2017

Affordability, Utilization and Satisfaction with Care: A Policy Context for Improving Health Care Experiences

Anushree M. Vichare
Virginia Commonwealth University

Affordability, Utilization and Satisfaction with Care: A Policy Context for Improving Health Care Experiences

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

by

Anushree Vichare

MPH, Virginia Commonwealth University, 2007

MBBS, MGM Medical College, 2004

Director: Peter Cunningham, Ph.D.
Professor
Department of Health Behavior and Policy

Virginia Commonwealth University
School of Medicine
Richmond, Virginia
June, 2017

Acknowledgements

This dissertation would not have been possible without the guidance and patience of my incredible committee. I would like to express my deepest gratitude for their continued support and for making me a better student and a researcher. I would like to thank my committee Chair, Dr. Peter Cunningham who expertly guided me through this scholarly journey. I will always remain grateful to my mentor, Dr. Lindsay Sabik for her advising, mentorship and unwavering enthusiasm. I am equally indebted to Dr. Bassam Dahman for sharing his knowledge and offering many important lessons that I will always try to implement to better the work I do. I also wish to express my appreciation for Dr. Andrew Barnes for his expertise and meaningful suggestions on the dissertation and his support as the graduate program director. I feel extremely fortunate to have had the opportunity to work with each of my dissertation committee members, who have been instrumental in my success. I would also like to extend my gratitude to the department faculty for their guidance and support and to Kate Grant who has been so very supportive and a great friend throughout this journey.

I have had the good fortune of being surrounded by phenomenal friends, some of whom I have known for a long time and the friends I was lucky to meet during the doctoral journey. My friends have been my biggest cheer-leaders and I cannot thank them enough for their support and encouragement. You know who you are and I will always be grateful to you for giving me the most wonderful memories that I will cherish for a lifetime. I will always remember the fun

conversations over lunch or coffee, the numerous happy hours and the countless hours spent studying together. Thank you for making it such a memorable experience.

I am eternally grateful to my parents and my family for their unconditional love and support. My parents particularly, have made many sacrifices and without them, I wouldn’t have been the person that I am. Finally, I would like to thank the most important person without whom it would have been impossible to successfully defend my dissertation. My husband Pranav, without your support and push to take that GRE exam, I wouldn’t have dared or even dreamed about beginning the journey on this path. You have cheered me on, tolerated my tantrums, celebrated every single milestone, encouraged me during many failures and stood by me like a rock. I will never forget the sacrifices you have made and I cannot thank you enough for staying by my side even on those days when I couldn’t tolerate myself. Thank you so very much!

I am grateful for the opportunity and experience of earning a doctorate from my Alma Mater at VCU. Richmond will always hold a special place in my heart. It was the first city I came to after moving to the US, received my graduate and post-graduate degrees, met my life partner and made some strong friendships for life. Transitions are always hard and I will miss these good times but I am excited for the new beginnings and to see how the future unfolds. I will be a perennial learner!

This study was partially supported under a graduate training fellowship in disparities research from the Susan G. Komen Breast Cancer Foundation (GTDR14302086). The funding institution had no role in the design and conduct of the study, analysis and interpretation of the data or preparation of this dissertation.

Table of Contents

List of Figures

Abstract

AFFORDABILITY, UTILIZATION AND SATISFACTION WITH CARE: A POLICY CONTEXT FOR IMPROVING HEALTH CARE EXPERIENCES

By Anushree Vichare, Ph.D., MPH, MBBS

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

Virginia Commonwealth University, 2017

Director: Peter Cunningham, Ph.D.
Professor, Department of Health Behavior and Policy

Disparate healthcare experiences continue to pose a challenge; vulnerable populations such as low-income and racial and ethnic minorities may not be able to afford or utilize care when needed or receive quality care. The sources of disparities are complex and multi-factorial, which include health care system-level factors such as insurance and health care workforce. It is relatively less known to what extent these contribute to disparities related to a patient's overall health care experience across three important domains – affordability, utilization and satisfaction with care.

This dissertation has three objectives. First, to assess how insurance benefit design affects health care utilization among poorest adults. Second, examine the role of insurance in addressing racial and ethnic disparities in access to preventive care. Finally, examine the role of health care providers in differences related to satisfaction with care among low-income patients.

To answer questions posed in this dissertation, two different types of datasets are used: a unique hospital administrative data from a coverage program for low-income adults and 2008-2014 Medical Expenditure Panel Survey (MEPS). To examine the role of insurance and health care providers in disparities related to different outcomes of patient experience, several models are estimated; including mixed effects linear probability and negative binomial regressions, decomposition and multivariate linear probability models.

Several efforts are being made to address inequalities through coverage expansions, removal of financial barriers for preventive services and incentivizing health care providers to improve patient satisfaction. The findings suggest that differences in utilization and satisfaction with care continue to persist among low-income and racial and ethnic minorities. However, policy levers and system-level reforms including value-based insurance designs that may curb healthcare costs without shifting the cost burden to poorer adults, continued reforms to expand coverage and improve access to a usual of care, and policy interventions that extend beyond improving workforce diversity and enhance provider skills to elicit patient communication preferences may foster positive patient experiences and ameliorate existing disparities. Improving patient experiences of care will thus require policy efforts with a comprehensive multi-level strategy that targets broad sectors – including payers, health care providers and society at large.

Chapter 1: Introduction

In the midst of great technological innovations, medical breakthroughs, and a historic health care reform, the struggle to narrow the gap between disparate health care experiences continues to pose a challenge. Disparities in health and health care in the United States have been a longstanding challenge resulting in some groups receiving less and lower quality health care than others and experiencing poorer health outcomes. Differences between groups in health coverage, access to care and quality of care is typically referred to as a "health care disparity" (Kaiser Family Foundation, 2016). The Institute of Medicine (IOM, 2003) in its landmark report titled; "Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care", defines racial and ethnic disparities as differences that are not due to access-related factors or clinical needs, preferences and appropriateness of interventions. While disparities are commonly viewed through the lens of race and ethnicity, they occur across many dimensions, including socioeconomic status (SES), thus extending the application of IOM's definition of health care disparities across these dimensions as well. A number of groups, including low-income individuals and racial and ethnic minorities are at a disproportionate risk of not receiving timely health care, experiencing the worst health outcomes and being dissatisfied with the health care received (Singh, Siahpush, 2006; AHRQ, 2015).

The sources of disparities are complex and are rooted in inequities that may arise at several but interrelated set of individual, provider, health system and societal factors. A patient's experience of care may include multiple domains including the extent to which care is affordable, timely and of highest quality. The IOM (2001) emphasized the role of patient-centered care and recognized that integration of efforts will be needed at all levels of the health care enterprise; including the patient-provider relationship. They noted six specific aims to make health care safe, effective, patient-centered, timely, efficient, and equitable, which should be achieved regardless of the patients' sociodemographic characteristics. Although the aims have been known and valued for decades among patients, health care professionals, and policy makers, the progress to achieve them has been slow. For over the past decade, there has been increased focus on reducing disparities and a growing set of initiatives to address disparities at the federal, state, community, and provider level. In addition, the Affordable Care Act (ACA; passed in 2010) includes provisions that advance efforts to eliminate disparities possibly through coverage expansions, elimination of copayments for preventive care and incentivizing improvements in patient's satisfaction with care. The ACA's coverage expansions have resulted in notable coverage gains for low- and moderate-income populations and racial and ethnic minorities that have helped narrow differences in coverage rates, but disparities in coverage and quality for these groups remain. As the population becomes increasingly diverse, broad and integrated policy efforts will need to span across the care continuum through interventions at multiple levels – individual patient, health care system, and the society at large.

Based on these theoretical foundations, the goal of this dissertation is three-fold and examines the patient's experience of care across the domains of affordability, adequate access for utilization of health services and receipt of quality care. Through three discrete papers, this dissertation examines two crucial factors and their roles in health care disparities among low-income and racial and ethnic minorities: first how health insurance and its benefit design affects utilization of care including cancer screening and to what extent provider characteristics act as barriers to patient-provider communication.

Specific Aims

Health insurance coverage is one of the most important factors to improve access to care but out-of-pocket costs may influence health seeking behaviors. Over time, cost-sharing has gained popularity as an instrument to curb moral hazard but it could have differential effects among low-income populations. The questions considered in this paper are particularly relevant in the current health policy context as states debate the expansion of Medicaid coverage and consider waivers from traditional Medicaid programs to implement cost-sharing for the poor. The first paper examines a study population of low-income adults who are similar to those likely to gain coverage through Medicaid expansions and subjected to cost-sharing under waivers. It explores variations in cost-sharing to examine differences in health care utilization patterns among those who are fully covered by the program versus enrollees who have to pay a portion of out-of-their pocket.

There is overwhelming evidence suggesting that those who are insured are more than twice as likely to receive timely health care as uninsured, including recommended preventive care such as cancer screening. Although cancer screening rates have increased substantially over time, these gains are not consistent across all population subgroups. The ACA implements several strategies that potentially aim to improve access, including elimination of copayments for preventive care which could potentially reduce differences in cancer screening. The second paper focuses on mammogram screening because this screening modality is covered by insurance, is expensive, and generally required a copayment for most insured patients prior to the ACA. Thus, the paper examines if racial and ethnic disparities in mammogram screening have changed over time and assesses the extent to which insurance coverage explains these differences in the light of the health care reform.

Finally, the role of health care providers is considered in disparities related to satisfaction with care; specifically, patient-provider communication among low-income adults. Debates about improving patient satisfaction have considered the role of increasing the health care workforce's diversity with the motivation that concordance of characteristics such as race/ethnicity and sex may improve patient's overall experience of care. Although the therapeutic relationship of effective patient-provider communication with positive outcomes is well documented; the patient-provider relationship is asymmetrical and complicated due to patient and provider related factors especially among the low-income. The third paper examines the role of this patient-provider relationship and if the concordance of demographic characteristics improves disparities associated with patients' perceptions of satisfaction with their provider's communication.

The following specific aims are addressed:

Aim 1: To examine health care utilization patterns of patients in a plan with no cost-sharing to those enrolled in plans with cost-sharing

HI: Low-income adults in plans with cost-sharing have lower utilization of primary care services than those in a plan without cost-sharing

H2: Low-income adults in plans with cost-sharing have lower utilization of hospital outpatient services than those in a plan without cost-sharing

H3: Low-income adults in plans with cost-sharing have lower utilization of inpatient hospitalizations than those in a plan without cost-sharing

H4: Low-income adults in plans with cost-sharing have lower utilization of emergency department than those in a plan without cost-sharing

Aim 2: To estimate racial and ethnic differences in mammogram screening and examine the extent to which these differences are explained due to differences in insurance coverage

H1: Hispanic women have lower mammogram screening rates compared to Non-Hispanic white and Non-Hispanic black women

H2: Disparities explained by differences in insurance coverage are higher before the passage of ACA compared to after the ACA

Aim 3: To examine if perception of provider communication differs across patients' income levels and if race/ethnicity or sex concordance moderates the association between income and perceptions of provider communication

H1: Perceptions of provider communication are reported to be less positive by low income patients compared to patients with middle and high incomes

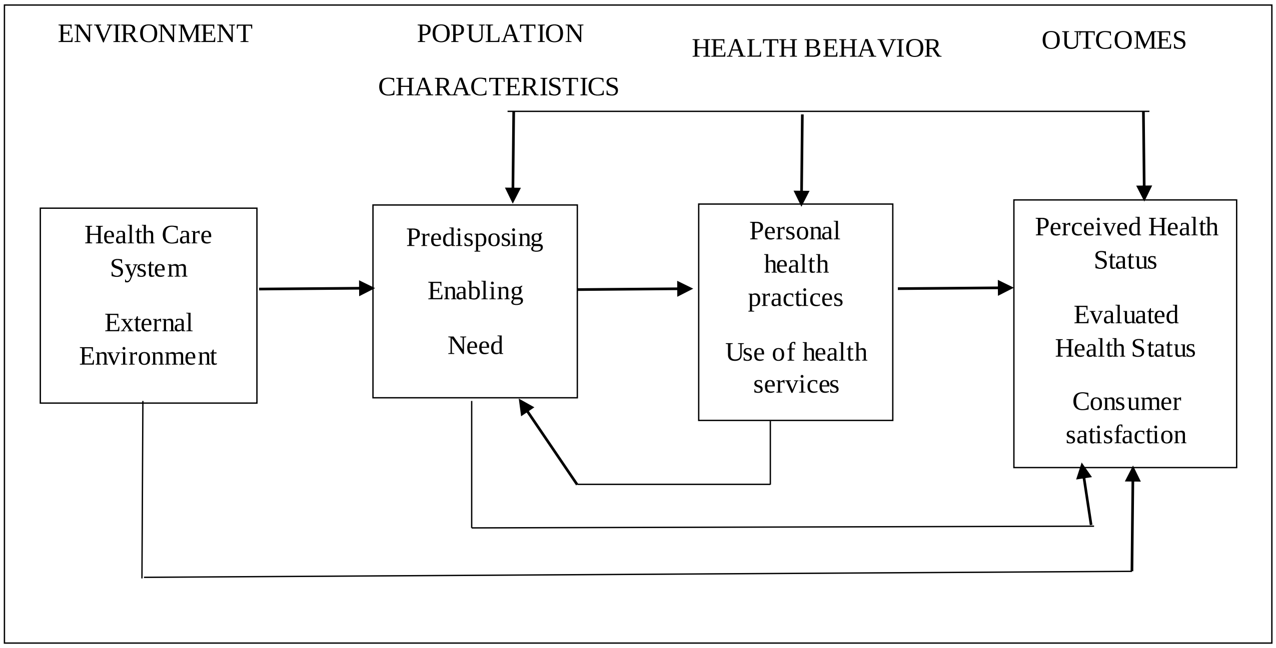
H2: Perceptions of provider communication are reported to be more positive by patients who have racial/ ethnicity or sex concordance with their providers compared to patients who are discordant

