1.0072
	[0.9931, 1.0062]	[0.9922, 1.0049]	[0.9965, 1.0108]	[0.9989, 1.0156]
Implementation Level PCMH PR	0.8853**	0.8890**	0.9548	0.8743**
	[0.8311, 0.9431]	[0.8363, 0.9451]	[0.8919, 1.0222]	[0.8076, 0.9465]
Implementation Trend PCMH PR	1.003	1.0014	0.9978	1.0012
	[0.9977, 1.0084]	[0.9962, 1.0066]	[0.9920, 1.0037]	[0.9944, 1.0081]
Post Implementation Level	0.9274	0.8862	1.0228	0.9272
	[0.8186, 1.0506]	[0.7848, 1.0007]	[0.8902, 1.1752]	[0.7825, 1.0987]
Post Implementation Trend	1.0129***	1.0141***	1.0055	1.0121**
	[1.0077, 1.0183]	[1.0089, 1.0193]	[0.9997, 1.0114]	[1.0049, 1.0194]
Post Implementation Level PCMH NR	1.0075	1.1281	1.081	1.1764
	[0.8122, 1.2497]	[0.9108, 1.3972]	[0.8463, 1.3808]	[0.8775, 1.5770]
Post Implementation Trend PCMH NR	**0.9977**	**0.9943**	**0.9989**	**0.9918**
	[0.9886, 1.0068]	**[0.9853, 1.0034]**	**[0.9886, 1.0093]**	**[0.9796, 1.0042]**
Post Implementation Level PCMH PR	1.0945	1.2474*	1.004	1.2785
	[0.9197, 1.3027]	[1.0477, 1.4850]	[0.8193, 1.2305]	[0.9996, 1.6352]
Post Implementation Trend PCMH PR	**0.9903****	**0.9866****	**0.9907***	**0.9765*****
	[0.9830, 0.9976]	**[0.9793, 0.9939]**	**[0.9822, 0.9993]**	**[0.9663, 0.9867]**
Age	0.9957***	1.0106***	1.0131***	1.0140***
	[0.9953, 0.9962]	[1.0101, 1.0111]	[1.0126, 1.0137]	[1.0134, 1.0146]
Female	2.1653***	1.3441***	1.1289***	1.0324**
	[2.1367, 2.1942]	[1.3270, 1.3614]	[1.1129, 1.1451]	[1.0153, 1.0499]
PCAL	1.5025***	1.3877***	1.2558***	1.1967***
	[1.4912, 1.5138]	[1.3788, 1.3966]	[1.2481, 1.2635]	[1.1892, 1.2043]
Observations (member-months)	665,906	535,117	389,405	279,752

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 5.9.18 Regression results for log(drug expenditures) for those with any drug expenditures for categories of MCC with antidepressant prescription, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	3.2793***	3.5512***	3.8527***	3.9401***
	[3.1484, 3.4101]	[3.4374, 3.6650]	[3.7401, 3.9652]	[3.8258, 4.0543]
PCMH NR	0.0682	0.0394	-0.0609	0.0572
	[-0.1654, 0.3018]	[-0.1505, 0.2292]	[-0.2345, 0.1128]	[-0.1294, 0.2439]
PCMH PR	-0.1003	0.0664	-0.1671	-0.0857
	[-0.2951, 0.0944]	[-0.1090, 0.2419]	[-0.3424, 0.0083]	[-0.2500, 0.0785]
Time Trend	-0.0190***	-0.0108***	-0.0103***	-0.0080***
	[-0.0229, -0.0151]	[-0.0139, -0.0076]	[-0.0132, -0.0075]	[-0.0113, -0.0048]
Time Trend PCMH NR	0.0011	-0.0106**	0.0047	0.0002
	[-0.0067, 0.0089]	[-0.0166, -0.0045]	[-0.0011, 0.0106]	[-0.0064, 0.0068]
Time Trend PCMH PR	0.0057	-0.0008	-0.0004	-0.0004
	[-0.0014, 0.0127]	[-0.0061, 0.0045]	[-0.0053, 0.0045]	[-0.0058, 0.0050]
Implementation Level	-0.0907	-0.0989*	-0.1368**	-0.2259***
	[-0.1910, 0.0097]	[-0.1798, -0.0179]	[-0.2095, -0.0640]	[-0.3089, -0.1430]
Implementation Trend	0.0198***	0.0054	0.0095**	0.0092*
	[0.0110, 0.0286]	[-0.0016, 0.0124]	[0.0032, 0.0158]	[0.0021, 0.0163]
Implementation Level PCMH NR	-0.0967	0.0025	-0.0130	0.0684
	[-0.2914, 0.0979]	[-0.1472, 0.1522]	[-0.1571, 0.1312]	[-0.0900, 0.2267]
Implementation Trend PCMH NR	0.0055	0.0282***	-0.0081	-0.0046
	[-0.0107, 0.0218]	[0.0159, 0.0405]	[-0.0200, 0.0037]	[-0.0177, 0.0084]
Implementation Level PCMH PR	0.0443	-0.1101	0.0223	0.0497
	[-0.1306, 0.2192]	[-0.2418, 0.0217]	[-0.0979, 0.1425]	[-0.0824, 0.1818]
Implementation Trend PCMH PR	-0.0153*	0.0077	-0.0033	0.0026
	[-0.0298, -0.0008]	[-0.0032, 0.0187]	[-0.0133, 0.0068]	[-0.0084, 0.0136]
Post Implementation Level	0.3408*	0.2205	0.4253**	0.1033
	[0.0472, 0.6345]	[-0.0202, 0.4612]	[0.2084, 0.6422]	[-0.1386, 0.3452]
Post Implementation Trend	-0.0095	-0.0102	-0.0151**	-0.0102
	[-0.0219, 0.0029]	[-0.0203, 0.0000]	[-0.0243, -0.0059]	[-0.0204, 0.0001]
Post Implementation Level PCMH NR	0.1737	0.3055	-0.5055**	-0.0027
	[-0.3345, 0.6818]	[-0.0742, 0.6852]	[-0.8717, -0.1393]	[-0.4028, 0.3974]
Post Implementation Trend PCMH NR	**0.0001**	**0.0088**	**0.0108**	**0.0052**
	[-0.0215, 0.0217]	**[-0.0075, 0.0250]**	**[-0.0049, 0.0265]**	**[-0.0120, 0.0223]**
Post Implementation Level PCMH PR	-0.3479	-0.3957*	-0.5614**	-0.2659
	[-0.7774, 0.0817]	[-0.7352, -0.0562]	[-0.8757, -0.2470]	[-0.6159, 0.0840]
Post Implementation Trend PCMH PR	**0.0162**	**0.0144**	**0.0177****	**0.0146**
	[-0.0021, 0.0346]	**[-0.0001, 0.0289]**	**[0.0043, 0.0311]**	**[-0.0003, 0.0296]**
Age	0.0039***	0.0048***	0.0047***	0.0069***
	[0.0025, 0.0053]	[0.0038, 0.0059]	[0.0038, 0.0056]	[0.0059, 0.0079]
Female	0.0414	-0.1051***	-0.0360*	-0.1224***
	[-0.0013, 0.0840]	[-0.1365, -0.0737]	[-0.0646, -0.0074]	[-0.1535, -0.0913]
PCAL	0.1406***	0.1681***	0.1074***	0.1235***
	[0.1228, 0.1584]	[0.1553, 0.1809]	[0.0974, 0.1173]	[0.1143, 0.1327]
Observations (member-months)	25,651	50,226	61,150	52,125

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 5.9.19 Regression results for log(drug expenditures) for those with any drug expenditures for categories of MCC without antidepressant prescription, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	3.5645***	3.7537***	3.9224***	4.1603***
	[3.5032, 3.6258]	[3.6868, 3.8206]	[3.8508, 3.9939]	[4.0801, 4.2405]
PCMH NR	-0.1057	0.006	0.0248	0.0384
	[-0.2125, 0.0012]	[-0.0971, 0.1090]	[-0.0897, 0.1392]	[-0.0809, 0.1578]
PCMH PR	0.0293	-0.0103	-0.0377	-0.0979
	[-0.0640, 0.1226]	[-0.1153, 0.0946]	[-0.1549, 0.0794]	[-0.2228, 0.0271]
Time Trend	-0.0054***	-0.0069***	-0.0042***	-0.0028**
	[-0.0068, -0.0039]	[-0.0083, -0.0054]	[-0.0057, -0.0027]	[-0.0045, -0.0010]
Time Trend PCMH NR	-0.0006	0.0014	-0.0027	0.0043*
	[-0.0036, 0.0024]	[-0.0017, 0.0045]	[-0.0061, 0.0006]	[0.0006, 0.0080]
Time Trend PCMH PR	-0.0032*	-0.0012	0.0009	0.0046**
	[-0.0056, -0.0007]	[-0.0038, 0.0013]	[-0.0018, 0.0037]	[0.0015, 0.0077]
Implementation Level	-0.1542***	-0.1584***	-0.1027***	-0.0974***
	[-0.1945, -0.1139]	[-0.1975, -0.1192]	[-0.1437, -0.0617]	[-0.1428, -0.0521]
Implementation Trend	0.0011	0.0054**	0.0017	-0.0037
	[-0.0024, 0.0046]	[0.0020, 0.0089]	[-0.0019, 0.0053]	[-0.0078, 0.0003]
Implementation Level PCMH NR	0.0125	-0.0657	-0.0337	-0.1376**
	[-0.0673, 0.0924]	[-0.1454, 0.0140]	[-0.1187, 0.0513]	[-0.2304, -0.0447]
Implementation Trend PCMH NR	-0.0034	-0.0032	-0.0011	0.0002
	[-0.0101, 0.0032]	[-0.0098, 0.0035]	[-0.0082, 0.0060]	[-0.0076, 0.0080]
Implementation Level PCMH PR	0.0220	0.0179	-0.0101	-0.0737
	[-0.0430, 0.0871]	[-0.0477, 0.0834]	[-0.0796, 0.0592]	[-0.1498, 0.0024]
Implementation Trend PCMH PR	0.0024	-0.0027	0.0012	0.0009
	[-0.0031, 0.0078]	[-0.0082, 0.0028]	[-0.0047, 0.0071]	[-0.0056, 0.0074]
Post Implementation Level	-0.0718	-0.1005	0.0363	-0.0057
	[-0.1962, 0.0527]	[-0.2234, 0.0224]	[-0.0937, 0.1663]	[-0.1517, 0.1403]
Post Implementation Trend	-0.0044	-0.0041	-0.0107**	-0.0093**
	[-0.0096, 0.0008]	[-0.0093, 0.0010]	[-0.0162, -0.0052]	[-0.0155, -0.0032]
Post Implementation Level PCMH NR	-0.1519	-0.0684	-0.24990*	-0.0610
	[-0.3669, 0.0631]	[-0.2855, 0.1487]	[-0.4829, -0.0150]	[-0.3174, 0.1954]
Post Implementation Trend PCMH NR	**0.0041**	**-0.0015**	**0.0082**	**-0.0090**
	[-0.0050, 0.0132]	**[-0.0107, 0.0077]**	**[-0.0017, 0.0181]**	**[-0.0199, 0.0019]**
Post Implementation Level PCMH PR	0.0482	-0.0310	0.1657	-0.0231
	[-0.1260, 0.2225]	[-0.2088, 0.1467]	[-0.0282, 0.3596]	[-0.2386, 0.1923]
Post Implementation Trend PCMH PR	**0.0004**	**0.0026**	**-0.0065**	**-0.0062**
	[-0.0070, 0.0077]	**[-0.0049, 0.0101]**	**[-0.0148, 0.0017]**	**[-0.0154, 0.0029]**
Age	0.0034***	0.0016***	0.0029***	0.0032***
	[0.0029, 0.0039]	[0.0011, 0.0021]	[0.0024, 0.0035]	[0.0026, 0.0038]
Female	-0.0326***	-0.0581***	-0.1523***	-0.1473***
	[-0.0468, -0.0185]	[-0.0719, -0.0443]	[-0.1666, -0.1380]	[-0.1631, -0.1315]
PCAL	0.1270***	0.1397***	0.1332***	0.1171***
	[0.1194, 0.1345]	[0.1333, 0.1461]	[0.1275, 0.1389]	[0.1116, 0.1225]
Observations (member-months)	160,098	195,453	180,759	151,205