H3: In the presence of concordance, low income patients report positive perceptions of their provider's communication compared to middle and high income patients

Conceptual Framework

The papers consider disparities across three separate domains of a patient's experience of care and examine if health coverage and health care providers contribute to the disparities. Although, each paper has its unique conceptual framework, the objectives of this dissertation are guided by the Aday and Andersen behavioral model of health care utilization (Figure 1). The model describes four components (environment, population characteristics, health behavior, and outcomes), which interact and assist in understanding utilization of care. It provides a dynamic understanding of the relationship between each main component and reinforces the interactions among each socio-ecological level. The overarching objective of the dissertation is to examine the environment (health care system and coverage), population characteristics and their role in explaining health seeking behaviors and satisfaction with care.

Figure 1: Theoretical Framework of Health Care Access and Utilization Scope and Approach



Source: Andersen RM. Revisiting the behavioral model and access to medical care: Does it matter? Journal of Health and Social Behavior 1995; 36:1-8

This study will use secondary datasets to test the hypotheses. To answer the first set of questions, data is obtained from hospital administrative data files which include utilization claims as well as enrollment characteristics for patients in a safety-net coverage program for low-income adults. Using a longitudinal analysis, mixed effects linear probability and negative binomial models are estimated to examine the association of cost-sharing with health utilization. The second and third papers use data from 2008-2014 Medical Expenditure Panel Survey. In the second paper, the econometric technique of decomposition is implemented to measure racial and ethnic disparities in breast cancer screening prior to and after the passage of the ACA and examine the contribution of insurance coverage in explaining racial and ethnic differences in breast cancer screening. Finally, multivariate linear probability and logistic regression models are used to assess the role of race and sex concordance on perception of provider communication among low-income patients.

Summary of Remaining Chapters

This chapter provided an overview of the study's specific aims, conceptual framework, and analytical approach. The remainder of this dissertation proceeds as follows. Chapter 2 focuses on the effects of cost-sharing on health care utilization among low-income adults. Chapter 3 examines the role of insurance coverage in racial and ethnic differences in breast cancer screening. Chapter 4 discusses the role of race and sex concordance in satisfaction with patient-provider communication among low-income. Each of these chapters are structured to include sections specific to each study and address background, summary of literature, research questions, conceptual framework, study design and methods and discussions with policy implications. Finally, Chapter 5 summarizes conclusions of the dissertation and its implications.

Chapter 2: Paper I

Cost-sharing and Health Care Utilization Patterns among Low-income Adults: Evidence from a Safety-Net Coverage Program

Abstract

Purpose: To examine the effects of cost-sharing on health care utilization of primary care, hospital outpatient, inpatient hospitalization and emergency department visits among low-income adults in a safety-net coverage program.

Background: Over time, cost-sharing has gained popularity among both private and public insurers, including Medicaid, as a policy instrument to decrease use of unnecessary health care services and curb rising healthcare costs. Many studies have sought to determine how patients alter utilization of healthcare in response to out-of-pocket costs but empirical estimates range from highly inelastic to elastic, thus providing mixed evidence. Additionally, out-of-pocket costs can have differential effects on population sub-groups and can act as a barrier to care especially for those who are low-income. There is increasing interest in the use of cost-sharing within Medicaid through shifts to managed care programs and development of state-level proposals to re-structure cost-sharing in Medicaid. However, little is known about the effect of cost-sharing on healthcare utilization among low-income adults. This study utilizes variations in cost-sharing from a unique coverage program offered to low-income adults and considers its effect on several measures of healthcare utilization.

Methods: The data come from a coverage program called Virginia Coordinated Care for the Uninsured (VCC) which provides coordinated care to eligible low-income adults living in a defined geographic area on the basis of financial screening and residence zip code. Historically, the program served individuals under 200% FPL and had a tiered cost-sharing structure based on the individual’s income level; therefore, the study sample includes adults (21-64 years) enrolled in VCC between 2000-2011. Dependent variables are several measures of utilization created from hospital administrative claims for primary care, hospital outpatient, inpatient hospitalizations and emergency department use. Additionally, patient demographics and enrollment characteristics including the type of cost-sharing plan are obtained from program’s enrollment files. Multivariate mixed effects linear probability and negative binomial models test the association between cost-sharing and utilization measures.

Results: Overall, cost-sharing is associated with a decreased probability of utilizing all healthcare services with largest declines of approximately 30% in the expected number of visits for primary care and emergency department (incidence rate ratio (IRR) = 0.71693; $p<0.01$ and IRR = 0.72969; $p<0.01$, respectively). Additionally, the likelihood of using healthcare services is the lowest for plans with the highest cost-sharing requirements.

Conclusion: The results suggest that low-income adults may alter their healthcare use in response to cost-sharing requirements, irrespective of the type of healthcare service. Thus, patients may not be able to distinguish between essential versus non-essential care which could have potential negative effects on health outcomes. The findings may have policy implications for states

considering waiver programs under Medicaid expansions in terms of identifying optimal levels for implementing cost-sharing without leading to adverse health effects.

Introduction

Health insurance coverage is perhaps the most important enabling factor for the receipt of timely medical care and to maintain continuity of care (Ayanian, Weissman, Schneider, 2000; Eisert, Gabow 2002; Baker, Shapiro, Schur, 2000; Broyles, Narine, Brandt, 2002; Kasper, Giovannini, Hoffman, 2000). However, in the United States (US) disparities in access between the insured and uninsured have continued to persist over the years (Sabik, Dahman 2012; DeLeire et al. 2013). Policy efforts to improve coverage have continued under the Affordable Care Act of 2010 (ACA) through expansions under Medicaid to nearly all adults with incomes at or below 138% of poverty (in states that expand) and tax credits for those who purchase coverage through health insurance exchanges.

While expanding health insurance is one of the key factors to improve access to care, health insurance can give rise to the problem of moral hazard. Moral hazard is said to occur when those insured may consume more of the insured service than they would if they faced the full-price (Pauly, 1968; Cutler, Zeckhauser, 2000). To limit this additional consumption, economic theory suggests the use of cost-sharing as a tool to reduce the effects of full insurance and promote appropriate health care use. Cost-sharing in the form of copayments, co-insurance and deductibles emerged as a demand-side cost-containment policy instrument due to growing concerns of rising health care costs stimulated by increases in health care demand. The assumption for the motivation behind cost-sharing is that when insured individuals are subjected to some financial responsibility at the point-of-service, it shifts a share of health care costs from the insurers to the beneficiaries. Proponents of cost-sharing argue that it can control the use of unnecessary care and subsequently lower health care expenditures and over time out-of-pocket costs have gained popularity among both private and public insurers, including Medicaid.

Cost-sharing in Medicaid and Medicaid Waivers

Cost-sharing in Medicaid, by definition, shifts a share of Medicaid costs from states and the federal government to Medicaid beneficiaries. Although the federal government has set parameters for Medicaid policies, states have flexibility to charge premiums and establish out of pocket requirements for Medicaid enrollees. The Medicaid population is low-income and generally cost-sharing has been nominal and on a targeted basis where states have imposed higher charges based on income cut-offs. Additionally, some states have charged copayments on most Medicaid services that are capped at the "maximum allowable" limits set by the Federal government (MACPAC, 2017).

Historically cost-sharing in Medicaid has been on a limited-basis but there has been growing interest in implementing higher cost-sharing. In 2003, 43 states charged copayments to some or all adult, elderly or disabled Medicaid beneficiaries (Government Accountability Office Report, 2004). In recent years, most states charge cost-sharing for Section 1931 parents in Medicaid and 20 of the 28 states that have expanded Medicaid have cost-sharing for expansion adults (Kaiser Family Foundation, 2015). Additionally, under the ACA a growing number of states are either considering or have already obtained Section 1115 waiver approvals to implement Medicaid expansion in ways that extend beyond the flexibility already provided by federal law (Section 1115 waivers, Medicaid Program). To date, the Centers for Medicare and Medicaid Services (CMS) has approved waivers to implement alternative to standard Medicaid expansion in seven states of which Arkansas, Iowa, Michigan, and Indiana are currently operating their expansions through a Section 1115 waiver (Rosenbaum, Schmucker, Rothenberg, 2016). Although each of the approved and pending expansion waivers is unique, there are some common themes across the waivers. For example, in Michigan, all expansion adults make monthly payments into health accounts based on their average copayments at state plan amounts for services used in the previous six months. Michigan's pending waiver amendment would also require cost-sharing up to 7% of income which is above the Medicaid limit of 5% for those from 101-138% FPL after 48 months of coverage if these beneficiaries did not move to Marketplace premium assistance. Under a separate Section 1916(f) authority, Indiana's Health Insurance Plan (HIP 2.0) has received approval for a two-year demonstration project to test whether graduated copayments ($8 for first visit and $25 for subsequent visits in the same year) discourage non-emergency use of the emergency department (ED). Arizona's pending waiver seeks Section 1916(f) waiver authority to charge co-payments for non-emergency use of ED and missed appointments. As of January 2017, co-payments in Arizona's Medicaid plan ranging from $4 to $10 are required for selected services, including specialist services without a primary-care physician referral (MACPAC, 2016). In addition to the waivers, more states are moving Medicaid coverage under managed care programs with increased patient financial responsibility (Ku et al. 2009; Ku, Steinmetz, 2013).

Although cost-sharing in Medicaid has been nominal, the issues of cost-sharing can be particularly salient for low-income populations who face tighter budget constraints, may be more price sensitive and may have to cut back on healthcare utilization, leading to adverse health consequences (Baicker, Goldman, 2011). Thus, there have been divided opinions that either favor cost-sharing as a mechanism for budget control or criticize it as a financial burden for those who are poor (Saloner, Sabik, Sommers, 2014). As states continue to implement cost-sharing, research examining its effects on healthcare utilization especially among low-income is important to provide insights for policy development.

Cost-sharing and Health Care Utilization

An extensive literature on cost-sharing examines its effects on prescription medication use which suggests decreased utilization due to increases in copayment (Reeder, Nelson, 1985; Stuart, Zacker, 1999; Cunningham, 2002; Lexchin, Grootendorst, 2004). However, relatively fewer studies have examined the association between cost-sharing and health care service utilization. Early evidence comes from the landmark RAND health insurance experiment (HIE) which randomly assigned families to different levels of cost-sharing and out of pocket maximums. The results indicated a price elasticity of -0.2 and showed that higher out of pocket payments significantly reduced health care utilization and led to significant adverse effects among low-income subgroups; particularly in relation to chronic disease management (Manning, Willard, Newhouse, 1987). In a short-run analysis (six-months post-policy change) examining the impact of insurance expansions in Massachusetts, Chandra et al. (2010) estimated elasticities in the range of -0.162 to -0.346 which were similar across service categories that experienced price increases (i.e. prescription drugs and outpatient visits). However, in a subsequent analysis that included a full year pre-and post-policy change data, the researchers found lower overall price elasticity (-0.158) and a substantially lower elasticity among individuals with chronic illness (Chandra, Gruber, McKnight, 2014). Additionally, studies examining the impact of cost-sharing on ED use have found mixed effects. For example, a study examining policy changes in Oregon's Medicaid expansion program (2003) found that increases in copayments for ED use were associated with 50% disenrollment and increases in ED and hospitalizations by the uninsured (Lowe, McConnell, Vogt, 2008). In another study that used self-reported measures of ED utilization for nine-states between 2001-2006 found no effect of copayment on the number of ED visits (Siddique, Roberts, Pollack, 2015). In contrast, examining changes over a 9-year period in state Medicaid copayment policies for ED use, Sabik & Gandhi (2015) estimated that Medicaid ED visits were significantly less likely to be for non-urgent reasons when a state required a copayment for non-urgent visits. Thus, overall previous empirical work examining the association between cost-sharing and healthcare utilization generally suggests that health care demand can be sensitive to cost-sharing but these effects may vary significantly across population subgroups such as the low-income. However, relatively less is known on how cost-sharing could affect non-disabled childless adults who are targeted under Medicaid expansions and are likely to be subjected to out-of-pocket costs. This study examines the association between cost-sharing and health care utilization patterns for primary care, hospital outpatient, inpatient hospitalization and emergency department visits among low-income adults in a safety-net coverage program. It is hypothesized that when low-income adults are subjected to cost-sharing, they may decrease utilization of all types of health care services.