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 5.9.20 Regression results for predicted odds of having any inpatient related expenditure for categories of MCC with antidepressant prescription, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	0.0072***	0.0121***	0.0229***	0.0474***
	[0.0033, 0.0159]	[0.0071, 0.0205]	[0.0146, 0.0358]	[0.0311, 0.0720]
PCMH NR	0.4126	0.1140***	0.2014***	0.1642***
	[0.1292, 1.3183]	[0.0426, 0.3053]	[0.0946, 0.4288]	[0.0756, 0.3564]
PCMH PR	0.997	0.2602**	0.3904**	0.3031***
	[0.4441, 2.2387]	[0.1308, 0.5176]	[0.2175, 0.7008]	[0.1706, 0.5383]
Time Trend	1.0368*	1.0515***	1.0570***	1.0647***
	[1.0044, 1.0703]	[1.0283, 1.0751]	[1.0361, 1.0783]	[1.0445, 1.0852]
Time Trend PCMH NR	0.9645	0.917**	0.9320**	0.9397**
	[0.9034, 1.0298]	[0.8720, 0.9661]	[0.8943, 0.9714]	[0.8988, 0.9825]
Time Trend PCMH PR	1.0081	0.9330**	0.9603*	0.9667
	[0.9559, 1.0632]	[0.8978, 0.9696]	[0.9267, 0.9951]	[0.9328, 1.0018]
Implementation Level	0.4444	0.7316	0.8467	0.5360**
	[0.1959, 1.0085]	[0.4437, 1.2064]	[0.5558, 1.2898]	[0.3486, 0.8239]
Implementation Trend	1.0201	0.9445*	0.9274**	0.9424**
	[0.9518, 1.0933]	[0.9017, 0.9894]	[0.8905, 0.9657]	[0.9054, 0.9809]
Implementation Level PCMH NR	2.7631	2.5714	1.7395	1.7522
	[0.5735, 13.3113]	[0.7800, 8.4777]	[0.6807, 4.4458]	[0.6511, 4.7154]
Implementation Trend PCMH NR	0.9718	1.1058*	1.0475	1.0484
	[0.8529, 1.1071]	[1.0098, 1.2108]	[0.9676, 1.1341]	[0.9667, 1.1368]
Implementation Level PCMH PR	1.2405	1.716	1.332	1.1548
	[0.3554, 4.3297]	[0.7005, 4.2036]	[0.6210, 2.8571]	[0.5269, 2.5307]
Implementation Trend PCMH PR	0.9165	1.0898*	1.0453	1.0689
	[0.8200, 1.0244]	[1.0100, 1.1758]	[0.9766, 1.1189]	[0.9993, 1.1433]
Post Implementation Level	0.0523	3.526	3.0486	0.2567
	[0.0027, 1.0157]	[0.8048, 15.4471]	[0.6233, 14.9122]	[0.0488, 1.3505]
Post Implementation Trend	1.0661	0.8977**	0.8804**	0.9594
	[0.9468, 1.2005]	[0.8410, 0.9582]	[0.8211, 0.9440]	[0.8951, 1.0284]
Post Implementation Level PCMH NR	165.75	3.0206	0.3754	1.869
	[0.9700, 28324.31]	[0.1805, 50.5483]	[0.0277, 5.0955]	[0.1535, 22.7536]
Post Implementation Trend PCMH NR	**0.8467**	**1.0733**	**1.1481***	**1.0849**
	[0.6781, 1.0573]	**[0.9481, 1.2151]**	**[1.0256, 1.2852]**	**[0.9741, 1.2063]**
Post Implementation Level PCMH PR	6.4475	0.2037	0.2549	15.0784*
	[0.1195, 347.88]	[0.0160, 2.5904]	[0.0235, 2.7630]	[1.5504, 146.6495]
Post Implementation Trend PCMH PR	**0.9119**	**1.1613****	**1.1265***	**0.9555**
	[0.7734, 1.0752]	**[1.0418, 1.2945]**	**[1.0157, 1.2493]**	**[0.8658, 1.0546]**
Age	0.9490***	0.9551***	0.9563***	0.9647***
	[0.9365, 0.9617]	[0.9474, 0.9629]	[0.9498, 0.9628]	[0.9589, 0.9705]
Female	4.4616***	2.9622***	1.9985***	1.2594*
	[2.7502, 7.2380]	[2.1907, 4.0053]	[1.5835, 2.5223]	[1.0410, 1.5235]
PCAL	1.5453***	1.5421***	1.4059***	1.3126***
	[1.4070, 1.6973]	[1.4546, 1.6349]	[1.3408, 1.4742]	[1.2654, 1.3616]
Observations (member-months)	54,383	96,631	109,337	86,958

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 5.9.21 Regression results for log(inpatient expenditures) for those with any inpatient expenditures for categories of MCC with antidepressant prescription, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	5.8573***	6.9436***	6.4264***	6.6124***
	[4.2048, 7.5098]	[6.0248, 7.8624]	[5.6002, 7.2527]	[5.8856, 7.3393]
PCMH NR	2.1835	1.4492	2.3991**	1.9768**
	[-0.1160, 4.4830]	[-0.0893, 2.9876]	[1.0971, 3.7011]	[0.8799, 3.0736]
PCMH PR	1.1477	2.1338***	0.9801	1.2473**
	[-0.2527, 2.5481]	[1.1346, 3.1329]	[-0.0425, 2.0027]	[0.3376, 2.1569]
Time Trend	-0.056	-0.0624**	-0.0728**	-0.0654**
	[-0.1199, 0.0079]	[-0.0972, -0.0277]	[-0.1106, -0.0350]	[-0.0981, -0.0326]
Time Trend PCMH NR	0.0783	0.0229	0.0826*	0.0624*
	[-0.0568, 0.2134]	[-0.0604, 0.1061]	[0.0073, 0.1578]	[0.0021, 0.1228]
Time Trend PCMH PR	0.0402	0.0785**	0.0183	0.0298
	[-0.0531, 0.1336]	[0.0229, 0.1341]	[-0.0454, 0.0820]	[-0.0248, 0.0844]
Implementation Level	-0.8041	0.5148	0.6534	1.0518**
	[-2.2598, 0.6516]	[-0.2664, 1.2959]	[-0.1063, 1.4131]	[0.3352, 1.7683]
Implementation Trend	0.1733**	0.0614	0.0657	0.0236
	[0.0428, 0.3038]	[-0.0131, 0.1350]	[-0.0052, 0.1366]	[-0.0421, 0.0894]
Implementation Level PCMH NR	-0.5089	1.1311	-0.5290	-1.0077
	[-3.4877, 2.4700]	[-0.7129, 2.9841]	[-2.1822, 1.1242]	[-2.4316, 0.4162]
Implementation Trend PCMH NR	-0.1171	-0.1477	-0.0897	-0.0539
	[-0.3403, 0.1061]	[-0.2955, 0.0002]	[-0.2297, 0.0503]	[-0.1665, 0.0586]
Implementation Level PCMH PR	0.2907	-0.6745	0.3545	-0.5800
	[-1.8011, 2.3825]	[-2.0568, 0.7078]	[-1.0303, 1.7394]	[-1.8144, 0.6544]
Implementation Trend PCMH PR	-0.0615	-0.1147	-0.0677	0.0148
	[-0.2547, 0.1317]	[-0.2340, 0.0045]	[-0.1893, 0.0539]	[-0.0908, 0.1204]
Post Implementation Level	1.3544	-3.3491**	-0.8573	1.8039
	[-3.6036, 6.3125]	[-5.7283, -0.9700]	[-3.4104, 1.6985]	[-0.6124, 4.2202]
Post Implementation Trend	-0.0084	0.2096**	0.1300*	0.0012
	[-0.2104, 0.1936]	[0.1055, 0.3136]	[0.0170, 0.2431]	[-0.0998, 0.1023]
Post Implementation Level PCMH NR	3.8323	4.4730*	1.3710	1.4955
	[-3.8668, 11.5314]	[0.1953, 8.7507]	[-3.5017, 6.2436]	[-2.1904, 5.1814]
Post Implementation Trend PCMH NR	**-0.2998**	**-0.2052***	**-0.1823**	**-0.1527**
	[-0.6335, 0.0340]	**[-0.4025, -0.0079]**	**[-0.3916, 0.0270]**	**[-0.3084, 0.0030]**
Post Implementation Level PCMH PR	-1.2762	6.0223**	0.3580	-5.3997**
	[-7.5409, 4.9884]	[2.2181, 9.8265]	[-3.6250, 4.3409]	[-8.8861, -1.9133]
Post Implementation Trend PCMH PR	**-0.012**	**-0.3599*** **	**-0.0356**	**0.1906***
	[-0.2748, 0.2508]	**[-0.5244, -0.1955]**	**[-0.2102, 0.1390]**	**[0.0407, 0.3405]**
Age	-0.0278	-0.0181**	-0.0077	-0.0038
	[-0.0560, 0.0003]	[-0.0318, -0.0045]	[-0.0200, 0.0047]	[-0.0133, 0.0057]
Female	0.9520*	-0.7940**	-0.3789	-0.2820
	[0.0601, 1.6438]	[-1.2868, -0.3012]	[-0.7987, 0.0409]	[-0.5903, 0.0263]
PCAL	0.2214*	0.2161***	0.1437**	0.0593*
	[0.0280, 0.4149]	[0.1174, 0.3149]	[0.0506, 0.2369]	[0.0008, 0.1178]
Observations (member-months)	254	571	713	768

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 5.9.22 Regression results for predicted odds of having any drug costs for categories of MCC with antidepressant prescription, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	0.5801***	0.6548***	0.8456**	1.0778
	[0.4995, 0.6737]	[0.5860, 0.7318]	[0.7509, 0.9523]	[0.9412, 1.2341]
PCMH NR	1.014	0.9697	0.8246*	0.9876
	[0.7741, 1.3282]	[0.8119, 1.1581]	[0.6956, 0.9775]	[0.8133, 1.1993]
PCMH PR	1.1342	0.8135*	0.7070**	0.6310***
	[0.9061, 1.4198]	[0.6894, 0.9600]	[0.5895, 0.8481]	[0.5193, 0.7667]
Time Trend	1.0220***	1.0177***	1.0199***	1.0293***
	[1.0175, 1.0266]	[1.0143, 1.0212]	[1.0166, 1.0232]	[1.0253, 1.0333]
Time Trend PCMH NR	1.0011	1.0043	0.9945	0.9998
	[0.9921, 1.0102]	[0.9975, 1.0112]	[0.9880, 1.0010]	[0.9921, 1.0075]
Time Trend PCMH PR	0.9968	0.9988	1.0042	0.9913**
	[0.9890, 1.0047]	[0.9932, 1.0044]	[0.9988, 1.0095]	[0.9852, 0.9974]
Implementation Level	0.8842*	0.7685***	0.9019*	0.8360**
	[0.7878, 0.9923]	[0.7039, 0.8392]	[0.8285, 0.9819]	[0.7542, 0.9266]
Implementation Trend	0.9854**	0.9967	0.9884**	0.9709***
	[0.9754, 0.9955]	[0.9890, 1.0045]	[0.9809, 0.9959]	[0.9621, 0.9797]
Implementation Level PCMH NR	0.9077	1.1233	1.0225	0.989
	[0.7247, 1.1369]	[0.9500, 1.3281]	[0.8695, 1.2025]	[0.8160, 1.1986]
Implementation Trend PCMH NR	1.0018	0.9922	1.0143*	1.0089
	[0.9829, 1.0210]	[0.9784, 1.0062]	[1.0005, 1.0284]	[0.9928, 1.0253]
Implementation Level PCMH PR	0.9618	1.2083**	0.9477	1.1241
	[0.7938, 1.1652]	[1.0525, 1.3871]	[0.8297, 1.0825]	[0.9606, 1.3155]
Implementation Trend PCMH PR	1.0082	0.9969	0.9986	1.0169*
	[0.9920, 1.0247]	[0.9852, 1.0088]	[0.9872, 1.0102]	[1.0032, 1.0308]
Post Implementation Level	1.0891	0.9258	0.8220	0.8393
	[0.7468, 1.5881]	[0.6896, 1.2428]	[0.6103, 1.1071]	[0.5891, 1.1956]
Post Implementation Trend	0.9841*	0.9860*	0.9921	0.9766**
	[0.9685, 0.9999]	[0.9738, 0.9983]	[0.9797, 1.0047]	[0.9622, 0.9913]
Post Implementation Level PCMH NR	0.6465	1.2259	1.6369*	1.2855
	[0.3392, 1.2321]	[0.7572, 1.9848]	[1.0080, 2.6582]	[0.7370, 2.2421]
Post Implementation Trend PCMH NR	**1.0100**	**0.9925**	**0.9887**	**0.9867**
	[0.3392, 1.2321]	**[0.9723, 1.0131]**	**[0.9686, 1.0093]**	**[0.9636, 1.0103]**
Post Implementation Level PCMH PR	0.8269	1.0995	1.2977	1.0786
	[0.4836, 1.4139]	[0.7272, 1.6624]	[0.8570, 1.9649]	[0.6580, 1.7678]
Post Implementation Trend PCMH PR	**1.0035**	**1.0056**	**0.9837**	**1.014**
	[0.9808, 1.0267]	**[0.9880, 1.0234]**	**[0.9665, 1.0011]**	**[0.9930, 1.0355]**
Age	1.0009	1.0104***	1.0119***	1.0144***
	[0.9993, 1.0025]	[1.0092, 1.0115]	[1.0109, 1.0130]	[1.0131, 1.0157]
Female	1.5512***	1.3329***	1.3058***	1.1626***
	[1.4805, 1.6252]	[1.2892, 1.3781]	[1.2650, 1.3480]	[1.1204, 1.2064]
PCAL	1.3999***	1.3266***	1.2776***	1.2500***
	[1.3687, 1.4319]	[1.3070, 1.3465]	[1.2614, 1.2941]	[1.2340, 1.2663]
Observations (member-months)	53,775	95,519	108,097	85,806

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 5.9.23 Regression results for predicted odds of having any drug costs for categories of MCC without antidepressant prescription, odds ratios with 95% confidence intervals.