Study Contribution

This study contributes to the nascent literature on cost-sharing among low-income populations by examining utilization in a rather homogenous sample of low-income adults enrolled in a unique safety-net coverage program. The program's breaks in cost-sharing requirements provide a useful source of non-experimental variation that is exploited to evaluate how low-income adults may utilize care when subjected to different levels of out-of-pocket costs. The overall objective is thus to examine health care utilization patterns for a variety of measures including primary care, hospital outpatient, inpatient hospitalization and ED use and compare utilization between patients in a plan with no cost-sharing to those in plans subjected to cost-sharing. It is hypothesized that utilization of all health care services is higher in patients with a no cost-sharing plan compared to a plan with cost-sharing. While cost-sharing may be theoretically sound, its implementation as a tool to curb costs is far more complicated as cost-sharing may have differential effects among the low-income due to differences in cost knowledge, clinical knowledge, autonomy and affordability (Powell, Saloner, Sabik, 2015). Thus, evaluating impacts of cost-sharing among low-income adults will help to better understand risks to patients and inform cost-sharing policies geared towards re-structuring Medicaid.

Conceptual Framework

Extensive literature suggests the profound impact of being uninsured on health outcomes especially among those who are poor and need care. Multiple factors such as age, income level, and race/ethnicity may interact to increase the likelihood of not having coverage making it difficult for certain population subgroups to obtain care. Among these vulnerable populations are poor childless adults, many of whom are not eligible to qualify for Medicaid due to the strict limits on the qualifying criteria (especially in non-expansion Medicaid states) or are not able to afford cost-sharing such as premiums or copayments due to financial constraints. This is also a population that may have greater health care needs due to comorbid conditions; some chronic conditions that either could be avoidable with timely preventive care or need continuous follow-up to reduce complications. The conceptual framework that informs this study is adapted from the Institute of Medicine's report: Coverage Matters (IOM, 2001). It draws on an economic model of insurance status and the impact of out-of-pocket costs on health care demand. Further it is linked to Andersen's model of access to health services which dissects the process of health services delivery and health-related outcomes for individuals (Aday, 1995). Figure 2 describes the model, which has three major components, two of which are being measured in this study: determinants of coverage and the process of obtaining access to health services.

Panel 1 of the model highlights the determinants of coverage at the community and individual level. In this study, the community level determinant comes from the indigent care program that provides assistance to patients whose incomes are <200% of the federal poverty level (FPL) and are not eligible for other forms of health insurance coverage. Panel 2 highlights important characteristics that can influence the process of obtaining health care. Individual level characteristics such as out of pocket payments or cost-sharing play a significant role especially in a financially constrained population. Cost-sharing may deter low-income patients from utilizing outpatient or preventive care and either seek care where it cannot be denied (e.g. ED) or delay/forgo care leading to an inpatient visit. The analyses for this study's aim arise from Panel 1 & 2 to reflect the impact of cost-sharing at the individual level in a coverage program. The hypothesis states that compared to patients in a plan with no cost-sharing, patients enrolled in plans subjected to out-of-pocket costs are less likely to use health care services.

Methods

Study Setting and the Safety-Net Coverage Program

The study setting is a large academic health center (AHC); a major safety-net provider that provides the bulk of care for low-income uninsured patients in urban Richmond, Virginia. The uninsured rate for non-elderly adults in Richmond is approximately 23%, which is higher than Virginia state average uninsured rate. Approximately 26.3% of the population has income <100% FPL and 42% has an income < 138% (Anderson, Skopec, Kenny, 2014). Additionally, low-income adults remain ineligible to qualify under Virginia's Medicaid program which does not currently cover childless adults and is a non-expansion state. This population is of particular interest given the on-going debates about Medicaid expansions as well as the proposals for waiver programs under Medicaid which are likely to receive coverage under these policies and subjected to cost-sharing.

The Virginia Coordinated Care (VCC), a community-based coordinated care program started in November 2000 (Retchin, Garland, Anum, 2009), provides care to uninsured adults living in the Richmond metropolitan area within a 50-mile radius of the AHC. VCC provides assistance to patients who are US citizens with household incomes below 200% of the FPL, meet a financial means asset test and have no other coverage options. Designed on managed care principles, the goals of VCC are to contain costs and improve access to primary care for uninsured patients who frequently sought care through the ED. Thus, the purpose of the VCC program is twofold: (1) to improve the health of the community, and (2) to decrease use of inappropriate services, such as avoidable hospitalizations and ED visits for non-urgent problems (Dow, Bohannan, Garland, 2013). VCC enrollees are assigned to a primary care physician within the VCU hospital or a community-health provider that acts as an access point for routine as well as specialty services. To incentivize community provider participation, primary care providers are reimbursed at fee-for-service rates comparable to approximately 110% of the Medicaid fee schedule in Virginia and also are paid a monthly management fee. The community providers are a crucial and unique feature of this program that facilitate care coordination. A number of elements in VCC mirror managed care plans; most notably a medical home, a network of providers, care managers, and the means for promoting and tracking continuity of care. This potentially could encourage patients to seek timely primary care in outpatient settings. Enrollees however are enrolled for only an initial period of one-year after which they have to go through financial screening to be eligible for reenrollment. Under VCC, there are no premiums for enrollment and no copayments at the point-of-service for any health care visit including visits to the participating community primary care providers. Copayments are however required for prescription drugs. Additionally, VCC transfers some costs to its members in the form of co-insurance which is tiered and based on family income as a percentage of FPL. For example, enrollees with income below 100% FPL are enrolled in plan A with 0% co-insurance for health care visits, which is the plan with majority (more than two thirds) of enrollees. The subsequent four plans cover those between 101% to 200% FPL and co-insurances for each plan are charged on a sliding scale from 5% to 70%, irrespective of the type of health care services (i.e. the co-insurance is the same within a plan for a primary care visit, hospital outpatient visit, inpatient hospitalization and ED visit).

Two prior studies have examined health care patterns using VCC data. First, using preliminary data, Retchin et al. (2009) found that utilization of inpatient hospitalizations and ED visits decreased over a three-year period for those who were assigned to a community primary care provider for at least one month during the study. Secondly, Bradley et al. (2012) examined data from 2000-2007 and determined that for enrollees with continuous enrollment, ED visits and inpatient admissions declined, while primary care visits increased. However, neither study examined variations in cost-sharing across the VCC plans which can provide important insights into health care patterns of low-income non-elderly adults when they are subjected to different out-of-pocket requirements. This can be particularly relevant in the current policy context as the Center for Medicare and Medicaid Services (CMS) and individual states consider waivers with a greater focus on cost-sharing requirements for their Medicaid programs.

Data

VCC is an on-going program that continues to enroll uninsured low-income non-elderly adults but has undergone significant changes since its inception. After 2011, VCC restricted eligibility to only those with incomes <100% FPL and primarily focused on enrolling high utilizers (i.e. chronically ill). Therefore, this study uses data from 2001-2011 for two reasons; first, prior to 2011, the program covered adults with incomes below 200% of FPL thus providing a study sample representing individuals who are likely to gain coverage through Medicaid expansion or waiver programs or who may be eligible for subsidies through the health insurance exchanges under the ACA. Secondly, during this period, VCC plans had more variability in their cost-sharing requirements which facilitates comparison of utilization across co-insurance levels. Data are obtained for VCC patients who used health care services at VCU Medical Center's outpatient clinics, inpatient settings, ED or at the community-based primary care providers participating in the program. Demographic information such as age, race/ethnicity and gender as well as enrollment characteristics such as type of VCC plan and the start and end dates of the enrollment are obtained from the enrollment files, whereas utilization was captured using hospital encounter data. Since patients had multiple enrollments, to ensure that utilization is captured for the appropriate enrollment period, the analytic dataset is created by linking the enrollment and encounter data using an indicator constructed with a combination of patient's ID and the start and end dates for the plan they are enrolled in during that specific enrollment period.

Study Population

The study population is patients 21-64 years of age who are enrolled in the VCC program during 2001-2011, have family incomes < 200% FPL, reside in the Richmond area, are uninsured and have no other coverage options. Enrollment period is identified using the start date and end dates of coverage using the enrollment files. To examine health care utilization patterns, only those enrollees with at least 30-days of continuous enrollment are included to allow exposure to the coverage program. A total of 78,654 patients enrolled in the VCC program during the study period, and approximately half of the people have multiple enrollments, thus there are 178,770 patient-enrollments. Exclusion criteria are applied at the enrollment level (appendix table A). Thus, observations are excluded if age of the enrollee is less than 21 years or greater than 64 years during enrollment, the enrollment year is prior to 2001 or after 2011 and if the enrollment term is less than 30 days. Additionally, observations with missing gender, race and type of plan are also excluded from the study. Finally, 122 observations with duplicate enrollment start dates for the same patient are also deleted. Thus, the final study sample is 141,072 patient-enrollments for 64,924 unique patients.

Study Variables

To examine the research questions posed in this study, different variables relating to utilization (table 1) are examined and factors that can impact health care utilization are included based on the conceptual framework.

Dependent Variables

A number of variables are constructed using appropriate procedure and diagnosis codes to measure utilization of health care services; including number of visits in a variety of locations (Bradley, Gandhi, Neumark, 2012; DeLeire, Dague, Leininger, 2013; Burns, Dague, DeLeire, 2014). A visit is defined as primary care if there is a claim by a primary care provider in the community. A hospital outpatient visit includes claims obtained from the hospital outpatient and ambulatory care center as well as those from specialist visits from the community files. Visits are identified in the claim as inpatient hospitalization, however, only those where the length of stay is more than a day are counted towards inpatient utilization. Finally, claims for ED visits are obtained from the hospital files where the visit type is identified as occurring in the emergency room.

First, a binary variable is created for each type of visit and identifies if the enrollee had any primary care, hospital outpatient, inpatient or ED visit during their enrollment in VCC.

Additionally, primary care, hospital outpatient, inpatient and hospital ED visits are also measured as the number of encounters per patient per enrollment period (i.e. as count variables). Each unique visit within a day is identified using visit ID and admit date or date of service and contributes to the number of specific visits per enrollment period.

Explanatory Variable

The primary explanatory variable is an indicator of the type of plan. In VCC, cost-sharing is included in the form of co-insurance, where only one plan has 0% co-insurance and the remaining four plans have co-insurance of either 5%, 20%, 45% or 70% depending on the patient's family income. Since majority of the enrollees over the study period are in the no-cost-sharing plan (appendix table B), to obtain adequate sample sizes for the primary analysis, the cost-sharing variable is specified as a binary indicator of whether there is no cost-sharing versus cost-sharing (which combines the remaining four plans with some percentage of co-insurance). However, to test the sensitivity of the results, utilization is also examined across the different tiers of co-insurance.

Control variables

The control variables are primarily predisposing factors that influence use of health care services and these demographic characteristics are obtained from the enrollment files. Age and race are specified as categorical variables, while patient gender is binary. Several variables are created to describe enrollment characteristics including an indicator for whether it is the first enrollment in VCC and the total length of enrollment in days. After the initial one-year period of enrollment, it is likely that patients that re-enrolled either stayed in the same plan or move to a different plan. For example, patient A in the first year of enrollment could be in a plan with cost-sharing but on reenrollment could be eligible for plan without cost-sharing, and vice versa. To capture the effect of being in different cost-sharing plans during enrollment, an indicator is created to identify if the plan is the same as the one from a previous enrollment or if the patient switched plans. Finally, ICD-9 diagnostic codes from the claims are used to create a measure to indicate the patient's health status and a categorical variable captures the presence of one or more common chronic conditions. These conditions include diabetes, cancer, chronic obstructive pulmonary disease (COPD), emphysema, heart problems, hypertension, stroke, asthma and mental health conditions using definitions from Goldman et al. (2004). This method of measuring health status has been used and validated in other studies of cost-sharing (Chandra, Gruber, McKnight, 2014; De Leire, 2013).

Analytic Approach

This study's aim is to examine health care utilization patterns for ED visits, inpatient hospitalizations, hospital outpatient visits and primary care visits between patients in a plan with no cost-sharing to those enrolled in plans with cost-sharing. To examine the association between cost-sharing and each type of health care utilization among low-income adults, multivariate regression models with the following generalized specification are used:

$$Y_{it} = \beta_0 + \beta_1 Cost\_Sharing_{it} + X_{it}\,\beta_2 + \alpha_{it}\;\beta_3 + u_{it} + \epsilon_{it}$$

where Y_{it} is an indicator for either a binary specification for having at least one visit for each type of health care service or a number (count) of encounter visits in hospital outpatient, primary care, inpatient or ED settings for patient i and time at t. Separate regression models are implemented for each of the four different types of healthcare services, i.e. primary care, hospital outpatient, inpatient hospitalizations and ED visits. $Cost\_sharing_{it}$ is either an indicator variable with a value of 0 for enrollees in a plan with no cost-sharing and 1 for plans with cost-sharing or a categorical variable where 0 = no co-insurance, 1 = 5% co-insurance, 2 = 20% co-insurance, 3 = 45% co-insurance and 4 = 70% co-insurance. X_{it} is a vector that includes patient characteristics such as age, gender, race and health status/ comorbidities, α_{it} is a vector for enrollment characteristics and includes length of enrollment in days as well as indicators for whether or not it is the first enrollment and whether the patient remained in the same plan or switched plans during their enrollment in VCC. u_{it} is the error term for between-patient whereas ϵ_{it} represents the within-patient error term. The coefficient of interest is β_1 which estimates the difference in the utilization of each health service between the plan without cost-sharing and the plans with cost-sharing. Thus, for the binary specification of the dependent variables it estimates the difference in the utilization or the marginal effect of cost-sharing on utilization. Similarly, for the count models (i.e. dependent variable is the number of visits), the coefficients represent the expected change in log counts for the type of visit when there is cost-sharing.

The analysis is conducted in two phases. First, descriptive statistics are implemented to examine sample demographics between the no cost-sharing and cost-sharing groups. Chi-square tests examine differences in proportions for categorical variables and t-test compares means between the plans with and without cost-sharing. To test if probabilities of using hospital outpatient, primary care, ED and inpatient are different between the cost-sharing and no cost-sharing plans, multivariate regression models are implemented. Mixed effects linear probability models examine differences in utilization between no cost-sharing and cost-sharing for the binary variables of having at least one primary care, hospital outpatient, inpatient hospitalization and ED visit. For the count dependent variables (i.e. number of hospital outpatient, primary care, inpatient hospitalizations and ED visits), several combinations of regression models appropriate for count variables are implemented including a mixed effects Poisson and a mixed effects Negative Binomial model. However, distributions of the count dependent variables (i.e. number of visits) suggests variances larger than mean and to account for the over-dispersion, negative binomial models are preferred over Poisson models.

To test the sensitivity of the results, various additional analyses are implemented. First, the association between cost-sharing and healthcare use is also examined across the different co-insurance tiers in the VCC plans. Second, data on chronic conditions captured through ICD-9 diagnosis codes is limited to only those patients who utilized care during their enrollment in VCC. However, since the goal of the analysis is to examine the association of cost-sharing with health care utilization, two separate analytic samples are created. The main results are presented on the sample (referred to as the full sample) where the indicator for chronic conditions is set to zero with the assumption that if a patient has not utilized care, it is likely that the patient does not have a chronic health condition. The robustness of the results is further examined by implementing regression models by restricting the sample to those who have data on chronic conditions. Third, results are compared across various models, for example, marginal effects are compared between linear probability and logistic regression models for the dichotomous dependent variable of having any (at least one) primary care, hospital outpatient, inpatient hospitalization and ED use. Finally, the association of cost-sharing with the appropriateness of ED use is examined across urgent versus non-urgent categories using New York University Emergency Department Algorithm, developed by John Billings and colleagues and validated by Dustin Ballard and colleagues (Billings, Parikh, Mijanovich, 2000). All analysis is conducted using SAS 9.1.3 (SAS Institute, Cary, NC, USA) and STATA 14 (64-bit) statistical packages.

Results

Enrollee Demographics and Enrollment Characteristics

In the study sample, approximately 65,000 patients are enrolled between 2001 and 2011; the mean age is 43 years (+/-11.72) and more than half (54%) are females. More than two-thirds (63%) are African Americans reflecting the demographic composition of urban central Virginia. Approximately, 47% of patients have multiple enrollments, where the mean enrollment term is 763 days and majority (47%) are enrolled for a one-year period. Three-fourths of the study sample (75%) is enrolled in a plan without cost-sharing and the remaining 25% is enrolled in a plan with cost-sharing (co-insurance) of 5% or higher (appendix table B).

Enrollee characteristics by cost-sharing plans

Table 2 presents the distribution of the sample characteristics across cost-sharing plans. More than half the sample is in the 35-54 age group and are African Americans across both groups but cost-sharing plans have a significantly higher number of females (68% vs. 55%, $p < 0.01$). There is no significant difference in the health status of the enrollees between the plans; but hypertension and diabetes are the most prevalent chronic conditions and approximately 12% of the enrollees have asthma and cancer. In this sample, mental health issues are more common among enrollees in the no cost-sharing plan compared to the plans with cost-sharing (28% vs. 21% respectively). Enrollment characteristics differ between the two groups, where the mean enrollment length (in days) is higher in the plan without cost-sharing and more than two-thirds of the sample in the cost-sharing plan switched plans during their enrollment in VCC. Sample characteristics are also compared across the co-insurance levels (appendix table C). As expected, there are significant differences in the enrollment characteristics between the cost-sharing plans; in this sample, the mean length of enrollment and the percent of multiple enrollments is found to decrease as the co-insurance level increases. However, as the co-insurance levels increases, it is associated with a decrease in the percent of those with multiple enrollments in VCC (54% in 0% co-insurance compared to 48% in 70% co-insurance).

Healthcare utilization

Healthcare utilization is measured as having any visit by service type and also the average numbers of visits for each type of service at the per patient per enrollment level. Overall, 68% of the enrollees utilize some form of healthcare service, while the remaining 32% did not use any healthcare even though they were enrolled in the VCC program. Among those who did not utilize any service, there is no statistical difference in their enrollment by cost-sharing. However, as cost-sharing increases, the share of non-utilizers also increases. Each type of health care use (i.e. having at least one visit to primary care, hospital outpatient, inpatient and ED) is more likely in the no cost-sharing plan. For example, 41% of the enrollees in plans without cost-sharing have at least one visit to a primary care physician compared to 35% in the plans with cost-sharing ($p < 0.01$). In this study's sample, among enrollees in the plan without cost-sharing, the average number of hospital outpatient visits is 3.3, while the average number of primary care visits is 1.6 compared to significantly lower visits among those enrolled in plans with cost-sharing (2.7 and 1.1, respectively; $p < 0.01$). Average number of inpatient hospitalizations are also significantly higher for plans without cost-sharing compared to the plans with cost-sharing (0.98, 0.67; $p<0.01$). Thus, all measures of utilization are higher for those with no cost-sharing.

Regression Results

Summary of the coefficients on cost-sharing across the various measures of utilization are presented in the tables 3 and 4, while the full set of regression results are available in the appendix tables D.1 – D.2. Overall, when the association between cost-sharing and utilization is considered, cost-sharing is associated with statistically significant decreases in all measures of utilization. In the first set of regression results (table 3), the association between cost-sharing and the binary utilization variable, i.e. having at least one primary care, hospital outpatient, inpatient and an ED visit is considered and presented as marginal effects. Specifically, having cost-sharing is associated with a 5-percentage point decrease in the probability of having any primary care visit and a 5.7-percentage point decrease in the probability of having a ED visit. While cost-sharing is associated with a lower probability of a hospital outpatient visit and inpatient hospitalization, the magnitude of these estimates is relatively smaller compared to those for primary care and ED visits (2.8 and 1.6-percentage points, respectively). The marginal effects remain generally comparable in direction and magnitude between the mixed effects linear probability and logistic regression models.

The next set of results examines the association between cost-sharing and the number of visits per patient-enrollment for each type of care setting. Table 4, includes the summary of coefficients from the mixed effects models using negative binomial estimation and are presented in several forms for interpretation, where estimates in Panel A are the expected log counts for each visit type and the coefficients in Panel B are incidence rate ratios for the expected number of visits. Overall, cost-sharing is associated with a significantly lower expected number of visits for all types of health care services. The findings suggest that the magnitude of the association between cost-sharing and number of visits is the largest for primary care and ED. For example, cost-sharing is associated with a decline in the expected number of primary care visits and ED visits by approximately 30% (incidence rate ratio (IRR) = 0.71693; $p<0.01$ and IRR = 0.72969; $p<0.01$, respectively). Additionally, cost-sharing is associated with a decrease in the expected number of hospital outpatient visits and inpatient hospitalizations by 21% (IRR = 0.79372; $p<0.01$) and 25% (IRR = 0.74612; $p<0.01$) respectively.

Finally, the association between the different levels of co-insurance, i.e. 0%, 20%, 45%, and 70% in the VCC plans with healthcare utilization is examined. Summary of coefficients from linear probability models are presented in Table 5 and the estimates from the mixed effects negative binomial model for the count dependent variables are presented in Table 6. Full sets of regression results are available in Appendix Tables E.1 and E.2. The first set of results (table 5) considers the association between co-insurance levels and the likelihood of having at least one primary care, outpatient care, inpatient hospitalization and ED visit during enrollment in VCC. A 5% co-insurance is associated with a 3.1 percentage point decrease in having any primary care visit, whereas a 70% co-insurance is associated with a significantly larger decrease (6.1 percentage point) in having any primary care visit compared to a plan with 0% co-insurance. Similarly, as percentage of co-insurance increases it is associated with decreases in ED visits (4.8 percentage points at 5% co-insurance and 7.1 percentage points at 70% co-insurance). The pattern of association between co-insurance and hospital outpatient visits is also similar to primary care and ED, where increases in co-insurance levels are associated with a decreasing probability of having a visit. However, this pattern is not observed for inpatient hospitalizations. While enrollment in a 20% or a 45% co-insurance plan is associated with an approximately 1.7 percentage point decrease in inpatient hospitalizations, co-insurance of 70% is associated with a comparatively smaller decrease of 1.1 percentage points (these results were not statistically significant). Thus, generally as co-insurance levels increase it is associated with a decreased probability of having a visit and the largest declines are for plans with 45% and 70% co-insurance. However, Wald tests suggest no statistical difference in the marginal predictions of having a visit between a 5% and a 20% co-insurance plan regardless of the type of service.

Further, regression models are implemented to examine the association between the co-insurance levels in the VCC plans and the expected number of visits for each health care service (table 6). As co-insurance increases from a 0% - 70% it is associated with a decrease in the expected number of visits for all types of services; where predicted number of visits are the lowest for the highest cost-sharing tier. Increasing levels of co-insurance are associated with the largest declines in the expected number of visits for primary care and ED. For example, compared to having no co-insurance, a 5% co-insurance is associated with an expected reduction in the number of primary care visits by 19%, while 70% co-insurance is associated with a 38% decrease in the expected number of primary care visits (IRR = 0.80503, IRR = 0.6117 respectively, p =0.002). Similarly, a 20% co-insurance is associated with a 28% decrease in expected number of ED visits while a 70% co-insurance is associated with a significant decrease of almost 40% in the expected number of ED visits. Finally, decreases in the expected number visits are not statistically different between 5% and 20% co-insurance plans except for number of primary care visits.

Robustness Checks

As indicated previously, since data on chronic conditions is extracted using hospital administrative files, it is only available for those patients who utilized care while enrolled in VCC. In the main analysis, chronic conditions are set to zero on the assumption that if patients did not utilize care, they are less likely to have a chronic condition. However, to test the robustness of the results, additional models are considered by restricting the sample to patients with data on chronic conditions, i.e. those who appeared in the hospital administrative files. The full regression results from the mixed effects linear probability models for the binary visit variable and the negative binomial models for the count visit variable using both the binary and categorical specifications for cost-sharing are presented in appendix tables F.1, F.2, F.3 and F.4. Generally, the results from regression models implemented on the restricted sample remain robust and suggest that cost-sharing is associated with a decrease in utilization for all types of health care visits. Additionally, as co-insurance within VCC increases, it is associated with a reduction in both the probability of having a visit as well as the expected number of visits for all types of health care services considered in this study. Finally, although cost-sharing is associated with decrease in the non-urgent ED use, these results were not statistically significant (appendix table G).