Variable	Zero	1-2	3-4	5+
Constant	0.1735***	0.2612***	0.4693***	0.7296***
	[0.1631, 0.1845]	[0.2451, 0.2783]	[0.4378, 0.5030]	[0.6722, 0.7920]
PCMH NR	1.0527	0.9818	0.9499	0.9147
	[0.9549, 1.1605]	[0.8964, 1.0752]	[0.8582, 1.0514]	[0.8148, 1.0268]
PCMH PR	1.1909**	1.0019	0.8702*	0.9057
	[1.0839, 1.3086]	[0.9070, 1.1067]	[0.7775, 0.9738]	[0.7968, 1.0294]
Time Trend	1.0066***	1.0076***	1.0098***	1.0105***
	[1.0052, 1.0080]	[1.0062, 1.0090]	[1.0082, 1.0114]	[1.0086, 1.0124]
Time Trend PCMH NR	0.9998	1.0005	0.9992	1.0027
	[0.9968, 1.0028]	[0.9975, 1.0034]	[0.9959, 1.0025]	[0.9989, 1.0066]
Time Trend PCMH PR	1.0047**	1.0073***	1.0097***	1.0104***
	[1.0023, 1.0070]	[1.0050, 1.0097]	[1.0070, 1.0124]	[1.0072, 1.0135]
Implementation Level	0.9333**	0.9486**	0.9042***	0.9437*
	[0.8982, 0.9697]	[0.9146, 0.9840]	[0.8681, 0.9419]	[0.8992, 0.9904]
Implementation Trend	0.9951**	0.9961*	0.9921***	0.9856***
	[0.9917, 0.9985]	[0.9929, 0.9994]	[0.9885, 0.9958]	[0.9813, 0.9899]
Implementation Level PCMH NR	1.012	0.9553	1.0464	0.9693
	[0.9371, 1.0928]	[0.8869, 1.0290]	[0.9628, 1.1372]	[0.8793, 1.0685]
Implementation Trend PCMH NR	1.0028	0.9988	1.0024	1.0056
	[0.9964, 1.0092]	[0.9925, 1.0050]	[0.9954, 1.0095]	[0.9973, 1.0139]
Implementation Level PCMH PR	0.9170**	0.9003**	0.9633	0.8882**
	[0.8628, 0.9747]	[0.8483, 0.9555]	[0.9006, 1.0303]	[0.8205, 0.9616]
Implementation Trend PCMH PR	1.0004	0.9978	0.9952	1.0006
	[0.9953, 1.0056]	[0.9928, 1.0029]	[0.9895, 1.0010]	[0.9938, 1.0076]
Post Implementation Level	0.9999	0.8868	1.0048	0.8687
	[0.8828, 1.1325]	[0.7857, 1.0011]	[0.8749, 1.1540]	[0.7334, 1.0291]
Post Implementation Trend	0.9934*	0.9992	0.9910**	0.9972
	[0.9882, 0.9986]	[0.9941, 1.0043]	[0.9853, 0.9968]	[0.9901, 1.0044]
Post Implementation Level PCMH NR	0.9983	1.0505	0.9889	1.0514
	[0.8051, 1.2380]	[0.8489, 1.3000]	[0.7755, 1.2610]	[0.7860, 1.4064]
Post Implementation Trend PCMH NR	**1.0025**	**0.9966**	**1.0013**	**0.995**
	[0.9934, 1.0117]	**[0.9876, 1.0057]**	**[0.9911, 1.0117]**	**[0.9828, 1.0073]**
Post Implementation Level PCMH PR	0.9373	1.0724	0.8753	1.1251
	[0.7878, 1.1151]	[0.9014, 1.2759]	[0.7148, 1.0717]	[0.8803, 1.4380]
Post Implementation Trend PCMH PR	**0.9954**	**0.9882****	**0.9935**	**0.9810****
	[0.9881, 1.0027]	**[0.9810, 0.9955]**	**[0.9850, 1.0020]**	**[0.9709, 0.9913]**
Age	0.9927***	1.0062***	1.0074***	1.0066***
	[0.9923, 0.9932]	[1.0057, 1.0067]	[1.0069, 1.0079]	[1.0060, 1.0073]
Female	2.1911***	1.3734***	1.1569***	1.0507***
	[2.1625, 2.2201]	[1.3561, 1.3908]	[1.1407, 1.1733]	[1.0333, 1.0684]
PCAL	1.5600***	1.4372***	1.2954***	1.2426***
	[1.5483, 1.5718]	[1.4280, 1.4465]	[1.2874, 1.3035]	[1.2346, 1.2506]
Observations (member-months)	665,906	535,117	389,405	279,752

*** p<0.001, ** p<0.01, * p<0.05

PCMH,NR = PCMH with standard FFS

PCMH,PR = PCMH with partial capitated payments and quality bonuses

Table 5.9.24 List of antidepressant drugs

Generic Name for Antidepressant Drugs

AMITRIP HCL/CHLORDIAZEPOXIDE
AMITRIP HCL/CL-DIAZEPOX HCL
AMITRIPTYLINE HCL
AMITRIPTYLINE HCL/PERPHENAZINE
AMOXAPINE
ATOMOXETINE HCL
BUPROPION HBR
BUPROPION HCL
BUPROPION HCL/DIET SUPP. NO.15
BUPROPION HCL/DIET SUPP. NO.16
CITALOPRAM HYDROBROMIDE
CLOMIPRAMINE HCL
DESIPRAMINE HCL
DESVENLAFAXINE SUCCINATE
DOXEPIN HCL
DULOXETINE HCL
ESCITALOPRAM OXALATE
FLUOXETINE
FLUOXETINE HCL
FLUOXETINE HCL/DIET. SUPP NO.8
FLUOXETINE HCL/DIET.SUPP NO.17
FLUVOXAMINE MALEATE
IMIPRAMINE HCL
IMIPRAMINE PAMOATE
ISOCARBOXAZID
MAPROTILINE HCL
MILNACIPRAN HCL
MIRTAZAPINE
NEFAZODONE HCL
NORTRIPTYLINE HCL
PAROXETINE HCL
PAROXETINE MESYLATE
PHENELZINE SULFATE
PROTRIPTYLINE HCL
SERTRALINE HCL
TRANYLCYPROMINE SULFATE
TRAZODONE HCL
TRAZODONE HCL/DIET8
TRAZODONE HYDROCHLORIDE
TRIMIPRAMINE MALEATE
VENLAFAXINE HCL

6.0 Conclusion

6.1 Summary of Results

This dissertation explores the effect of PCMH with two models of reimbursement on the use of medical services, prescription drugs and spending, in an adult population and two subgroups; those with multiple chronic conditions, and those with co-morbid depression. The study takes advantage of a natural experiment in which a single commercial payer financed the transformation of primary care practices into NCQA Level 3-certified PCMHs with the option of adopting partial capitation or retaining FFS as a method of reimbursement. All three papers use this exposure in a segmented, interrupted time series design with individual-level data, clustered at the PCP level.

The setting for this study consists of 22 primary care practices in Albany and upstate New York that transformed to PCMH in July 2010. Pharmacy and medical claims data from 2008 – 2013 were used. The PCMH is a medical model encouraged under the ACA that supports highly accessible, patient-centered and coordinated care through teamwork, the use of IT, and patient outreach. 15 of the 22 practices went off FFS reimbursement and adopted a partial capitated model with bonuses based on quality and efficiency measures.

Medical home advocates debate as to whether PCMH should be applied to all patient needs or focus on attaining greater responsiveness from patients with higher need and cost.[4] Nearly 25 percent of Americans have been diagnosed with two or more chronic

conditions, accounting for more than two-thirds of health care spending[15] In this sample of intervention and matched controls, nearly 55 percent have one or more chronic conditions of which 15 percent have co-morbid depression. Examining the effect of PCMH on their medical expenditures and utilization of medical services will be important in understanding how PCMH, and different methods of reimbursement, affect these subpopulations.

The first paper (Chapter 3) analyzes the effect of PCMH with and without partial capitation on changes in expenditures and utilization among the entire adult population served by these primary care sites and their matched controls. Utilization is examined in terms of inpatient admissions, emergency department visits, ambulatory office visits, drug and medical spending. While PCMH with partial capitation had no effect on emergency room visits, office visits or inpatient admissions, PCMH with FFS was found to increase the predicted odds of having an emergency room visit and decrease the predicted odds of having an office visit. PCMH with both types of payment decreased the predicted odds of having inpatient and ambulatory expenditures as well as decreasing the monthly log dollars associated with inpatient and ambulatory spending indicative of intensive and extensive reductions. It is unclear why the reduction in the predicted odds of inpatient expenditures does not translate directly to reductions in inpatient admissions. No effect is evident on drug or total medical expenditures in either type of PCMH when looking at the primary care population at large.

The second paper (Chapter 4) examines the effect of the two types of PCMH to changes in expenditures and utilization among the adult population with multiple chronic conditions served by these primary care sites and their matched controls. This paper found that PCMH with partial capitation had more impact among members with chronic conditions than PCMH with fee-for-service; in particular increases in the monthly probability of incurring an ambulatory expenditure and reductions in the monthly probability of incurring a drug expenditure; both of which had dose response by number of chronic condition. However, for most services there was not a dose response between the number of chronic conditions and the probability of an expenditure or the level of expenditure suggesting that in these settings PCMH is not more effective in treating people with more chronic conditions. Both types of PCMH saw reductions in monthly log ambulatory expenditures relative to usual source of care. The sickest members were the most affected; decreases in the probability of having an office visit (both PCMHs), reductions in monthly log total medical expenditures (both PCMHs), and reductions in monthly ambulatory expenditures (FFS only). No effects were evident in the areas of high utilization; emergency room visits and inpatient admissions.

The third paper (Chapter 5) examines the effect of the two types of PCMH to changes in expenditures and utilization among the adult population with multiple chronic conditions and co-morbid depression served by these primary care sites and their matched controls. This study found that PCMH with partial capitation has a pronounced effect on ambulatory and drug expenditures whereas PCMH with FFS does not. In PCMH with partial capitation, there is an increase in the predicted odds of having ambulatory

expenditures concurrently with a decrease in the log expenditures in ambulatory expenditures among those who have some ambulatory service use.

6.2 Policy Implications

This study shows that the effects of PCMH on subpopulations such as those with multiple chronic conditions and depression can differ substantially from the effects of PCMH on the entire population treated by primary care; but in many cases there is not a dose response. This is consistent with other studies that are finding that sicker subgroups of patients experience greater benefits from PCMH[190,191]. Several important points can be made; a) although PCMH as a whole-practice intervention is expected to improve care for all, subgroup analysis will uncover important beneficial effects; b) evaluations should consider that shorter timeframes will suffice for evaluations to see effects among sicker subgroups, and longer timeframes necessary for effects to be evident among healthier patients as increased prevention leads to a healthier future patient population.

Another finding of this study is the differences in the effect that payment reform will have on subpopulations, even when structural and functional changes associated with NCQA PCMH Level 3 certification, are shared. This is seen distinctly in the effects for MCC and MCC with comorbid depression in monthly predicted odds of having ambulatory and drug expenditures when enrolled in PCMH with partial capitation that were absent from PCMH with FFS. For payers, reimbursement models should be implemented jointly with structural and procedural site transformations.

Another finding uncovered by this study is regarding the nature of depression and the effect PCMH has on members with comorbid depressive symptoms. For instance, although effects in ambulatory expenditures were found among all subgroups with multiple chronic conditions, a dose response in the effect only became evident upon analysis of those with multiple chronic conditions without depression. This dose response or the statistical significance associated with some of the effects is lost again upon analysis of those with multiple chronic conditions and depression.

The policy implications of this study for PCMH are that those with multiple chronic conditions do derive more benefit and need to be considered in further evaluations. Studies that have begun to evaluate subgroups of members with chronic conditions are finding similar conclusions.[192] However, PCMH will need interventions other than those it currently implements to address the mental health of its patients, in particular among the multi morbid subgroups.

7.0Appendix

7.1 Example of non-normal distribution and transformation of outcome

Figure 7.1.1 Distribution of monthly average values of pharmacy expenditures

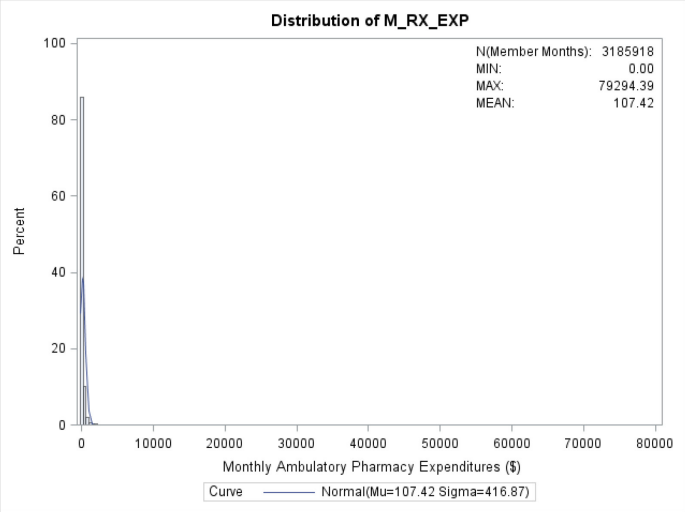


Figure 7.1.2 Distribution of monthly average values of pharmacy expenditure when greater than zero

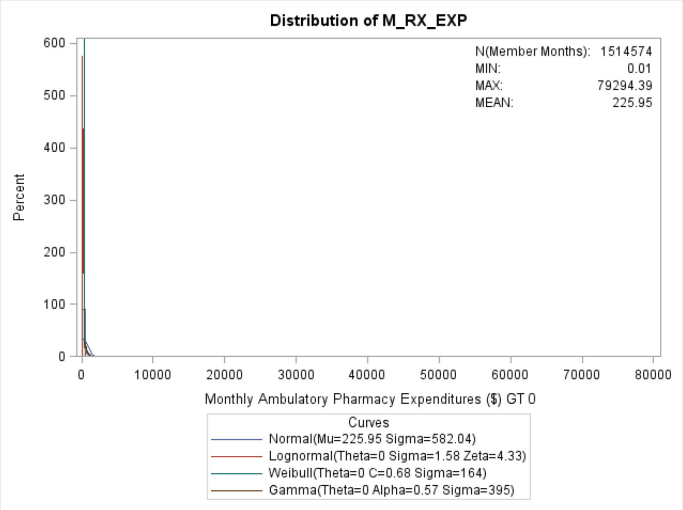


Table 7.1.1 Percentiles of fitted distributions against the observed for average monthly pharmacy expenditures when greater than zero.

		Estimated			
Percent	Observed	Normal	Lognormal	Weibull	Gamma
1.0	2.27	-1128.078	1.94661	0.19110	0.10275
5.0	4.83	-731.421	5.69773	2.09276	1.71820
10.0	9.36	-519.964	10.10067	6.02245	5.81151
25.0	25.16	-166.629	26.29239	26.32396	29.97840
50.0	87.47	225.951	76.11293	95.75487	114.76713
75.0	239.78	618.531	220.33668	264.97234	304.76824
90.0	511.01	971.866	573.54397	558.19096	593.97090
95.0	787.49	1183.323	1016.75127	821.49520	827.20416
99.0	2112.01	1579.980	2976.02806	1544.62291	1393.71340
Mean		225.9509	263.4786	213.303	225.9509
Std. Dev		582.0406	873.1935	322.0127	298.779

Figure 7.1.3 Distribution of log transformed monthly average values of pharmacy expenditures

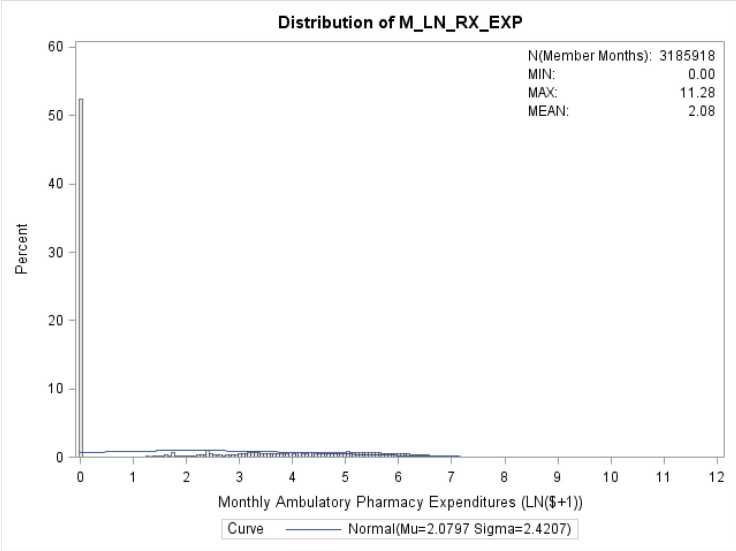


Table 7.1.2 Goodness-of-fit tests for normality for observed monthly pharmacy expenditures

Test	Statistic		P Value
Kolmogorov-Smirnov	D	0.329	<0.010
Cramer-von Mises	W-Sq	51736.815	<0.005
Anderson-Darling	A-Sq	301463.946	<0.005

*All reject the null hypothesis that the data is normally distributed and the quantiles for 10% and under for a normal distribution are estimated to have negative values

Figure 7.1.4 Distribution of log transformed monthly average values of pharmacy expenditures when greater than zero

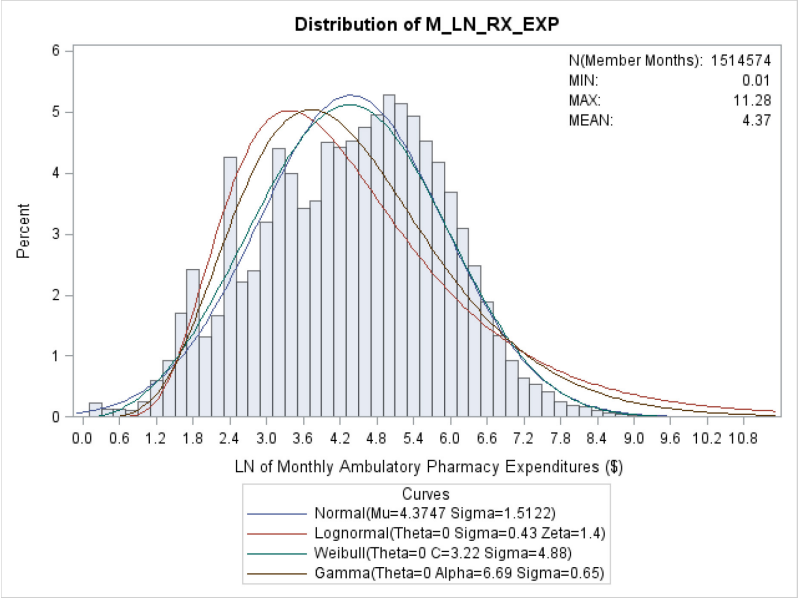


Table 7.1.3 Percentiles of fitted distributions against the observed for log transformed average monthly pharmacy expenditures when greater than zero.

	Estimated				
Percent	Observed	Normal	Lognormal	Weibull	Gamma
1.0	1.18478998	0.85680	1.49070	1.16983	1.41071
5.0	1.76301700	1.88735	1.99807	1.94075	2.01004
10.0	2.33795224	2.43673	2.33578	2.42693	2.39464
25.0	3.26423153	3.35472	3.03221	3.31541	3.14767
50.0	4.48266351	4.37467	4.05203	4.35659	4.15869
75.0	5.48388365	5.39462	5.41485	5.40302	5.36709
90.0	6.23834416	6.31261	7.02932	6.32519	6.63383
95.0	6.67011972	6.86199	8.21740	6.86384	7.47658
99.0	7.65586875	7.89254	11.01428	7.84447	9.23464
Mean	4.37466995	4.37467	4.444212	4.373735	4.37467
Std. Dev	1.51218563	1.51218563	2.002069	1.491868	1.691526

Kolmogorov-Smirnov	<0.010	<0.010		<0.001
Cramer-von Mises	<0.005	<0.005	<0.010	<0.001
Anderson-Darling	<0.005	<0.005	<0.010	<0.001

8.0 Bibliography

1. Agency for Healthcare Research and Quality. Defining the Patient-Centered Medical Home. http://pcmh.ahrq.gov/portal/server.pt/community/pcmh__home/1483/PCMH_Defining%20the%20PCMH_v2. Accessed August 20, 2013.
2. Rosenthal TC. The medical home: growing evidence to support a new approach to primary care. J Am Board Fam Med. 2008;21(5):427–40.
3. Baird M, Blount A, Brungardt S, Dickinson P, Dietrich A, Epperly T, et al. The development of joint principles: integrating behavioral health care into the patient-centered medical home: Ann Fam Med. 2014 Mar-Apr;12(2):183. doi: 10.1370/afm.1634.
4. Berenson RA, Hammons T, et al. A house is not a home:keeping patients at the center of practice resdesign. Health Affairs. 2008; 27:1219-1230.
5. North SW, McElligot J, Douglas G, Martin A. Improving access to care through the patient-centered medical home. Pediatr Ann 2014;43(2):00904481-20140127.
6. American Academy of Family Physicians. Joint principles of the patient-centered medical home. Del Med J 2008;80(1):21–2.
7. Stewart M. Towards a global definition of patient centred care. BMJ 2001; 322(7284):444–5.
8. General principles in the care of children and adolescents with genetic disorders and other chronic health conditions. American Academy of Pediatrics Committee on Children with Disabilities. Pediatrics 1997;99(4):643–4.
9. Wagner EH, Austin BT, Davis C, et al. Improving chronic illness care: translating evidence into action. Health Aff (Millwood) 2001;20(6):64–78. Cooley WC, McAllister JW. Building medical homes: improvement strategies in primary care for children with special health care needs. Pediatrics 2004; 113(Suppl 5):1499–506.
10. Alakeson V, Frank RG, Katz RE. Specialty care medical homes for people with severe persistent mental disorders.
11. Pham HH, Good neighbors: How will the patient-centered medical home relate to the rest of the health-care delivery system? J Gen Intern Med. 2010 June; 25(6): 630-634.
12. Simon, G. E., Ormel, J., Von Korff, M., & Barlow, W. (1995). Health care costs associated with depressive and anxiety disorder in primary care. American Journal of Psychiatry, 152, 352–357.

13. Wells, K. B., Stewart, A., Hays, R. D., Burnam, M. A., Rogers, W., Daniels, M., et al. (1989). The functioning and well-being of depressed patients: Results from the medical outcomes study. JAMA, 262, 914–919.
14. Himelhock S, Weller WE, Wu AW, Anderson G, Cooper LA. Chronic medical illness, depression, and use of acute medical services among medicare beneficiaries. Medical Care. June 2004: 42(6)
15. Anderson G. Chronic care: making the case for ongoing care. Princeton, NJ: Robert Wood Johnson Foundation, 2010
16. Pappas G, Yujiang J, Siler N et al. Perspective on the role of patient-centered medical homes in HIV care. American Journal of Public Health. July 2014;104(7):
17. Alakeson V, Frank RG, Katz RE. Specialty care medical homes for people with severe, persistent mental disorders. Health Aff (Millwood). 2010;29(5):867--- 873.
18. Berenson RA, Rich EC. How to buy a medical home? Policy options and practical questions. J Gen Intern Med. 2010;25(6):619–24. doi:10.1007/s11606-010-1290
19. Berenson RA, Rich EC. US approaches to physician payment: the deconstruction of primary care. J Gen Intern Med. 2010;25(6):613–8. doi:10.1007/s11606-010-1295-z.
20. Domino ME, Humble C, Lawrence WW, Jr., Wegner S. Enhancing the medical homes model for children with asthma. Med Care 2009;47(11):1113-20.
21. Bitton A, Martin C, Landon BE. A nationwide survey of patient centered medical home demonstration projects. J Gen Intern Med. 2010 Jun; 25(6):584-92
22. A National Survey of Patient Centered Medical Home Initiatives Samuel T. Edwards; Asaf Bitton; Johan S. Hong; Bruce E. Landon. SGIM National Meeting 2014.
23. Jackson GL et al. The patient-centered medical home: a systematic review. Ann Intern Med. 2013;158:169-178.
24. Sia C, Tonniges TF, Osterhus E, Taba S. History of the medical home concept. Pediatrics. 2004;113:1473-8. [PMID: 15121914]
25. Wagner EH, Glasgow RE, Davis C, Bonomi AE, Provost L, McCulloch D, et al. Quality improvement in chronic illness care: a collaborative approach. Jt Comm J Qual Improv. 2001;27:63-80. [PMID: 11221012]
26. Kilo CM, Wasson JH. Practice redesign and the patient-centered medical home: history, promises, and challenges. Health Aff (Millwood). 2010;29:773-8. [PMID: 20439860]
27. Shanafelt TD, Boone S, Tan L, Dyrbye LN, Sotile W, Satele D, et al. Burnout and satisfaction with worklife balance among US physicians relative to the general US population. Arch Intern Med. 2012;172(18): 1377–85.
28. Petterson SM, Liaw WR, Phillips RL Jr, Rabin DL, Meyers DS, Bazemore AW. Projecting US primary care physician workforce needs: 2010–2025. Ann Fam Med. 2012;10(6):503–9.
29. Huang ES, Finegold K. Seven million Americans live in areas where demand for primary care may exceed supply by more than 10 percent. Health Aff (Millwood). 2013;32(3): 614–21.
30. Patient-Centered Primary Care Collaborative.Washington (DC): PCPCC; c2013 [cited 2014 Aug 12]. Available from: http://www.pcpcc.org/
31. American Academy of Family Physicians, American Academy of Pediatrics, American College of Physicians, American Osteopathic Association. Joint principles of the patient-centered medical home [Internet]. Washington (DC):Patient-Centered Primary