Discussion

Improving access to care through coverage expansions is crucial but there is mixed evidence on how low-income adults may alter their healthcare utilization in response to cost-sharing. This study utilizes a unique dataset from a coverage program for low-income adults with family incomes below 200% FPL who are subjected to varying degrees of out-of-pocket costs based on financial eligibility. While the enrollees generally do not have copayments for health care visits, they are responsible for a co-insurance ranging from 0%-70% on a sliding income scale. Thus, variations in co-insurance and its association with healthcare utilization is explored for different healthcare utilization measures including primary care, hospital outpatient care, inpatient hospitalization and ED visits among low-income adults. Overall, findings suggest that cost-sharing is associated with a decrease in health care utilization regardless of the type of healthcare service. These findings are consistent with previous studies including the RAND HIE which suggest that increases in copayments are associated with overall decreases in utilization. The consistent negative association in this study between cost-sharing and healthcare use suggests that individuals' price-sensitivity to cost-sharing is less likely to be influenced by the type of service and consumers may be fairly elastic when subjected to out-of-pockets. The use of cost-sharing as a tool to curb costs especially in Medicaid suggests that Medicaid beneficiaries are likely using healthcare services at greater rates than those with private insurance. However, research suggests that there are no significant differences in the number of doctor visits, ED visits or hospital stays between Medicaid beneficiaries and those with private insurance (Long, Coughlin, King, 2005; Hadley, Holahan, 2003). Thus, cost-sharing in low-income may in fact act as a deterrent to using health care when it is needed and as states consider cost-sharing policies in Medicaid and as low-income individuals are subjected to out-of-pockets, several considerations will have to be made to ensure that it does not act as a barrier to care.

In this study, cost-sharing is associated with largest declines for primary care and ED visits, likely suggesting that patients may lower all services, contrary to the assumption that cost-sharing simply causes people to eliminate or reduce utilization of less effective care. In fact, when subjected to out-of-pocket costs, low-income patients may reduce both effective and less effective care leading to adverse health consequences (Goldman et al. 2003). Additionally, the finding that cost-sharing is associated with a decline in primary care visits is disconcerting. Access to primary care is the cornerstone for building a strong healthcare system that ensures positive health outcomes and maintains continuity of care (Shi, 2012). This is particularly relevant for those who are low-income and have chronic conditions; two groups that should have access to health care when needed to avoid adverse health consequences (Newhouse, 1993). As states consider cost-sharing strategies, most likely one size does not fit all when it comes to Medicaid and both traditional and new approaches such as value-based insurance design that can exist side-by-side could be considered without imposing a financial risk to low-income patients. Currently, Medicaid programs implement cost-sharing primarily in the form of fixed copayments which are incurred by the patient at the time of a visit. However, cost-sharing in the form of co-insurance or deductibles are likely to deter low-income patients even further from utilizing care due to the nontransparency of health care prices and the fear of not knowing the cost incurred. Thus, the findings from this study which examines co-insurance levels may in fact be conservative estimates of the true effect of cost-sharing on health care use among low-income patients. As value-based insurance designs are considered, it will be important to identify policy solutions that on one hand can curb moral hazard but do not act as a financial barrier, especially for poor patients.

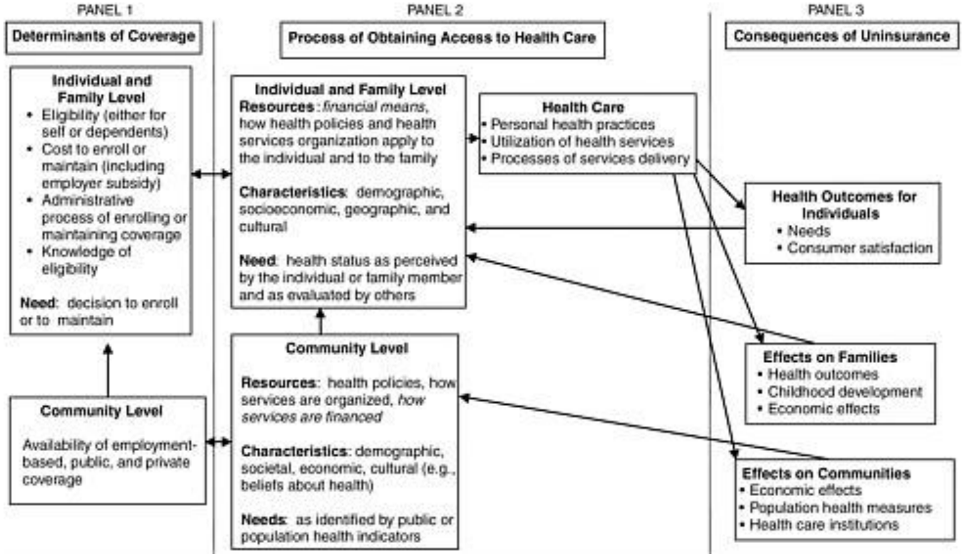
Low-income populations face tight budget constraints and even nominal amounts of cost-sharing could act as a barrier to care, where they have to make decisions to either delay or forgo the needed care (Ku, Deschamps, Hilman, 2004). Over time, many states have increased copayment requirements and Medicaid beneficiaries may actually spend a considerably larger share of their incomes on out-of-pocket medical expenses than do middle-class people with private health insurance (Ku, Broaddus, 2005). Low-income adults in this study are subjected to cost-sharing that ranges from 0%-70% and increasing levels of co-insurance are associated with decreasing probability of utilizing all types of care. While a co-insurance of 45% and 70% is associated with largest declines in utilizing health care, no statistical difference is found between utilization for a 5% versus a 20% co-insurance plan. As states experiment with re-structuring cost-sharing in Medicaid, it will be important to identify optimal levels of cost-sharing so that, on one hand, it can function as an effective tool to curb moral hazard and on the other, it does not lead to adverse effects due to not utilizing care. Thus one approach has been the use of value-based insurance design which is built on the premise that cost-sharing structures are determined

This data explored a longitudinal analysis but less than-half of the patients re-enrolled in the program and it is likely that a shorter exposure to the program may not allow patients to understand complexities of cost-sharing. One challenge of Medicaid as a means-tested program is the churning of the enrollees in and out of the program based on income eligibility leading to discontinuity of care. Enrollment characteristics could be an important determinant in how patients utilize care, where it can be expected that those who are enrolled longer are more likely to utilize effective care and are more likely to understand cost-sharing requirements to make informed decisions. Indeed, in a previous analysis by Bradley et al. (2012) found that more effective use of clinical services may take a while due to a learning curve in navigating the healthcare system or changing health-seeking behaviors. Thus, as individuals gain coverages, substantial challenges remain; first the newly insured will need to navigate the health system, second gain knowledge of the complicated health insurance process, third make decisions about differentiating necessary beneficial care from unnecessary care.

The provision of health care to low-income patients has been studied in a variety of different contexts, especially with respect to utilization and outcomes for these patients. This study provides a unique opportunity to delve into one such program that transforms episodic, on-demand care into coordinated care low-income adults using managed care principles. However, the findings of this study should be viewed in light of its limitations. First, given that the data come from a single study setting that is a safety-net provider, generalizability may be limited. However, the bulk of care to the uninsured low-income patients is provided through safety net hospitals, AHC’s and community-based programs. Additionally, the study setting is the largest safety-net hospital in Virginia that caters to majority of the low-income uninsured population in and around the inner city. The enrollees in the study are low-income non-elderly adults who would likely gain coverage if states considered Medicaid expansions, through the waiver programs and are most likely to be subjected to cost-sharing. Thus, examining health care utilization patterns across cost-sharing levels in VCC informs policy efforts on structuring optimal cost-sharing levels for low-income adults. Second, due to the observational nature of the study design and unavailability of the income data, only an association between cost-sharing and health care utilization is examined and causality cannot be established. Additionally, since assignment to a cost-sharing plan in VCC is based on a patient's income level, it likely that some amount of selection bias may exist. For example, patients with the lowest incomes and in a zero cost-sharing plan could have the poorest health status and therefore utilize more care which may overestimate the effect of zero cost-sharing. Although, health status is used as a control variable in all models, without a comparison group or random assignment of the patients to cost-sharing plans, it is challenging to isolate the effect of cost-sharing from the effect of income on health care utilization. Future studies may use alternative study designs to either randomize the assignment into the cost-sharing groups which can be a challenging natural experiment or utilize administrative income data to identify comparison groups. Third, the study data does not capture care that enrollees may have possibly used outside of VCC and the medical center. However, since the low-income adults in VCC have some coverage for healthcare services through the program and do not have any other coverage it is likely that most healthcare utilization for this population is captured. Additionally, VCC partners with a large network of community providers and majority are familiar with the VCC program. Therefore, patients going outside the program are often referred back to VCC for care. Fourth, unobserved characteristics that can influence health care utilization patterns (e.g. prior utilization patterns) could not be accounted as data is available only after enrollment in VCC. However, majority of the individuals have multiple years of enrollment data which lends itself to the examination of health care utilization patterns over a period of time.

As states continue to explore innovative models to improve access to the low-income uninsured adults, policy-makers and program administrators have little time to observe current patterns of care among the newly insured and identify strategies that can increase the likelihood of gaining coverage and improving access. The VCC program offers an established setting from which policy makers can make inferences on health seeking behaviors and response to cost-sharing in a low-income population. The largest coverage expansions under the ACA either through the Medicaid expansions and waivers or subsidies in the health insurance marketplaces, aim to increase access to care but there remains a gap to understand the role of cost-sharing in influencing health care utilization among the low-income adults when they gain insurance coverage. Among the poorest adults who are faced with constrained budgets and often lack sufficient information to choose the most effective medical treatment, cost-sharing could have adverse effects. It is likely that the estimates from this study are rather conservative due to the relatively less-strict cost-sharing implemented under VCC. Thus, it can be expected that cost-sharing could have potentially larger effects on utilization when it is implemented in private and public health insurances. Thus, the findings of this study may have important policy implications as states consider alternate Medicaid expansion models that include sharing financial burden between the state and the beneficiary. As more states develop and implement new approaches to structuring Medicaid and delivering care to low-income populations, ongoing objective research will be critical in determining what works for whom and under what conditions.

Figure 2: Institute of Medicine's Conceptual Framework for Evaluating the Consequences of Un-insurance (2001)



Reference: Institute of Medicine. Coverage Matters: Insurance and Health Care. Washington, D.C.: National Academies Press; 2001.

Table 1: Key Study Variables

Measure	Operational Definition	Type of Variable	Variable Description	Data Source
		Dependent Variables		
Primary care visit (PCP)	At least one visit to a primary care provider	Binary PCP visit No PCP visit	PCP visit claim with unique visit ID and date of service	Community claims
Number of primary care visits	Number of visits to a primary care provider	Count	Average primary care claims per patient per enrollment	Community claims
Hospital Outpatient visit (OP)	At least one hospital outpatient visit (including specialist care but excluding emergency care)	Binary OP visit No OP visit	Count as hospital OP visit if claim with pt_type is outpatient or ambulatory or prov_type in community in specialist	VCC MCVP + MCVH + Community claims
Total number of outpatient visits	Number of outpatient visits per patient-enrollment	Count	Average outpatient claims per unique service date per provider/ day	VCC MCVP + MCVH + Community claims
Any emergency department visit	At least one emergency department (ED) visit	Binary Yes, ED visit No, ED visit	Count as ED visit if claim with pt_type as emergency department	MCVP + MCVH
Total number of ED visits	Number of ED visits per patient-enrollment	Count	Average ED visit claims with pt_type as emergency department per unique service date per provider/ day	MCVH + MCVP
Type of ED visit	Is ED visit emergent or non-emergent using NYU algorithm using four categories; non-emergent, emergent/primary care treatable, emergent-ED care needed preventable/avoidable, emergent-ED care needed not preventable/avoidable	Binary Emergent Non-emergent	If pt_type is ED then use discharge code/primary diagnosis code/patient discharge disposition for algorithm	MCVH + MCVP

Any inpatient hospital (IP) stay	At least one inpatient hospital admission where length of stay is at least 1 day	Binary Yes, IP No, IP	Count as IP admission if LOS > = 1 and pt_type in claim is inpatient	MCVH
Total number of inpatient hospitalizations	Number of inpatient hospitalizations per patient-enrollment	Count	Average inpatient claims per unique service date per provider/ day identified if pt_type is inpatient	VCC MCVH + MCVP
		Explanatory Variable		
VCC plan type	Type of cost-sharing (CS) plan under VCC, i.e. no cost-sharing (0% co-insurance) and cost-sharing (plans with 5% - 70% co-insurance)	Binary No cost-sharing Cost-sharing Categorical 0% co-insurance 5% co-insurance 20% co-insurance 45% co-insurance 70% co-insurance	Identified using PLAN	VCC enrollment
		Control Variables		
Age	Patient’s age at enrollment	Categorical 21-34 years 35- 54 years 55- 64 years	Age_at_Effective_Date	VCC enrollment
Gender	Reported male or female	Binary Male Female	Gender	VCC enrollment
Race	Reported race/ethnicity	Categorical White Black Other	Race	VCC enrollment