Care Collaborative; 2007 Feb [cited 2010 Apr 1]. Available from: http://www.pcpcc.net/node/14
32. Agency for Healthcare Research and Quality. Patient Centered Medical Home Resource Center.
33. Pourat N, Lavarreda SA, Snyder S. Patient-centered medical homes improve care for adults with chronic conditions. Policy Brief UCLA Cent Health Policy Res 2013;3:1-8.
34. Coleman K, Austin BT, Brach C, et al. Evidence on the Chronic Care Model in the new millennium. Health Aff (Millwood) 2009;28(1):75–85.
35. S. Edwards, A. Bitton, J. Hong et al., "Patient-Centered Medical Home Initiatives Expanded in 2009–13: Providers, Patients, and Payment Incentives Increased," Health Affairs, Oct. 2014 33(10):1823–31.
36. Edwards ST, Bitton A, Hong J, Landon BE. Patient-centered medical home initiatives expanded in 2009–13: providers, patients, and payment incentives increased. Health Aff (Millwood). 2014;33(10):1823–31.
37. DeVries, A, Chia-Hsuan W, Sridhar G, Hummel J, Breidbart S., Barron J. (2012) Impact of Medical Homes on Quality Healthcare Utilization and Costs. The American Journal of Managed Care.
38. National Academy for State Health Policy. Medical home and patient-centered care [Internet]. Portland (ME): NASHP; c2013 [cited 2014 Aug 12]. Available from: http://www.nashp.org/med-home-map
39. Takah M, Townley C, Yalowich R, Kinsler S. Making multipayer reform work: what can be learned from medical home initiatives. 2015. Health Affairs, 34(4):662-672
40. Gabbay RA, Bailit MH, Mauger DT et al. Multipayer patient-centered medical home implementation guided by the chronic care model. 2011 Jun;37(6):265-73.
41. Peikes, D., S. Dale, E. Lundquist, J. Genevro, and D. Meyers. 2011. Building the Evidence Base for the Medical Home: What Sample and Sample Size Do Studies Need? White Paper (Prepared by Mathematica Policy Research). Rockville,MD.
42. Hoff T, Weller W, Depucio M. The Patient-Centered Medical Home: A Review of Recent Research." Medical Care Research and Review 2012; 69:619-44
43. Williams JW, Jackson GL, Powers BJ. Closing the quality gap: revisting the state of the science (vol.2: the patient-centered medical home.) Evid Rep Technol Assess. 2012 July(208.2):1-210
44. alexander JA, Bae D. Does the patient-centered medical home work? A critical synthesis of research on patient-centered medical homes and patient-related outcomes. Health Serv Manage Res. 2012 May;25(2):51-9.
45. Rosenthal MB, Abrams MK, Bitton A. Recommended core measures for evaluation the patient-centered medical home: cost, utilization and clinical quality. Commonwealth Fund Data Brief May 2012.
http://www.commonwealthfund.org/~/media/files/publications/data-brief/2012/1601_rosenthal_recommended_core_measures_pcmh_v2.pdf
46. Hwang W, Weller W, Ireys H, Anderson GF. Out-of-pocket medical spending for care of chronic conditions. Health Affairs, 20, no.6(2001):267-278.
47. Corcoran KJ, Jowsey T, Leeder SR. One size does not fit all: the different experiences of those with CHF, type II diabetes and COPD. Aust Health Rev. 2013 Feb;37(1):19-25.

48. Christnesen EW, Dorance KA, Ramchadani S, et al. Impact of a patient-centered medical home on access, quality, and cost. Mil Med 2013 Feb;178(2):135-41.
49. Pourat N, Lavarreda SA, Snyder S. Patient-centered medical homes improve care for adults with chronic conditions. Policy Brief UCA Cent Health Policy Res. 2013 May;1-8
50. Christensen EW, Dorrance KA Ramchandani S, et al. Impact of a patient-centered medical home on access, quality and cost. Mil Med, 201 Feb;178(2):135-41.
51. DeVries A, Li CH, Sridhar G, et al. Impact of medical homes on quality, healthcare utilization, and costs. Am J Manag Care. 2012 Sep;18(9):534-44
52. Gabbay RA, Bailit MH, Mauger DT et al. Multipayer patient-centered medical home implementation guided by the chronic care model. 2011 Jun;37(6):265-73.
53. David G, Gunnarsson C, Saynisch PA et al. Do patient-centered medical homes reduce emergency department visits? Health Serv Res 2015 Apr;50(2):418-39.
54. Berenson RA, Rich EC. How to buy a medical home? Policy options and practical questions. J Gen Intern Med. 2010;25(6):619–24. doi:10.1007/s11606-010-1290-4
55. Berenson RA, Rich EC. US approaches to physician payment: the deconstruction of primary care. J Gen Intern Med. 2010;25(6):613–8. doi:10.1007/s11606-010-1295-
56. Edwards ST, Abrams MK, Baron RJ, Berenson RA, Rich EC, Rosenthal GE, Rosenthal MB, Landon BE. Structuring payment to medical homes after the affordable care act. J Gen Intern Med. 2014 Oct;29(10):1410-3. doi: 10.1007/s11606-014-2848-3
57. Heyworth L, Bitton A, Lipsitz S et al. Patient-Centered Medical Home Transformation with Payment Reform: Patient Experience Outcomes. Am J Manag Care. 2014;20(1):26-33
58. DHHS CMS Chronic Care management services. http://www.cms.gov/outreach-and-education/medicare-learning-network-mln/mlnproducts/downloads/chroniccaremanagement.pdf [last access august 8, 2015.]
59. Abrams M, Nuzum R, Mike S et al. Realizing Health Reform's Potential. How the ACAwill strengthen primary care and benefit patients, providers and payers.2011 Commonwealt Fund Publ. 1466 Vol 1
60. Kellerman R, Kirk L. Principles of the patient-centered medical home: An Fam Physician. 15 Sep 2007:76(6):774-5
61. NCQA. NCQA's Patient-Centered Medical Home (PCMH) 31 January 2011 (Accessed at: https://www.ncqa.org/Portals/0/Programs/Recognition/PCMH_2011_Overview_5.2.pdf) Last accessed: April 30,2014
62. Bitton A, Frolkis J, Sinsky C, Pollack S. The Medical Home: Better for Whom?. Med Roundtable Gen Med Ed.1(2):164–171. 2012.
63. SullivanMD, Newton K, Hecht J, Russo JE, Spertus JA. Depression and health status in elderly patients with heart failure: A 6-month prospective study in primary care. Am J Geriatr Cardiol. 2007;13(5):252-260.
64. Dorr DA, Jones SS, Burns L, et al. Use of health-related, quality-of-life metrics to predict mortality and hospitalizations in community-dwelling seniors. J Am Geriatr Soc. 2006;54(4):667-673.
65. Andrews G. Should depression be managed as a chronic disease? BMJ 2001; 322: 419-21.
66. Katon W. Shculberg H. Epidemiology of depression in primary care. Gen Hosp

Psychiatry 1992; 14: 237-47.
67. Harpole LH. Williams JW Jr. Olsen MK, et al. Improving depression outcomes in older adults with comorbid medical illness. Gen Hosp Psychiatry 2005; 27:4-12
68. Chapman DP, Perry GS, STrine TW. The vital link between chronic disease and depressive disorders. Prev Chronic Dis 2005; 2:A14.
69. Moussavi S, Chatterji S, Verdes E, et al. Depression, chronic diseases and decrements in health: results from the World Health Surveys. Lancet 2007; 370: 851-58.
70. Harman Js, Edlund MJ, Fortney JC. The influence of comorbid chronic medical conditions on the adequacy of depression care for older Americans.
71. Vyas A, Sambamoorthi U. Multimorbidity and depression treatment. General Hospital Psychiatry 33 (2011) 248-245.
72. Loeb DF, Ghushchyan, Amy GH, et al. Association of treatment modality for depression and burden of comorbid chronic illness in a nationally representative sample in the United States. General Hospital Psychiatry Nov-Dec 2012; (34);6:588-597.
73. Hutter N, Schnurr A, Baumesister H. Healthcare costs in patients with diabetes mellitus and comorbid mental disorders – a systematic review. Diabetologia 53(12):2470-9, 2010.
74. Himelhock S, Weller, WE, Wu AW. Chronic medical illness, depression and use of acute medical services among Medicare beneficiaries. Med Care 42(6):512-21, Jun 2004
75. Katon W, Lin EH, Kroenke K. The association of depression and anxiety with medical symptom burden in patients with chronic medical illness. Gen Hosp Psychiatry. 2007 May-Apr;29(2):147-55
76. Katon WJ. Clinical and health service relationships between major depression, depressive symptoms, and general medical illness. Biol Psychiatry. 2003. Aug 1;54(3):216-26.
77. Bonds D, Boyd C, Davis M, et al. Understanding the context of health for people with multiple chronic conditions: moving from what is the matter to what matters. Ann Fam Med. 2014;12(3):260-269
78. Wells, K. B., Stewart, A., Hays, R. D., Burnam, M. A., Rogers, W., Daniels, M., et al. (1989). The functioning and well-being of depressed patients: Results from the medical outcomes study. JAMA, 262, 914–919.
79. The world health report 2001-mental health:new understanding new hopegeneva)
80. Wang PS, Lane M, Olfson M, Pincus HA, Wells KB, Kessler RC. Twelve-month use of mental health services in the United States: results from the National Comorbidity Survey Replication. Arch Gen Psychiatry. 2005; 62(6):629-40.
81. Katon W, Von Korff M, Lin E, Simon G. Rethinking practitioner roles in chronic illness: the specialist, primary care physician and the practice nurse.Gen Hosp Psychiatry2001; 23:138–44
82. Sanchez K, Watt TT. Collaborative care for the treatment of depression in primary care with a low-incoms Spanish-speaking population: outcomes from a community-based program evaluation. Prim Care Companion CNS Disord. 201: 14(6):pii
83. Mertens JR, Flisher AK, Satre DD, Weisner CM. The role of medical conditions and primary care services in 5-year substance use outcomes among chemical dependency treatment patients. Drug Alcohol Depend. 2008:98(1-2):45-53.
84. Kessler R, Miller BF, Kelly M, et al. Mental health, substance abuse, and health

behavior services in patient-centered medical homes. J Am Board Fam Med 2014;27(5):637-44
85. Michaud P-A, Suris J-C, Viner R. The adolescent with a chronic condition. Part II: healthcare provision. Arch Dis Child 2004;89(10):943–9
86. Rezaee ME, Pollock M. Multiple Chronic Conditions Among Outpatient Pediatric Patients, Southeastern Michigan, 2008–2013. Prev Chronic Dis 2015;12:140397
87. Burton RA, Devers KJ, Berenson RA. PCMH Recognitions Tools: A Comparison of Ten Surveys' Content and Operational Details. Urban Institute 2012.
88. Rossiter LF, Langwell K, Wan TT, Rivnyah M. Patient satisfaction among elderly enrollees and disenrollees in Medicare health maintenance organizations. Results from the National Medicare Competition Evaluatinos. JAMA. 1989. July 7;262(1):57-63.
89. Druss BG, Schlesinger M, Thomas T, Allen H. Chronic illness and plan satisfaction under managed care. Health AFf. 2000 Jan-Feb;19(1):203-9.
90. Altman D, Cutler D, Zeckhauser R. Enrollee mix, treatment intensity, and cost in competing indemnity and HMO plans. J Health Econ. 2003 Jan;22(1):23-45.
91. Williams MN, Gomez Grajales CA, Kurkiewicz D. Assumptions of Multiple Regression: Correcting Two Misconceptions. 2013. Practical Assessment, Research and Evaluatoin. September;18(11)
92. Austin PC. Estimating multilevel logistic regression models when the number of clusters is low: a comparison of different statistical software procedures. Int J biostat. 2010 Jan 1;6(1)
93. Medicare Payment Advisory Commission. Report to the Congress: Regional Variation in Medicare Service Use. Washington, DC: Medicare Payment Advisory Commission; 2011. Accessed at http://www.medpac.gov/documents/reports/Jan11_RegionalVariation_report.pdf on 23 July, 2015
94. Green W. Accounting for excess zeros and sample selection in Poisson and negative binomial regression models; 1994. Working Paper EC-94-10, Department of Economics, New York University.
95. Osborne JW, Overbay A. The power of outliers (and why researchers should always check for them). Practical Assessment, Research & Evaluation, 9(6). Retrieved XXX from http://PAREonline.net/getv.aps?v=9&6n=6.
96. Manning WG, Mullahy J. 2001. Estimating log models: to transform or not to transform? Journal of Health Economics 20 (4), 461–494.
97. Too much ado about two-part models and transformation? Cmparing methods of modeling Medicare expenditures. MB Buntin, AM Zaslavsky Journal of Health economics. 2004.
98. Stuart EA. Matching Methods for Causal Inference: A review and a look forward. Statistical Science 2010 V.25 N 1;1-21
99. Rosenbaum P. Optimal matching for observational studies. Journal of the American Statistical Association. December 1989. V.84(408
100. Rao, CR. The use and interpretation of principal component analysis in applied research. Sankhya 1964;a(26): 329-358.
101. U minnesotta match it
102. American Academy of Family Physicians, American Academy of Pediatrics, American College of Physicians, American Osteopathic Association. Joint principles of

the patient-centered medical home, March 2007. Washington, DC: American College of Physicians, 2007.
103. Janamian T, Jackson CL, Glasson N, Nicholson C. A systematic revie of the challenges to implementation of the PCMH: lessons for Australia. Med J Aust. 2014. Aug 4; 201(# suppl):S69-73.
104. Berenson RA, Rich EC. How to buy a medical home? Policy options and practical questions. J Gen Intern Med. 2010;25(6):619–24. doi:10.1007/s11606-010-1290
105. Berenson RA, Rich EC. US approaches to physician payment: the deconstruction of primary care. J Gen Intern Med. 2010;25(6):613–8. doi:10.1007/s11606-010-1295-z
106. Merrell K, Berenson RA. Structuring payment for medical homes. Health Aff (Milllwood). 2010;29(5):852–8. doi:10.1377/ hlthaff.2009.0995.
107. Edwards ST, Abrams MK, Baron RJ, Berenson RA, Rich EC, Rosenthal GE, Rosenthal MB, Landon BE. Structuring payment to medical homes after the affordable care act. J Gen Intern Med. 2014 Oct;29(10):1410-3. doi: 10.1007/s11606-014-2848-3
108. Baillit Health Purchasing, LLC. Facilitators and Barriers to Payment Reform: Market based, Governmental, Organizational and Design Considerations. http://www.bailit-health.com/articles/092713_bhp_rwjf_facilitators.pdf. Accessed May 27, 2015.
109. Weissman JS, Bailit M, D'Andrea G, Rosenthal MB. The design and application of shared savings programs: lessons from early adopters. Health Af f (Millwood). 2012;31(9):1959–68
110. Abbo ED, Zhang Q, Zelder M, Huang ES. The increasing number of clinical items addressed during the time of adult primary care visits. J Gen Intern Med. 2008 Dec;23(12):2058-65.
111. Goroll AH, Berenson RA, Schoenbaum SC, et al. Fundamental reform of payment for adult primary care: comprehensive payment for comprehensive care. J Gen Intern Med. 2007;22:410–415.
112. Ash AS, Ellis RP. Risk-adjusted payment and performance assessment for primary care. Med Care. 2012;50:643–653
113. Ellis RP, Ash AS. Payments in support of effective primary care for chronic conditions. Nordic Econ Policy Rev. 2012;2:193–212.
114. O'Donnell AN1, Williams M, Kilbourne AM. Overcoming roadblocks: current and emerging reimbursement strategies for integrated mental health services in primary care. J Gen Intern Med. 2013 Dec;28(12):1667-72. doi: 10.1007/s11606-013-2496-z. Epub 2013 Jun 4
115. 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 2104 Aug;174(8):1350-8.
116. Chaiyachati KH, Godon K, Long T. Continuity in a VA patient-centered medical home reduces emergency department visits. PLoS One. 2014 May 27;9(5
117. Werner RM, Duggan M, Duey K et al. The patient-centered medical home: an evaluation of a single private payer demonstration in New Jersey. Med Care. 2013 Jun;51(6):487-93
118. Rosenthal MB, Friedberg MW, Singer SJ, Eastman D, Li Z, Schneider EC. Effect of a multipayer patient-centered medical home on health care utilization and quality: the

Rhode Island chronic care sustainability initiative pilot program. JAMA Intern Med. 2013 Nov 11;173(20):1907-13.
119. Friedberg MW, Schneider EC, Rosenthal MB, Volpp KG, Werner RM. Association between participation in a multipayer medical home intervention and changes in quality, utilization, and costs of care. JAMA. 2014 Feb 26;311(8):815-25
120. Yoon J, Liu CF, Lo et al. Early changes in VA medical home components and utilization. Am J Manag Care 2015 Mar;21(3):197-204.
121. Chaiyachati KH, Godon K, Long T. Continuity in a VA patient-centered medical home reduces emergency department visits. PLoS One. 2014 May 27;9(5)
122. Reid RJ, Johnson EA, Hsu C. et al. Spreading a medical home redesign: effects on emergency department use and hospital admissions. Ann Fam Med. 2013 May-Jun; 11 Suppl 1:S19-26.
123. Kaushal R, Edwards A, Kern LM. Association between the patient-centered medical home and healthcare utilization. Am J Manage Care. 2015 May;21(5):378-8
124. Gabbay RA, Bailit MH, Mauger DT et al. Multipayer patient-centered medical home implementation guided by the chronic care model. 2011 Jun;37(6):265-73.
125. Hsiao CJ, Boult C. Effects of quality on outcomes in primary care: a review of the literature. Am J Med Qual. 2008;23:302–310.
126. Press MJ. Instant Replay – A quarterback's view of care coordination. N Engl J Med. 2014; 371:489-491.
127. Ford ES, Croft JB, Posner SF, Goodman RA, Giles WH. Co-occurrence of leading lifestyle-related chronic conditions among adults in the United States, 2002-2009. Prev Chronic Dis. 2013; 10:E60.
128. Ward BW, Schiller JS. Prevalence of multiple chronic conditions among US adults: estimates from the National Health Interview Survey, 2010. Prev Chronic Dis. 2013; 10:E65.
129. U.S. Department of Health and Human Services. 2011 report to Congress: National Strategy for Quality Improvement in Health Care. 2011. Accessed at www.ahrq.gov/workingforquality/nqs/nqs2011annlrpt.htm on 25 Jun5 2015.
130. Ashman JJ, Beresovsky V. Multiple chronic conditions among US adults who visited physician offices: data from the National Ambulatory Medical Care Survey, 2009. Prev Chronic Dis. 2013; 10:E64.
131. Bonds D, Boyd C, Davis M, et al. Understanding the context of health for people with multiple chronic conditions: moving from what is the matter to what matters. Ann Fam Med. 2014;12(3):260-269
132. Tinetti ME, Bogardus ST Jr, Agostini JV. Potential pitfalls of diseasespecific guidelines for patients with multiple conditions. N Engl J Med. 2004;351(27):2870-2874
133. Hwang W, Weller W, Ireys H, Anderson GF. Out-of-pocket medical spending for care of chronic conditions. Health Affairs, 20, no.6(2001):267-278.
134. Steiner CA, Friedman B. Hospital utilization, costs, and mortality for adults with multiple chronic conditions, Nationwide Inpatient Sample, 2009. Prev Chronic Dis. 2013;10:E62.
135. Condelius A, Edberg AK, Jakobsson U, Hallberg IR. Hospital admissions among people 65+ related to multimorbidity, municipal and outpatient care. Arch Gerontol Geriatr. 2008;46(1):41–55.
136. Lehnert T, Heider D, Leicht H, et al. Review: health care utilization and costs of

elderly persons with multiple chronic conditions. Med Care Res Rev. 2011;68(4):387–420.
137. Wolff JL, Starfield B, Anderson G. Prevalence, expenditures, and complications of multiple chronic conditions in the elderly. Arch Intern Med. 2002;162(20):2269–2276.
138. Chu HY, Chen CC, Cheng SH. Continuity of care, potentially inappropriate medication, and health care outcomes among the elderly: evidence from a longitudinal analysis in Taiwan. Med Care.2012;50(11):1002–1009.
139. Cheng SH, Chen CC, Hou YF. A longitudinal examination of continuity of care and avoidable hospitalization: evidence from a universal coverage health care system. Arch Intern Med. 2010;170(18):1671–1677.
140. Boult C. Wieland GD. Comprehensive primary care for older patients with multiple chronic conditions. JAMA. 2010; 304(17):1936-1943
141. Press MJ. Instant Replay – A quarterback's view of care coordination. N Engl J Med. 2014; 371:489-491.
142. Simon, G. E., Ormel, J., Von Korff, M., & Barlow, W. (1995). Health care costs associated with depressive and anxiety disorder in primary care. American Journal of Psychiatry, 152, 352–357.
143. Wells, K. B., Stewart, A., Hays, R. D., Burnam, M. A., Rogers, W., Daniels, M., et al. (1989). The functioning and well-being of depressed patients: Results from the medical outcomes study. JAMA, 262, 914–919.
144. Pourat N, Lavarreda SA, Snyder S. Patient-centered medical homes improve care for adults with chronic conditions. Policy Brief UCLA Cent Health Policy Res 2013;3:1-8.
145. Gilfillan RJ, Tomcavage J, Rosenthal MB, et al.Value and the medical home: effects of transformed primary care. Am J Manag Care. 2010;16(8): 607-614.
146. Reid RJ, Coleman K, Johnson EA, et al. The Group Health medical home at year two: cost savings, higher patient satisfaction, and less burnout for providers. Health Aff (Millwood). 2010;29(5):835-843.
147. Rosenthal MB, Friedberg MW, Singer SJ, Eastman D, Zhonege L, Schneider EC. Effect of a Multipayer Patient-Centered Medical Home on Health Care Utilization and Quality. JAMA Intern Med. 2013 Nov 11;173(20):1907-13
148. Christnesen EW, Dorance KA, Ramchadani S, et al. Impact of a patient-centered medical home on access, quality, and cost. Mil Med 2013 Feb;178(2):135-41.
149. Pourat N, Lavarreda SA, Snyder S. Patient-centered medical homes improve care for adults with chronic conditions. Policy Brief UCA Cent Health Policy Res. 2013 May;1-8
150. Christensen EW, Dorrance KA Ramchandani S, et al. Impact of a patient-centered medical home on access, quality and cost. Mil Med, 201 Feb;178(2):135-41.
151. DeVries A, Li CH, Sridhar G, et al. Impact of medical homes on quality, healthcare utilization, and costs. Am J Manag Care. 2012 Sep;18(9):534-44
152. Gabbay RA, Bailit MH, Mauger DT et al. Multipayer patient-centered medical home implementation guided by the chronic care model. 2011 Jun;37(6):265-73.
153. Hsiao CJ, Boult C. Effects of quality on outcomes in primary care: a review of the literature. Am J Med Qual. 2008;23:302–310.
154. van Walraven C, Oake N, Jennings A, et al. The association between continuity of care and outcomes: a systematic and critical review. J Eval Clin Pract. 2010;16:947–956.