Health Status	Indicator for presence of one or more chronic conditions; hypertension, diabetes, high cholesterol, asthma, arthritis, affective disorders (e.g. depression, bipolar disorder, and anxiety disorder), gastritis	Categorical 0 comorbidity 1 comorbidity 2 comorbidities 3 or more comorbidities	Unique ICD-9 diagnosis codes for the common chronic conditions	MCVH + MCVP
Length of enrollment	Number of days per enrollment	Continuous	Calculated by effective date – termination date	VCC enrollment
VCC plan change	For patients enrolled more than one term, capture change in plan type from no cost-sharing to some cost-sharing OR some cost-sharing to no cost-sharing	Binary No change in plan Switched plans	PLAN	VCC enrollment

Table 2: Sample Characteristics by Cost-Sharing

	No cost-sharing (0% co-insurance) n = 105,297	Cost-sharing [a] (5-75% co-insurance) n = 35,775	p-value[b]
Demographic characteristics			
Female (%)	54.9	67.9	***
Age, years (%)			
Age 21-34	27.3	25.9	***
Age 35-54	56.1	51.4	***
Age 55-64	16.6	22.7	***
Race (%)			
White	27.8	28.6	***
African American	67.1	64.4	***
Other	5.2	7.0	***
Health Status (%)			
No comorbidity	47.8	49.2	
1 comorbidity	21.9	21.6	
2 comorbidity	16.0	16.1	
3 or more comorbidity	14.3	13.1	
Prevalence of chronic conditions (%)			
Asthma	8.7	7.6	***
Cancer	8.2	9.0	***
COPD [c]	1.5	1.5	
Emphysema	0.5	0.5	
Diabetes	16.3	16.8	**
Heart problems	6.9	6.6	**
Hypertension	32.9	34.7	***
Stroke	0.4	0.4	
Mental health	27.5	21.1	***
Enrollment characteristics			
Enrollment length in days (mean, SD[d])	352.5 (0.15)	345.4 (0.3)	***
Switched plans (%)	24.2	68.1	***
Multiple enrollments in VCC[e]	53.7	54.7	**
Healthcare utilization			
At least one inpatient hospitalization (%)	11.5	8.6	***
Mean inpatient hospitalizations (SD)	0.98 (0.02)	0.67 (0.02)	***
At least one hospital outpatient visit (%)	56.7	53.9	***
Mean hospital outpatient visits (SD)	3.32 (0.02)	2.71 (0.03)	***
At least one ED[f] visit (%)	33.2	24.0	***
Mean ED (SD)	0.95 (0.06)	0.57 (0.07)	***
At least one primary care visit (%)	40.9	35.2	***
Mean primary care visits (SD)	1.63 (0.01)	1.14 (0.01)	***

[a] Note: plans have zero copayments but differ in co-insurance [b] Chi-square tests for equality in proportions and t-test to compare equality in means across the cost-sharing plans, *p < 0.1 **p < 0.05 ***p < 0.01. [c] Chronic obstructive pulmonary disease. [d] SD = standard deviation [e] VCC = Virginia Coordinated Care. [f] ED = Emergency department

Table 3: Summary of Estimates for the Probability of Having At least One Visit; by Visit Type

	Any primary care	**Any outpatient care**	**Any inpatient hospitalization**	**Any ED visit[a]**
N	141,072	141,072	141,072	141,072
Have cost-sharing (LPM Models)	-0.0505*** (0.0027)	-0.0284*** (0.0028)	-0.0157*** (0.0021)	-0.0571*** (0.0029)
Have cost-sharing (Marginal Effects, Logistic Model)	-0.0494*** (0.0028)	-0.0259*** (0.0029)	-0.0151*** (0.0021)	-0.0559*** (0.0029)

Notes: Regression models test the association between utilization of each type of service between those who have no cost-sharing to those with some cost-sharing. [a]ED = Emergency department. *** p<0.01, ** p<0.05, * p<0.1. Full sample includes all observations in the study period regardless of whether data on chronic conditions was available, thus the indicator for chronic conditions was set to zero for those who did not utilize any care.

Table 4: Summary of Estimates for Number of Visits, by Visit Type

	Number of Primary Care Visits	**Number of Hospital Outpatient Visits**	**Number of Inpatient Hospitalizations**	**Number of ED visits[a]**
N	141,072	141,072	141,072	141,072
Panel A Have cost-sharing in plan (log odds of expected counts)	-0.3328*** (0.0126)	-0.2310*** (0.0112)	-0.2929*** (0.0436)	-0.3151*** (0.0159)
Panel B IRR	0.7169*** (0.0090)	0.7937*** (0.0089)	0.7461*** (0.0325)	0.7297*** (0.0115)

Notes: Mixed effects zero-inflated negative binomial models test the association between cost-sharing and number of each type of visit. Coefficients are log odds of the expected counts. IRR = Incidence rate ratio. [a]ED = Emergency Department. Regression results on full sample where chronic conditions were set to zero if data on utilization was not available. *** p<0.01, ** p<0.05, * p<0.1

Table 5: Summary of Estimates for Having Any Visit, by Type of Visit and Co-Insurance Levels

	Any primary care	**Any outpatient care**	**Any inpatient hospitalization**	**Any ED visit[a]**
N	141,072	141,072	141,072	141,072
Ref: 0% co--insurance				
5% co-insurance	-0.0308***	-0.0179***	-0.0148***	-0.0476***
	(0.0055)	(0.0056)	(0.0042)	(0.0059)
20% co-insurance	-0.0346***	-0.0211***	-0.0176***	-0.0492***
	(0.0041)	(0.0042)	(0.0031)	(0.0044)
45% co-insurance	-0.0601***	-0.0348***	-0.0171***	-0.0617***
	(0.0041)	(0.0042)	(0.0031)	(0.0043)
70% co-insurance	-0.0788***	-0.0390***	-0.0112***	-0.0707***
	(0.0051)	(0.0052)	(0.0038)	(0.0054)

Notes: Mixed effects linear probability models test the association between utilization of each type of service across co-insurance levels in VCC plans. [a]ED = Emergency Department. *** p<0.01, ** p<0.05, * p<0.1. Full sample includes all observations in the study period regardless of whether data on chronic conditions was available, thus the indicator for chronic conditions was set to zero for those who did not utilize any care.

Table 6: Summary of Estimates for Number of Visits, by Visit Type and Co-Insurance Levels

	Number of Primary Care Visits	**Number of Hospital Outpatient Visits**	**Number of Inpatient Hospitalizations**	**Number of ED visits[a]**
N	141,072	141,072	141,072	141,072
Ref: 0% co--insurance				
5% co-insurance	-0.2169***	-0.1326***	-0.2420***	-0.2298***
	(0.0246)	(0.0222)	(0.0918)	(0.0325)
IRR	0.80503***	0. .8758***	0.7850***	0. .7946***
	(0.01978)	(0.0194)	(0.0721)	(0 .0258)
20% co-insurance	-0.2715***	-0.2013***	-0.3334***	-0.2859***
	(0.0185)	(0.0166)	(0.0670)	(0.0241)
IRR	0.76223***	0.8176***	0.7196***	0.7513***
	(0.0141)	(0.0136)	(0.0481)	(0.0181)
45% co-insurance	-0.3801***	-0.2709***	-0.3291***	-0.3324***
	(0.0190)	(0.0169)	(0.0661)	(0.0242)
IRR	0.6838***	0.7627***	0.7196***	0.7172***
	(0.0130)	(0.0128)	(0.0476)	(0.0173)
70% co-insurance	-0.4915***	-0.3139***	-0.2094**	-0.4132***
	(0.0247)	(0.0215)	(0.0821)	(0.0309)
IRR	0.6117***	0.7306***	0.8110***	0.6615***
	(0.01513)	(0.0157)	(0.0667)	(0.0205)

Notes: Mixed effects negative binomial models test the association between cost-sharing and number of each type of visit. Coefficients are log odds of the expected counts. IRR = Incidence rate ratio. [a] ED = Emergency Department. Regression results on full sample where chronic conditions were set to zero if data on utilization was not available. *** p<0.01, ** p<0.05, * p<0.1

Appendices

Appendix Table A: Sample exclusions

Exclusion Criteria	**Frequency**	**Percent**
Enrollment year before 2001 or after 2011	24849	13.90
Age of the patient is < 21 or > 64	9926	5.55
Patient enrolled for less than 30 days	522	0.29
Plan information missing	2	0.001
Gender missing	6	0.003
Race missing	2271	1.27
Duplicate observations	122	0.07
Retained sample	**141072**	100.00

Appendix Table B: Number of observations per plan

VCC plan	**Frequency**	**Percent**	**Cumulative Percent**
0% co-insurance	105356	74.62	74.62
5% co-insurance	5613	3.98	78.59
20% co-insurance	11423	8.09	86.68
45% co-insurance	11763	8.33	95.01
70% co-insurance	7039	4.99	100.00

Notes* Plans do not have copayments except for prescriptive drugs. Cost-sharing is in the form of co-insurance which is tiered based on income levels.

Appendix Table C: Sample Characteristics by Co-Insurance Levels

Co-insurance	**0%**	**5%**	**20%**	**45%**	**70%**	**p- value**[a]
N	105,297	5,606	11,407	11,745	7,017	
Demographic characteristics						
Female (%)	54.9	68.7	68.5	68.1	65.8	***
Age, years (%)						
Age 21-34	27.3	26.7	26.8	25.4	24.6	***
Age 35-54	56.1	51.3	51.1	51.1	52.8	***
Age 55-64	16.6	22.1	22.1	23.5	22.5	***
Race (%)						
White	27.8	29.3	28.8	28.7	27.8	***
African American	67.1	61.8	63.4	65.4	66.3	***
Other	5.2	8.8	7.8	5.9	5.9	***
Health Status (%)						
No comorbidity	47.8	48.1	48.0	49.2	52.1	***
1 comorbidity	21.9	21.5	21.8	21.4	21.9	***
2 comorbidity	16.0	16.5	16.3	16.5	14.2	***
3 or more comorbidity	14.3	13.4	13.8	12.9	11.7	***
Prevalence of chronic conditions (%)						
Asthma	8.7	8.4	7.8	7.6	6.7	***
Cancer	8.2	8.9	9.7	8.8	8.4	***
COPD [b]	1.5	1.7	1.6	1.4	1.5	
Emphysema	0.5	0.7	0.5	0.4	0.3	*
Diabetes	16.3	17.1	14.4	17.2	15.1	***
Heart problems	6.9	6.7	6.4	6.6	6.6	
Hypertension	32.7	34.7	35.2	35.3	33.1	***
Stroke	0.4	0.4	0.4	0.4	0.4	
Mental health	27.5	23.2	22.2	20.5	25.8	***
Enrollment characteristics						
Enrollment length in days (mean, SD[c])	352.5 (0.1)	349.1 (0.7)	346.3 (0.6)	344.7 (0.6)	342.3 (0.8)	**
Switched plans (%)	24.2	73.8	69.7	33.2	36.6	***
Multiple enrollments in VCC[d]	53.7	56.7	55.7	45.7	48.1	***

Healthcare utilization						
At least one inpatient hospitalization (%)	11.5	8.6	8.5	8.4	9.1	***
Mean inpatient hospitalizations (SD)	0.98 (0.07)	0.63 (0.05)	0.64 (0.04)	0.65 (0.04)	0.77 (0.05)	***
At least one hospital outpatient visit (%)	43.3	44.9	44.9	46.5	48.2	***
Mean hospital outpatient (SD)	3.3 (0.02)	2.9 (0.07)	2.83 (0.05)	2.64 (0.04)	2.45 (0.06)	***
At least one ED[e] visit (%)	66.7	75.0	75.2	76.4	77.5	***
Mean ED (SD)	0.95 (0.01)	0.6 (0.02)	0.59 (0.01)	0.56 (0.01)	0.51 (0.01)	***
At least one primary care visit (%)	40.9	37.9	37.1	34.4	31.2	***
Mean primary care visits (SD)	1.63 (0.01)	1.3 (0.03)	1.3 (0.02)	1.10 (0.02)	0.94 (0.02)	***

---

[a] Chi-square tests for equality in proportions of the samples across the five VCC plans, *p<0.10 **p < 0.05 ***p < 0.01. [b] Chronic obstructive pulmonary disease. [c] SD = standard deviation [d] VCC = Virginia Coordinated Care. [e] ED = Emergency department

Appendix Table D.1: Full Regression Results for Having Any Primary Care, Hospital Outpatient Care, Inpatient Hospitalization and ED visit