155. 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 2104 Aug;174(8):1350-8.
156. DeVoe JE, Tillotson CJ, Wallace LS. Usual source of care as a health insurance substitute for U.S. adults with diabetes? Diabetes Care. 2009;32:983–9
157. FandreM Patient-centered medical home implementation effects on emergency room utilization:as case study. Hosp Top. 2014)
158. david G Gunnarsson C et al. do patient centered medical homes reduce emergency department visits. Health serv rese. 2015 apr 50(2):418-39
159. Kessler RC, Berglund P, Demler O, Jin R, Merikangas KR, Walters EE. Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. Arch Gen Psychiatry. 2005;62:593–602
160. Kessler RC, Chiu WT, Demler O, Walters EE. Prevalence, severity, and comorbidity of twelve-month DSM-IV disorders in the National Comorbidity Survey Replication (NCS-R). *Archives of General Psychiatry*, 2005 Jun;62(6):617-27.
161. Kessler RC, Demler O, Frank RG, et al. Prevalence and treatment of mental disorders, 1990 to 2003. N Engl J Med. 2005;352(24): 2515-2523
162. Egede LE. Major depression in individuals with chronic medical disorders: prevalence, correlates and association with health resource utilization, lost productivity and functional disability. Gen Hosp Psychiatry. 2007;29:409–16. 3.
163. Moussavi S, Chatterji S, Verdes E, Tandon A, Patel V, Ustun B. Depression, chronic diseases, and decrements in health: results from the World Health Surveys. Lancet. 2007;370:851–8.
164. Wang PS, Berglund P, Olfson M et al. Failure and delay in initial treatment contact after first onset of mental disorders in the National Comorbidity Survey Replication. Arch Gen Psychiatry. 2005 Jun;62(6):603-13.
165. Chiavegatto Filho AD, Wang YP, Campino AC, et al. Incremental health expenditure and lost days of normal activity for individuals with mental disorders: results from the Sao Paulo Megacity Study. BMC Public Health. 2015 Aug 5;15:745.
166. US Department of Health and Human Services. Results from the 2012 National Survey on Drug Use and Health: Mental Health Findings. Rockville, MD: Substance Abuse and Mental Health Services Administration Center for Behavioral Health Statistics and Quality; 2013.
167. Borowsky SJ, Rubenstein LV, Meredith LS, Camp P, Jackson-Triche M, Wells KB. Who is at risk of nondetection of mental health problems in primary care? J Gen Intern Med 2000;15:381-8.
168. Wang PS, Lane M, Olfson M, Pincus HA, Wells KB, Kessler RC. Twelve-month use of mental health services in the United States: results from the National Comorbidity Survey Replication. Arch Gen Psychiatry 2005;62:629–40.
169. Simon GE, VonKorff M. Recognition, management, and outcomes of depression in primary care. Arch Fam Med. 1995;4:99-105.
170. Ansseau M, Dierick M, Buntinkx F, et al. High prevalence of mental disorders in primary care. J Affect Disord. 2004;78(1):49-55.
171. Melfi CA, Chawla AJ, Croghan TW, et al. The effects of adherence to antidepressant treatment guidelines on relapse and recurrence of depression. Arch Gen

Psychiatry. 1998;55:1128-1132.
172. Lin EH, Von Korff M, Katon W, et al. The role of the primary care physician in patients' adherence to antidepressant therapy. Med Care. 1995;33:67-74.
173. O'Donnell AN1, Williams M, Kilbourne AM. Overcoming roadblocks: current and emerging reimbursement strategies for integrated mental health services in primary care. J Gen Intern Med. 2013 Dec;28(12):1667-72. doi: 10.1007/s11606-013-2496-z. Epub 2013 Jun 4.
174. Druss B, von Esenwein S, Compton M, et al. A randomized trial of medical care management for community mental health settings: The Primary Care Access Referral and Evaluation (PCAR) study. The American Journal of Psychiatry. 2009;167, 151-159.
175. Kilbourne A, Pirraglia P., Lai Z, et al. Quality of general medical care among patients with serious mental illness: Does co-location matter? Psychiatric Services. 2011; 62;922-928.
176. Mertens J, Flisher A, Satre D, et al. The role of medical conditions and primary care services in 5-year substance use outcomes among chemical dependency treatment patients. Drug and Alcohol Dependence, 98(1-2), 45-53.
177. Roy-Byrne P, Katon W, Cowley D, et al. A randomized effectiveness trial of collaborative care for patients with panic disorder in primary care. Archives of General Psychiatry, 2001;58: 867-876.
178. 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 2104 Aug;174(8):1350-8.
179. DeVoe JE, Tillotson CJ, Wallace LS. Usual source of care as a health insurance substitute for U.S. adults with diabetes? Diabetes Care. 2009;32:983–9
180. DeVoe JE, Tillotson CJ, Lesko SE, Wallace LS, Angier H. The case for synergy between a usual source of care and health insurance coverage. J Gen Intern Med. 2011;26:1059–66.
181. Stockbridge EL, Philpot LM, Pagan JA. Patient-centered medical home features and expenditures by medicare beneficiaries. Am J Manage Care. 2014;20:379–85.
182. Jones AL, Cochran SD, Leibowitz A, et al. Usual primary care provider characteristics of a patient-centered medical home and mental health service use. JGIM June 2015 [epub ahead of print]
183. Holt RI. The prevention of diabetes and cardiovascular disease in people with schizophrenia. Acta Psychiatr Scand. 2015 Aug; 132(2):86-96
184. Dixon LB, Goldman HH, Bennett ME. Implementing Coordinated Specialty Care for Early Psychosis: The RAISE Connection Program. Psychiatr Serv. 2015;66(7):691-8
185. Katon WK, Lin EH, Von Korff M. Collaborative care for patients with depression and chronic illnesses. N Engl J Med 2010: 363(27):2611-20
186. Nielsen M. Behavioral health integration; A critical component of primary care and the patient-centered medical home. Families, Systems & Health. 2014; 32(2): 149-150.
187. Kessler R, Miller BF, Kelly M, Graham D, Kennedy A, Littenberg B, MacLean CD, van Eeghen C, Scholle SH, Tirodkar M, Morton S, Pace WD. Mental health, substance abuse, and health behavior services in patient-centered medical homes. J Am Board Fam Med. 2014 Sep-Oct;27(5):637-44.

188. Townsend L, Walkup J, Crystal S, et al. A systematic review of validated methods for identifying depression using administrative data. Pharmacoepidemiology and Drug Safety. 212;21(S1):163-173.
189. Shern DL, Donahues SA, Felton C et al. Partial capitation versus fee-for-service in mental and health care. Health Affairs, 1995;14(3):208-219.
190. Hsiao CJ, Boult C. Effects of quality on outcomes in primary care: a review of the literature. Am J Med Qual. 2008;23:302–310.
191. van Walraven C, Oake N, Jennings A, et al. The association between continuity of care and outcomes: a systematic and critical review. J Eval Clin Pract. 2010;16:947–956.
192. Friedberg MW, Schneider EC, Rosenthal MB, Volpp KG, Werner RM. Association between participation in a multipayer medical home intervention and changes in quality, utilization, and costs of care. JAMA. 2014;311(8):815–25.
193. Patient Centered Primary Care Collaborative. Joint principles of the patient centered medical home. February 2007. http://www.pcmh.ahrq.gov/page/federal-pcmh-activitiesAccessed June 3, 2015.
194. Multi-Payer Advanced Primary Care Practice. Baltimore (http://innovation.cms.gov/initiatives/Multi-Payer-Advanced-Primary-Care-Practice/)
195. Comprehensive Primary Care initiative. Baltimore: Centers for Medicare and Medicaid Services http://innovation.cms.gov/initiatives/Comprehensive-Primary-Care-Initiative/index.html
196. Shanafelt TD, Boone S, Tan L, Dyrbye LN, Sotile W, Satele D, et al. Burnout and satisfaction with worklife balance among US physicians relative to the general US population. Arch Intern Med. 2012;172(18): 1377–85.
197. Petterson SM, Liaw WR, Phillips RL Jr, Rabin DL, Meyers DS, Bazemore AW. Projecting US primary care physician workforce needs: 2010–2025. Ann Fam Med. 2012;10(6):503–9.
198. http://innovation.cms.gov/initiatives/state-innovations/
199. http://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Long-Term-Services-and-Supports/Integrating-Care/Health-Homes/Health-Homes.html
200. David G, Gunnarsson C, Saynisch PA et al. Do patient-centered medical homes reduce emergency department visits? Health Serv Res 2015 Apr;50(2):418-39.
201. Beadles CA, Farley JF, Ellis AR, et al. Do medical homes increase medication adherence for persons with multiple chronic conditions? Med Care 2015 Feb; 53(2):168-76.
202. Liss DT, Fishman PA, Rutter CM et al. Outcomes among chronically ill adults in a medical home prototype. Am J Manag Care. 2013 Oct 1;19(10):e348-58.

9.0 Curriculum Vitae

CLAUDIA SALZBERG

Department of Health Policy and Management

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Baltimore, MD 21205

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EDUCATION

PhD Public Health

Department of Health Policy and Management

Johns Hopkins Bloomberg School of Public Health, September 2015

MSE Computer Science

Department of Computer and Information Science

School of Engineering and Applied Science

University of Pennsylvania, May 1999

BS Biology

Division of Biology and Medicine

Brown University, May 1997

HONORS AND AWARDS

Jan. 2014 - Dec. 2014 Jayne Koskinas Ted Giovanis Foundation for Health Policy Dissertation Support Grant (2014)

Sep. 2011- Aug. 2013 AHRQ-NRSA Trainee Fellowship

Jul. 2011 Best Paper Award First Runner Up - WHITE 2011, Second Annual Workshop on Health IT and Economics.

May 2006 IBM Author Award 2006

RESEARCH AND POLICY EXPERIENCE

Jun. 2013 - present **Research Analyst, Johns Hopkins Bloomberg School of Public Health**

(preceptor Dr. Don Steinwachs)

Performed analysis and management of data for study evaluating the impact of Part D policy on access to drugs for dual-eligibles with severe mental illness.
Performed analysis and management of data for study evaluating the impact of employment programs on health outcomes among patients with severe mental illness.

Jun. 2013 - present **Research Assistant, Johns Hopkins Bloomberg School of Public Health**

(preceptor Dr. Gerard Anderson)

Contributor to Commonwealth funded project to identify Top Ten Policies the US Can Learn From Other Countries
Contributor to Commonwealth funded project to identify successful programs for individuals with multiple chronic conditions.
Contributor to project on using Medicare as a payment standard.

Jun. 2013 - present **Co-Investigator, Center for Patient Safety Research and Practice, Division of General Medicine and Primary Care, Brigham and Women's Hospital**

(preceptor Dr. David Bates)

Co-lead an evaluation of a Patient-Centered Medical Home pilot with novel payment system

Jun. 2013 - Feb. 2014 **Senior Health Care Analyst (Intern)**

National Committee for Quality Alliance (NCQA)

(preceptor Dr. Sarah Schole, VP Research and Analysis)

Conducted research and analysis towards defining barriers and opportunities for Health IT in patient engagement

Aug. 2009 - Dec. 2011 **Lead Analyst**

Center for Patient Safety Research and Practice, Division of General Medicine and Primary Care, Brigham and Women's Hospital

(preceptor Dr. David Bates)

Conducted analysis and management of claims data for MA eHealth Collaborative Economic Evaluation of the correlation of the implementation of Electronic Health Records with health care utilization and costs.

Oct. 2010 - Aug. 2011 **Research Analyst, Department of Clinical Affairs, Partner's Healthcare**

Participated in the development of a pilot program to develop new outcome measures to improve internal assessment of patient-centered healthcare value. This pilot is currently running in two hospitals of the Partners network.

May 2008 - Aug. 2009 **Research Assistant, Center for Patient Safety Research and Practice, Division of General Medicine and Primary Care, Brigham and Women's Hospital**

Conducted literature reviews, chart reviews, data analysis (acquisition, maintenance and management of datasets, basic statistical analysis, table generation), manuscript writing, ACCESS database design, deployment and management, generation of documentation to support dataset interpretation, database usage and development, and project management for the following projects:

Commonwealth Fund National EHR Initiatives Study
Study Goals: Summarize, through interviews with key HIT policy and opinion leaders, the Canadian nearly 10-years HIT policy experience and US experience. Draw comparisons and drive lessons learned for the US and for Canada
Preceptor: David W. Bates

Dissecting the Unintended Consequences of Electronic Prescribing
Study Goals: Characterization of new errors and other unintended consequences that may occur when electronic prescribing is implemented in the community.
Preceptor: David W. Bates, MD, MSc

Medication Error Recovered by Emergency Department Pharmacists
Study Goals: Evaluation of the pharmacist role in the improvement of patient safety in the Emergency Department
Preceptor: David Bates, MD, MSc

Public Health Approach to Screening and Lifestyle Intervention in Uninsured Women
Study Goals: Examination of the impact on women's risk of CVD of an office-based screening lifestyle intervention, Healthy Heart, designed to influence nutrition and fitness lifestyle changes. To examine the impact of Mass Health Care Reform on health and risk of breast, and cervical cancer screening and cardiovascular screening.
Preceptor: Paula Johnson, MD, MPH

Procedural Complications Associated with Attending Physician Extended-Duration Work Shifts
Study Goals: Evaluating the effects of extended work-shifts and fatigue on attending physicians
Preceptor: Jeffrey Rothschild, MD, MPH

Jul. 1998-Jun. 1999 **Research Assistant, Medical Image Processing Group, Department of Radiology, University of Pennsylvania School of Medicine**

Implemented 3D image manipulation software, researched hardware rendering techniques.
Binary Tomography for Triplane Cardiography
Study Goals: To validate the classification of images of certain distribution in order to limit the class of possible solutions for image reconstruction from projections in a class of binary images representing cardiac cross-sections.
Preceptor: Herman Gabor, PhD

TEACHING EXPERIENCE

Jan. 2015 - May 2015 **Lead Teaching Assistant, Johns Hopkins Bloomberg School of Public Health (preceptor Dr. Don Steinwachs)**

Lead teaching assistant for *Introduction to Health Policy and Management (180 students)*

Oct. 2014 **Guest Lecturer, Johns Hopkins Bloomberg School of Public Health (preceptors: Dr. Judith Kasper, Dr. Kitty Chan)**

Advanced Methods in Health Services Research: Research Design and Data Sources

Jun. 2014 - Aug. 2014 **Teaching Assistant, Johns Hopkins Bloomberg School of Public Health**

(preceptor Dr. Gerard Anderson)

Teaching assistant for *Public Health Policy (300 students)*

Jan. 2014 - May 2014 **Teaching Assistant, Johns Hopkins Bloomberg School of Public Health (preceptor Dr. Don Steinwachs)**

Teaching assistant for *Introduction to Health Policy and Management (180 students)*

Jan. 2013 - Mar. 2013 **Teaching Assistant**, **Johns Hopkins Bloomberg School of Public Health**

(preceptor Dr. Jonathan Weiner)

Teaching assistant for *Managed Care and Health Insurance*

Jun. 2009 - Aug. 2009 **Teaching Assistant, Harvard School of Public Health (preceptor Dr. John Orav)**

Teaching assistant for *Biostatistics* summer course. Taught introductory level tutorials and help

sessions for the SAS programming language to students of the Clinical Effectiveness summer program.

PROFESSIONAL EXPERIENCE

Sep. 2006 - Jun. 2008 **Advisory Engineer, Sales and Distribution Group – IBM**

Technical Lead
Served as the main technical contact for Raytheon across the North East, managing and co-architecting multiple large-scale projects.
Identified customer requirements for multi-generational solutions, architects solutions to address these requirements, and provided support for the solution's successful implementation for contracts under the Department of Defense.
Provided feedback to IBM Development and Architecture groups on customer needs and customer interest in technology trends in order to aid in the projection of future product development. Tracked technology trends, roadmaps, and discontinuities.
Made presentations to prospective customers on key technology; provided assessment of solutions and feedback on business prospects
Linux Technical Resource
Linux expert in the support network; Provided support and feedback regarding feasibility of Linux based solutions across all IBM hardware platforms to all members of the Sales and Distribution group.

Jan. 2006 - Oct. 2006 **Technology and Architecture, Systems and Technology Group**

Technical Assistant to Distinguished Engineer and Chief Architect, eServer I/O
Technical Assistant positions are competitive, short-term assignments conferred upon employees selected by IBM executive leadership to compose part of IBM's Top Technical Talent.
Executed strategic analysis of IBM's competitiveness in the systems market - This is a study done across all competitive technology in the I/O server market that is used for strategic projections of IBM's product roadmap.
Co-developed semantics for PCI based I/O Virtualization standards group (PCI-SIG)
Co-created an analysis on the future of digital entertainment
I/O Technical Community council member. Co-authored over 12 patent applications on I/O Virtualization
Co-edited RDMA specification.

Aug. 2004 - Sep. 2006 **Linux Technology Center, Systems and Technology Group**

Team Lead Development Kit
Lead the design and release of the Development Kit, a set of 20 tools including open source debuggers, kernel debuggers, memory profilers, and system profilers. This involved ensuring the complete functionality of each tool across all 5 supported architectures. Addressed any gaps in functionality. Lead a team of 10 programmers and validation engineers.
Oversaw integration testing of the Development Kit and provided feedback for its improvement.

Custom kernel lead
Responsible for defining and customizing a customer tailored Linux kernel and package solution that is implemented internally in IBM products.

Linux Technology Center Patent Review Board Member
Evaluated patent applications for novelty and quality prior to allowing their processing and submission to the US Patent Office.

Mar. 2001 - Aug. 2004 **Microelectronics Division, Systems and Technology Group**

STI (Sony, Toshiba, IBM – Playstation II) Lab lead
Project planning for validation lab infrastructure, build systems, tool deployment, machine and network availability, database design, and partner information exchange mechanisms

PowerPC Systems Validation lead architect BlueControl
Architected and lead implementation of an IBM internal tool designed to support the stress validation automation for IBM PowerPC validation

PowerPC Systems Validation Linux Kernel lead
Ported the Linux Kernel to newly emerging embedded systems for validation purposes, lead the education of the team in the inner workings of the kernel, generated device drivers for newly emerging hardware.

PUBLICATIONS

Books:

Glaser J, **Salzberg C.** *The Strategic Application of Information Technology in Healthcare Organizations*. 3e. Jossey-Bass. March 2011.

Salzberg C, Fischer G, Smolski S. *The Linux Kernel Primer: A Top-Down Approach for x86 and PPC architectures*. Prentice Hall PTR. September 19, 2005.

Technical Editor for *Unix to Linux Porting: A Comprehensive Reference* (Mendoza, et al). Prentice Hall PTR.

Articles and Technical Reports:

Paget L, **Salzberg C**, Scholle SH. Building a Strategy to Leverage Health Information Technology to Support Patient and Family Engagement. Feb. 2014.

Wu AW, Jensen RE, **Salzberg C**, Snyder C. Advances in the Use of Patient Reported Outcome Measures in Electronic Health Records. Nov. 7, 2013

Glaser J, **Salzberg C**. Information Technology for Accountable Care Organizations. Hospitals & Health Networks. Sep. 6, 2010.

Peer-Reviewed Papers:

Adler-Milstein J, **Salzberg C,** Franz C, Orav EJ, Newhouse JP, Bates DW. Effect of electronic health records on health care costs: longitudinal comparative evidence from community practices. *Ann Intern Med*. 2013 Jul 16;159(2):97-104.

Frankel M, Chinitz D, **Salzberg CA**, Reichman K. Sustainable health information exchanges: the role of institutional factors. *Isr J Health Policy Res*. 2013 May 21;2(1):21

Rozenblum R, Lisby M, Hockey PM, Levtzion-Korach O, **Salzberg CA**, Efrati N, Lipstiz S, Bates DW. The patient satisfaction chasm: the gap between hospital management and frontline clinicians. *BMJ Quality and Safety*. 2012 Nov 23

Salzberg CA, Jang Y, Rozenblum R, Zimlichman E, Tamblyn R, Bates DW. Policy inititatives for health information technology: a qualitative study of U.S. expectations and Canada's experience. *International Journal of Medical Informatics*. 2012 Oct;81(10):713-22.

Rudin RS, Schneider EC, Volk LA, Szolovits P, **Salzberg CA**, Simon SR, Bates DW. Simulation suggests that medical group mergers won't undermine the potential utility of health information excahnges. *Health Affairs*. 2012 Mar;31(3):584-59.

Rozenblum R, Lisby M, Hockey PM, Levtizion-Korach O, **Salzberg CA**, Lipsitz S, Bates DW. Uncovering the blind spot of patient satisfaction: an international survey. *BMJ Quality and Safety*. 2011 Nov;20(11):959-65

Zimlichman E, Rozenblum R, **Salzberg CA**, Jang Y, Tamblyn M, Tamblyn R, Bates DW. Lessons from the Canadian national health information technology plan for the United States: opinions of key Canadian experts. *JAMIA*. 2012 May-Jun;19(3):453-9.

Rozenblum R, Jang Y, Zimlichman E, **Salzberg C**, Tamblyn M, Buckeridge D, Forster A, Bates DW Tamblyn R. A qualitative study of Canada's experience with the implementation of electronic health information techonology. *Canadian Medical Association Journal*. 2011 Mar 22;183(5)

Nanji KC, Rothschild JM, **Salzberg C**, Keohane CA, Zigmont K, Devita J, Gandhi TK, Dalal AK, Bates DW, Poon EG. Errors associated with outpatient computerized prescribing systems. *JAMIA*. 2011 Nov-Dec;18(6):767-73.

Rudin RS, **Salzberg CA**, Szolovits P, Volk LA, Simon SR, Bates DW. Care transitions as opportunities for clinicians to sue data exchange services: how often do they occur? *JAMIA* 2011 Nov-Dec;18(6):853-8.

Rothschild JM, Churchill W, Erickson A, Munz Kristin, Schuur JD, **Salzberg CA**, Lewinski D, Shane R, Aazami R, Patka J, Jaggers R, Steffenhagen A, Rough S, Bates DW . Medication Errors Recovered by Emergency Pharmacists. *Annals of Emergency Medicine.* 2009 Oct.

Rothschild JM, Keohane CA, Rogers S, Gardner R, Lipsitz SR, **Salzberg CA**, Yu T, Yoon CS, Williams DH, Wien MF, Cseisler CA, Bates DW, Landrigan CP. Risks of Complications by attending physicians after performing nighttime procedures. *JAMA* 2009 Oct 14;302(14):1565-72

Recio R, **Salzberg C**, Palm J, Machuca C. Leveraging Collaborative Technologies in the IO Requirements Process. 16th *IEEE International Requirements Engineering Conference*; Cataluña, Spain, September, 2008. RE 2008: 283-288

Jagana V, **Salzberg C**, Recio R, Metzler B. A Success Story: Collaborative Effort with the Industry in Addressing Requirements Challenges for Early Adoption of iWARP in Linux. *ICEIS* 2007

Ko M, Recio R, **Salzberg C**. Out of User Space Storage and RDMA. *IEEE International Conference on Cluster Computing* 2006; Barcelona, Spain.

Carvalho BM, Herman GT, Matej S, **Salzberg C**, Vardi E. Binary Tomography for Triplane Cardiography" LNCS (Lecture Notes in Computer Science) 1613, p. 29 ff. *Information Processing in Medical Imaging* 1999: 29-41

Manuscripts in Progress:

Salzberg C, Bitton A, Lipsitz S, Shaykevich S, Newmark L, Kawtra J, Bates DW. The Impact of Alternative Payment in Chronically Ill and Older Patients in the Patient Centered Medical Home

White C, Anderson G, Andersen M, **Salzberg C**. Setting the Standard

Salzberg C, Leff B, Boyd C, Mor K, Anderson

Targeting the high need, high cost population for successful outcomes in care management programs

Salzberg C, Leff B, Boyd C, Wolff J, Anderson G. The denominator is broken

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CONFERENCES

Oct. 2011 **AMIA 2011 Annual Symposium,** Washington, DC October 2011

Poster Presentations:

Zimlichman E, Rozenblum R, Salzberg C, Jang Y, Tamblyn R, Bates DW. "National Initiatives to Implement Health Information Technology in the United States: Perspective of Key Policy Experts."
Salzberg C, Adler-Milstein J, Franz C, Orav ED, Bates DW. "The Impact of Ambulatory Electronic

Health Records on Healthcare Costs".

Jun. 2007 **International Conference on Enterprise Information Systems.** Madeira, Portugal

Poster Presentation:

"Collaborative Effort with the Industry in addressing requirement challenges for early adoption of iWARP in Linux"
Jul. 2006 **IBM Academy of Technology Best Practices Conference**

Speaker.

"Leveraging Collaborative Processes to Generate a Strategic Mission for System I/O Technology"
Apr. 2006 **IBM World Wide Community Symposium.** Atlanta, GA

Speaker

"Systems and Technology Group I/O Architecture and Design Technical Community"
Feb. 2006 **LinuxWorld** Boston, MA

Conference Faculty. Speaker

"Demystifying the Kernel Bootstrap Process"

PROFESSIONAL ACTIVITIES

Aug. 2004 – Jan. 2007 Involvement in community activities

On-site mentor at various Austin Elementary Schools throughout the school year.
Partners in Education, program aimed at increasing minority participation in sciences and engineering.
STEM

PROFESSIONAL ASSOCIATIONS

2012- 2014 Academy Health

2010 - 2011 AMIA – American Medical Informatics Association

2013 – 2014 American Public Health Association

PATENTS

Kehne K., Salzberg C., Smolski S., “Method of performing operational validation with limited CPU use of a communications network”. US Patent No.: 7,392,441 B2. Date of Patent: June 24, 2008
Moertl D., Recio R., Salzberg C., Thurber S., “Apparatus and method for communicating with a memory registration enabled adapter using cached address translations” US Patent No.: 7,587,575 B2. Date of Patent: September 8, 2009
Moertl D., Recio R., Salzberg C., Thurber S., “Communicating with an I/O device using a queue data structure and pre-translated addresses” US Patent No.: 7,590,817 B2. Date of Patent: September 15, 2009
Moertl D., Recio R., Salzberg C., Thurber S., “Splitting endpoint address translation cache management responsibilities between a device driver and device driver services.” US Patent No.: 7,617,377 B2 Date of Patent: November 10, 2009
Kehne K., Salzberg C., Smolski S., “System, apparatus, computer program product for performing operational validation with limited CPU use of a communications network” US Patent No.: 7,624,312 B2. Date of Patent: November 24, 2009
Chakravarty V., Herescu O., Salzberg C., Snider R., “Executing multiple file management operations” US Patent No.: 7,614,007 B2. Date of Patent: November 3, 2009
Kehne K., Salzberg C., Smolski S., “System, apparatus and computer program product for performing functional validation testing” US Patent No.: 7,721,145 B2. Date of Patent: May 18, 2010

SKILLS SUMMARY

Programming/Technology: STATA and SAS statistical packages, C/C++, Perl, Python, SQL, MS Access, MS Excel, Linux, Standard Windows Office applications.

Languages: English (Fluent), Spanish (Fluent)