	Any primary care visit	**Any hospital outpatient visit**	**Any inpatient hospitalization**	**Any ED visit**[a]
Cost-sharing	-0.0505***	-0.0284***	-0.0157***	-0.0571***
	(0.0027)	(0.0028)	(0.0021)	(0.0029)
Age 35-54 (ref: 21-34 yrs)	-0.0119***	-0.0566***	-0.0016	-0.0459***
	(0.0032)	(0.0032)	(0.0022)	(0.0032)
Age 55-64	-0.0266***	-0.0693***	-0.0089***	-0.1128***
	(0.0043)	(0.0043)	(0.0030)	(0.0043)
Female	0.0099***	0.0449***	-0.0325***	-0.0659***
	(0.0030)	(0.0030)	(0.0020)	(0.0030)
Black (ref: White)	-0.0131***	-0.0510***	-0.0244***	0.0166***
	(0.0033)	(0.0033)	(0.0022)	(0.0032)
Other	0.0254***	-0.0356***	-0.0272***	-0.0901***
	(0.0070)	(0.0070)	(0.0046)	(0.0068)
1 comorbidity (ref: no comorbidity)	0.3464***	0.3662***	0.0747***	0.1902***
	(0.0037)	(0.0038)	(0.0025)	(0.0037)
2 comorbidities	0.4606***	0.4551***	0.0854***	0.2232***
	(0.0045)	(0.0045)	(0.0030)	(0.0044)
3+ comorbidities	0.4889***	0.5015***	0.1138***	0.2761***
	(0.0052)	(0.0051)	(0.0033)	(0.0049)
Not first enrollment	0.0229***	-0.0051**	-0.0492***	-0.0668***
	(0.0022)	(0.0023)	(0.0017)	(0.0024)
Length of enrollment in days	0.0005***	0.0005***	0.0000**	0.0004***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Changed plans	-0.0110***	-0.0280***	-0.0186***	-0.0244***
	(0.0037)	(0.0037)	(0.0024)	(0.0036)
Constant	0.0373***	0.2601***	0.1294***	0.1910***
	(0.0081)	(0.0083)	(0.0060)	(0.0086)
Random Effects Parameters				
Var (cons)	0.0765	0.0724	0.0222	0.0573
	(0.0008)	(0.0009)	(0.0004)	(0.0008)

Notes: Mixed effects linear probability models test the association between utilization of each type of service between plans with no cost-sharing to plans with cost-sharing. Regression results on full sample where chronic conditions were set to zero if data on utilization was not available. [a] ED = Emergency Department. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table D.2: Full Regression Results for Mixed Effects Negative Binomial Models-Number of Visits, by Visit Type

	Number of Primary Care Visits	**Number of Hospital Outpatient Visits**	**Number of Inpatient Hospitalizations**	**Number of ED visits[a]**
N	141,072	141,072	141,072	141,072
Cost-sharing	-0.3328***	-0.2310***	-0.2929***	-0.3151***
	(0.0126)	(0.0112)	(0.0436)	(0.0159)
Age 35-54 (ref: 21-34 yrs)	-0.0128	-0.1684***	-0.0158	-0.2139***
	(0.0159)	(0.0138)	(0.0438)	(0.0170)
Age 55-64	-0.0789***	-0.1202***	-0.0654	-0.5654***
	(0.0210)	(0.0184)	(0.0576)	(0.0236)
Female	0.0614***	0.1825***	-0.8209***	-0.4019***
	(0.0150)	(0.0130)	(0.0373)	(0.0157)
Blacks (Ref: Whites)	-0.1335***	-0.3195***	-0.4600***	-0.0073
	(0.0162)	(0.0140)	(0.0403)	(0.0170)
Other race	0.0526	-0.1387***	-0.5526***	-0.5845***
	(0.0351)	(0.0301)	(0.0889)	(0.0400)
One comorbidity (ref: no comorbidity)	1.8859***	1.4686***	1.6261***	1.0738***
	(0.0188)	(0.0161)	(0.0480)	(0.0194)
2 comorbidities	2.4247***	1.8095***	1.9524***	1.2899***
	(0.0218)	(0.0191)	(0.0553)	(0.0229)
3 comorbidities	2.6436***	2.1015***	2.4157***	1.5676***
	(0.0243)	(0.0215)	(0.0603)	(0.0254)
Not first enrollment	-0.0049	0.0171*	-1.0445***	-0.2783***
	(0.0094)	(0.0089)	(0.0362)	(0.0121)
Enrollment length in days	0.0034***	0.0023***	-0.0006*	0.0024***
	(0.0001)	(0.0001)	(0.0003)	(0.0001)
Changed plans	-0.0335*	-0.0651***	-0.5231***	-0.1886***
	(0.0178)	(0.0157)	(0.0457)	(0.0193)
Constant	-2.8584***	-1.0207***	-0.9250***	-1.6851***
	(0.0459)	(0.0372)	(0.1305)	(0.0517)
Var (_cons)	1.5955***	1.3468***	3.9107***	1.4509***
	(0.0223)	(0.0163)	(0.1342)	(0.0238)

Notes: Mixed effects negative binomial models test the association between cost-sharing and number of each type of visit. Coefficients are log odds of the expected counts. [a]ED = Emergency department. Regression results on full sample where chronic conditions were set to zero if data on utilization was not available. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table E.1: Full Regression Results for Having Any Visit, By Visit Type and Co-Insurance Levels

	Any primary care	**Any hospital outpatient**	**Any inpatient hospitalization**	**Any ED visit**[a]
N	141,072	141,072	141,072	141,072
5% co-insurance (Ref: 0% co-insurance)	-0.0308***	-0.0179***	-0.0148***	-0.0476***
	(0.0055)	(0.0056)	(0.0042)	(0.0059)
20% co-insurance	-0.0346***	-0.0211***	-0.0176***	-0.0492***
	(0.0041)	(0.0042)	(0.0031)	(0.0044)
45% co-insurance	-0.0601***	-0.0348***	-0.0171***	-0.0617***
	(0.0041)	(0.0042)	(0.0031)	(0.0043)
70% co-insurance	-0.0788***	-0.0390***	-0.0112***	-0.0707***
	(0.0051)	(0.0052)	(0.0038)	(0.0054)
Age 35-54 (ref: 21-34 years)	-0.0115***	-0.0564***	-0.0017	-0.0457***
	(0.0032)	(0.0032)	(0.0022)	(0.0032)
Age 55-64	-0.0261***	-0.0690***	-0.0089***	-0.1125***
	(0.0043)	(0.0043)	(0.0030)	(0.0043)
Female	0.0098***	0.0449***	-0.0325***	-0.0659***
	(0.0030)	(0.0030)	(0.0020)	(0.0030)
Blacks (Ref: Whites)	-0.0130***	-0.0509***	-0.0244***	0.0167***
	(0.0033)	(0.0033)	(0.0022)	(0.0032)
Other race	0.0248***	-0.0359***	-0.0272***	-0.0904***
	(0.0070)	(0.0070)	(0.0046)	(0.0068)
One comorbidity (ref: no comorbidity)	0.3461***	0.3660***	0.0747***	0.1901***
	(0.0037)	(0.0038)	(0.0025)	(0.0037)
2 comorbidities	0.4601***	0.4549***	0.0855***	0.2229***
	(0.0045)	(0.0045)	(0.0030)	(0.0044)
3 comorbidities	0.4881***	0.5012***	0.1138***	0.2757***
	(0.0052)	(0.0051)	(0.0033)	(0.0049)
Not first enrollment	0.0230***	-0.0051**	-0.0491***	-0.0668***
	(0.0022)	(0.0023)	(0.0017)	(0.0024)
Enrollment length in days	0.0005***	0.0005***	0.0000**	0.0004***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Changed plans	-0.0114***	-0.0282***	-0.0186***	-0.0247***
	(0.0037)	(0.0037)	(0.0024)	(0.0036)
Constant	0.0571***	0.2645***	0.1426***	0.1998***
	(0.0095)	(0.0108)	(0.0058)	(0.0099)
Var(_cons)	0.07647	0.07254	0.02220	0.05732
	(0.0008)	(0.00086)	(0.07266)	(0.1384)

Notes: Mixed effects linear probability models test the association between utilization of each type of service between co-insurance levels. [a] ED = Emergency Department. Regression results on full sample where chronic conditions were set to zero if data on utilization was not available.. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Appendix Table E.2: Full Regression Results for Number of Visits, By Visit Type and Co-Insurance Levels

	Number of Primary Care Visits	**Number of Hospital Outpatient Visits**	**Number of Inpatient Hospitalizations**	**Number of ED visits**[a]
N	141,072	141,072	141,072	141,072
5% co-insurance (Ref: 0% co-insurance)	-0.2169***	-0.1326***	-0.2420***	-0.2298***
	(0.0246)	(0.0222)	(0.0918)	(0.0325)
20% co-insurance	-0.2715***	-0.2013***	-0.3334***	-0.2859***
	(0.0185)	(0.0166)	(0.0670)	(0.0241)
45% co-insurance	-0.3801***	-0.2709***	-0.3291***	-0.3324***
	(0.0190)	(0.0169)	(0.0661)	(0.0242)
70% co-insurance	-0.4915***	-0.3139***	-0.2094**	-0.4132***
	(0.0247)	(0.0215)	(0.0821)	(0.0309)
Age 35-54 (ref: 21-34 years)	-0.0109	-0.1671***	-0.0164	-0.2128***
	(0.0159)	(0.0138)	(0.0438)	(0.0170)
Age 55-64	-0.0752***	-0.1178***	-0.0656	-0.5638***
	(0.0210)	(0.0184)	(0.0576)	(0.0236)
Female	0.0615***	0.1826***	-0.8206***	-0.4022***
	(0.0150)	(0.0130)	(0.0373)	(0.0157)
Blacks (Ref: Whites)	-0.1324***	-0.3192***	-0.4600***	-0.0067
	(0.0162)	(0.0140)	(0.0403)	(0.0170)
Other race	0.0501	-0.1416***	-0.5532***	-0.5863***
	(0.0351)	(0.0302)	(0.0889)	(0.0400)
One comorbidity (ref: no comorbidity)	1.8847***	1.4676***	1.6267***	1.0729***
	(0.0188)	(0.0161)	(0.0480)	(0.0194)
2 comorbidities	2.4221***	1.8080***	1.9530***	1.2884***
	(0.0218)	(0.0191)	(0.0553)	(0.0229)
3 comorbidities	2.6403***	2.0992***	2.4164***	1.5657***
	(0.0243)	(0.0215)	(0.0603)	(0.0254)
Not first enrollment	-0.0045	0.0172*	-1.0439***	-0.2783***
	(0.0094)	(0.0089)	(0.0362)	(0.0121)
Enrollment length in days	0.0034***	0.0023***	-0.0006*	0.0024***
	(0.0001)	(0.0001)	(0.0003)	(0.0001)
Changed plans	-0.0345*	-0.0663***	-0.5232***	-0.1899***
	(0.0178)	(0.0157)	(0.0457)	(0.0193)
Constant	-2.8463***	-1.0147***	-0.9236***	-1.6798***
	(0.0458)	(0.0372)	(0.1305)	(0.0517)
Var(_cons)	1.5957***	1.3481***	3.9092***	1.4512***
	(0.0223)	(0.0163)	(0.1342)	(0.0238)

Notes: Mixed effects negative binomial models test the association between expected counts for each type of service between co-insurance levels. [a] ED = Emergency Department. Regression results on full sample where chronic conditions were set to zero if data on utilization was not available. *** p<0.01, ** p<0.05, * p<0.1

Appendices - Sensitivity Analysis

Appendix Table F.1: Full Regression Results for Having Any Primary Care, Hospital Outpatient Care, Inpatient Hospitalization and ED visit (Restricted Sample)

	Any primary care visit	**Any hospital outpatient visit**	**Any inpatient hospitalization**	**Any ED visit[a]**
N	107,282	107,282	107,282	107,282
Cost-sharing	-0.0505***	-0.0478***	-0.0232***	-0.0878***
	(0.0027)	(0.0034)	(0.0027)	(0.0037)
Age 35-54 (ref: 21-34 years)	-0.0744***	0.0049	0.0138***	-0.0120***
	(0.0036)	(0.0034)	(0.0028)	(0.0039)
Age 55-64	0.0250***	0.0377***	0.0140***	-0.0783***
	(0.0040)	(0.0047)	(0.0039)	(0.0054)
Female	0.0277***	0.0901***	-0.0348***	-0.0615***
	(0.0055)	(0.0030)	(0.0025)	(0.0035)
Black (ref: White)	0.0291***	-0.0325***	-0.0256***	0.0361***
	(0.0037)	(0.0032)	(0.0027)	(0.0038)
Other	-0.0022	-0.0447***	-0.0316***	-0.1144***
	(0.0039)	(0.0069)	(0.0058)	(0.0082)
1 comorbidity (ref: no comorbidity)	0.0340***	0.0942***	0.0201***	0.0347***
	(0.0086)	(0.0038)	(0.0031)	(0.0044)
2 comorbidities	0.2084***	0.1609***	0.0290***	0.0611***
	(0.0045)	(0.0044)	(0.0036)	(0.0051)
3+ comorbidities	0.3108***	0.1941***	0.0565***	0.1106***
	(0.0054)	(0.0048)	(0.0040)	(0.0057)
Not first enrollment	0.3335***	0.0085***	-0.0605***	-0.0721***
	(0.0060)	(0.0028)	(0.0022)	(0.0031)
Length of enrollment in days	0.0388***	0.0001***	-0.0001***	0.0002***
	(0.0028)	(0.0000)	(0.0000)	(0.0000)
Did not switch plans	0.0005***	0.0012	-0.0195***	-0.0090**
	(0.0000)	(0.0037)	(0.0031)	(0.0043)
Constant	0.1281***	0.5785***	0.2401***	0.3841***
	(0.0115)	(0.0109)	(0.0087)	(0.0121)

Notes: Mixed effects linear probability models test the association between utilization of each type of service between plans with no cost-sharing to plans with cost-sharing. Regression results on sample with utilization claims and therefore data on chronic conditions. [a] ED = Emergency Department. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table F.2: Full Regression Results for Mixed Effects Negative Binomial Models-Number of Visits, by Visit Type (Restricted Sample)

	Number of Primary Care Visits	**Number of Hospital Outpatient Visits**	**Number of Inpatient Hospitalizations**	**Number of ED visits[a]**
N	107,282	107,282	107,282	107,282
Cost-sharing	-0.3676***	-0.2734***	-0.3309***	-0.3798***
	(0.0123)	(0.0105)	(0.0405)	(0.0153)
Age 35-54 (ref: 21-34 yrs)	0.1801***	0.1219***	0.3948***	0.0115
	(0.0146)	(0.0115)	(0.0396)	(0.0157)
Age 55-64	0.1948***	0.3124***	0.5503***	-0.2318***
	(0.0195)	(0.0156)	(0.0526)	(0.0220)
Female	0.1328***	0.2744***	-0.6406***	-0.2864***
	(0.0134)	(0.0103)	(0.0334)	(0.0142)
Blacks (Ref: Whites)	-0.0803***	-0.2191***	-0.1993***	0.0663***
	(0.0144)	(0.0110)	(0.0360)	(0.0152)
Other race	-0.0044	-0.1671***	-0.5357***	-0.5874***
	(0.0316)	(0.0239)	(0.0773)	(0.0361)
One comorbidity (ref: no comorbidity)	0.9912***	0.3756***	0.2241***	0.2088***
	(0.0171)	(0.0130)	(0.0429)	(0.0177)
2 comorbidities	1.4426***	0.5887***	0.4112***	0.3484***
	(0.0195)	(0.0150)	(0.0488)	(0.0205)
3 comorbidities	1.6326***	0.8048***	0.6648***	0.5607***
	(0.0215)	(0.0164)	(0.0528)	(0.0225)
Not first enrollment	0.0342***	0.0807***	-0.7264***	-0.2031***
	(0.0093)	(0.0085)	(0.0362)	(0.0119)
Enrollment length in days	0.0026***	0.0007***	-0.0032***	0.0009***
	(0.0001)	(0.0001)	(0.0003)	(0.0001)
Changed plans	0.0593***	0.0674***	-0.3522***	-0.0745***
	(0.0160)	(0.0124)	(0.0405)	(0.0175)
Constant	-1.8113***	0.3660***	1.3578***	-0.4832***
	(0.0460)	(0.0367)	(0.1281)	(0.0519)
Var (_cons)	0.9912***	0.4745***	0.7932***	0.8110***
	(0.0160)	(0.0083)	(0.0712)	(0.0167)

Notes: Mixed effects negative binomial models test the association between cost-sharing and number of each type of visit. Coefficients are log odds of the expected counts. [a]ED = Emergency department. Regression results on sample with utilization claims and therefore data on chronic conditions. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table F.3: Full Regression Results for Having Any Visit, By Visit Type and Co-Insurance Levels (Restricted Sample)

	Any primary care	**Any hospital outpatient**	**Any inpatient hospitalization**	**Any ED visit[a]**
N	107,282	107,282	107,282	107,282
5% co-insurance (Ref: 0% co-insurance)	-0.0463***	-0.0324***	-0.0208***	-0.0727***
	(0.0072)	(0.0069)	(0.0055)	(0.0076)
20% co-insurance	-0.0510***	-0.0327***	-0.0246***	-0.0746***
	(0.0053)	(0.0051)	(0.0041)	(0.0056)
45% co-insurance	-0.0882***	-0.0593***	-0.0259***	-0.0953***
	(0.0053)	(0.0050)	(0.0040)	(0.0056)
70% co-insurance	-0.1149***	-0.0654***	-0.0185***	-0.1095***
	(0.0066)	(0.0063)	(0.0050)	(0.0070)
Age 35-54 (ref: 21-34 years)	0.0256***	0.0052	0.0137***	-0.0117***
	(0.0040)	(0.0034)	(0.0028)	(0.0039)
Age 55-64	0.0287***	0.0382***	0.0140***	-0.0778***
	(0.0055)	(0.0047)	(0.0039)	(0.0054)
Female	0.0291***	0.0901***	-0.0348***	-0.0615***
	(0.0037)	(0.0030)	(0.0025)	(0.0035)
Blacks (Ref: Whites)	-0.0020	-0.0324***	-0.0256***	0.0362***
	(0.0039)	(0.0032)	(0.0027)	(0.0038)
Other race	0.0331***	-0.0453***	-0.0316***	-0.1149***
	(0.0086)	(0.0069)	(0.0058)	(0.0082)
One comorbidity (ref: no comorbidity)	0.2077***	0.0938***	0.0201***	0.0344***
	(0.0045)	(0.0038)	(0.0031)	(0.0044)
2 comorbidities	0.3097***	0.1604***	0.0291***	0.0606***
	(0.0054)	(0.0044)	(0.0036)	(0.0051)
3 comorbidities	0.3322***	0.1935***	0.0565***	0.1099***
	(0.0060)	(0.0048)	(0.0040)	(0.0057)
Not first enrollment	0.0389***	0.0085***	-0.0605***	-0.0721***
	(0.0028)	(0.0028)	(0.0022)	(0.0031)
Enrollment length in days	0.0005***	0.0001***	-0.0001***	0.0002***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Changed plans	0.0092**	0.0008	-0.0195***	-0.0093**
	(0.0045)	(0.0037)	(0.0031)	(0.0043)
Constant	0.1313***	0.5800***	0.2401***	0.3857***
	(0.0115)	(0.0109)	(0.0087)	(0.0121)
Var(_cons)	0.9534***	0.9118***	1.1626***	0.8456***
	(0.0028)	(0.0028)	(0.0030)	(0.0028)

Notes: Mixed effects linear probability models test the association between utilization of each type of service between co-insurance levels. [a] ED = Emergency Department. Regression results on sample with utilization claims and therefore data on chronic conditions. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table F.4: Full Regression Results for Number of Visits, By Visit Type and Co-Insurance Levels (Restricted Sample)

	Number of Primary Care Visits	**Number of Hospital Outpatient Visits**	**Number of Inpatient Hospitalizations**	**Number of ED visits[a]**
N	107,282	107,282	107,282	107,282
5% co-insurance (Ref: 0% co-insurance)	-0.2426***	-0.1701***	-0.2600***	-0.2749***
	(0.0241)	(0.0211)	(0.0847)	(0.0314)
20% co-insurance	-0.2986***	-0.2284***	-0.3433***	-0.3391***
	(0.0181)	(0.0156)	(0.0618)	(0.0233)
45% co-insurance	-0.4184***	-0.3215***	-0.3976***	-0.4090***
	(0.0185)	(0.0157)	(0.0607)	(0.0232)
70% co-insurance	-0.5388***	-0.3660***	-0.2575***	-0.4926***
	(0.0240)	(0.0199)	(0.0761)	(0.0297)
Age 35-54 (ref: 21-64 years)	0.1823***	0.1233***	0.3945***	0.0129
	(0.0146)	(0.0116)	(0.0396)	(0.0157)
Age 55-64	0.1991***	0.3152***	0.5512***	-0.2297***
	(0.0195)	(0.0156)	(0.0526)	(0.0220)
Female	0.1328***	0.2744***	-0.6400***	-0.2867***
	(0.0134)	(0.0103)	(0.0333)	(0.0142)
Blacks (Ref: Whites)	-0.0789***	-0.2184***	-0.1993***	0.0672***
	(0.0144)	(0.0110)	(0.0360)	(0.0152)
Other race	-0.0077	-0.1712***	-0.5386***	-0.5899***
	(0.0316)	(0.0239)	(0.0773)	(0.0361)
One comorbidity (ref: no comorbidity)	0.9892***	0.3742***	0.2243***	0.2073***
	(0.0171)	(0.0130)	(0.0429)	(0.0177)
2 comorbidities	1.4391***	0.5867***	0.4110***	0.3463***
	(0.0195)	(0.0150)	(0.0488)	(0.0205)
3 comorbidities	1.6283***	0.8021***	0.6644***	0.5578***
	(0.0214)	(0.0164)	(0.0528)	(0.0225)
Not first enrollment	0.0345***	0.0806***	-0.7259***	-0.2032***
	(0.0093)	(0.0085)	(0.0362)	(0.0119)
Enrollment length in days	0.0026***	0.0007***	-0.0033***	0.0009***
	(0.0001)	(0.0001)	(0.0003)	(0.0001)
Changed plans	0.0582***	0.0659***	-0.3528***	-0.0761***
	(0.0160)	(0.0124)	(0.0405)	(0.0175)
Constant	-1.7972***	0.3722***	1.3620***	-0.4754***
	(0.0460)	(0.0366)	(0.1281)	(0.0519)
Var(_cons)	0.9911***	0.4753***	0.7905***	0.8110***
	(0.0160)	(0.0083)	(0.0711)	(0.0167)

Notes: Mixed effects negative binomial models test the association between expected counts for each type of service between co-insurance levels. [a] ED = Emergency Department. Regression results on sample with utilization claims and therefore data on chronic conditions. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table G: Comparing Estimates for Urgent versus Non-Urgent ED use

Model		**Coefficient (S.E)**	**p-value**
	Ref: Urgent ED		
Multinomial Logit	Not-urgent	-0.0153 (0.080)	0.849
	Other causes	-0.116 (0.028)	<0.01
Logistic	Not Urgent	-0.0230 (0.079)	0.773

Chapter 3: Paper II

Decomposing the Racial/Ethnicity Gap in Mammogram Screening: Role of Insurance and Access

Abstract

Background: Breast cancer screening by mammogram has been shown to decrease cancer-related mortality. Although screening rates have generally increased over time, racial and ethnic differences in uptake continue to persist. Lack of insurance coverage and access to care are identified as among the most important barriers to timely screening. Through insurance coverage expansions, mandated coverage and elimination of cost-sharing for preventive services, the Affordable Care Act (passed in 2010) offers several opportunities to potentially impact racial and ethnic disparities in cancer screening, including for mammography.

Purpose: This study examines racial and ethnic differences in the utilization of mammogram before and after the ACA and quantifies the extent to which insurance status explains these differences

Methods: Analysis of the retrospective pooled cross-sectional Medical Expenditure Panel Survey data from 2008-2014 is conducted. Women aged 40-74 years are included in the study to represent the sample recommended to receive mammogram. Non-linear Oaxaca-Blinder (Fairlie) decomposition method is used to identify and quality the contribution of each insurance status toward racial-ethnic differences in mammogram screening.

Results: Hispanic women have significantly lower odds of receiving mammogram screening compared to Non-Hispanic white and Non-Hispanic black women. However, these differences have declined over time. The decomposition estimates that insurance status contributes to a significant proportion of the difference (approximately 35%); these differences are generally lower in 2013 and 2014. Additionally, decomposition estimates that improving access to a usual source of care, education and income will considerably increase screening rates among Hispanic women.

Conclusions: Racial and ethnic differences in mammogram screening have generally narrowed over time and are likely associated with gains in insurance coverage. However, lack of access to usual source of care and differences in socio-economic factors continue to pose a challenge among Hispanic women. While improving coverage is important, policies such as health education and culturally sensitive interventions might considerably reduce screening disparities in the Hispanic population.

Introduction

Breast cancer is the most common cancer among women in the United States (U.S.) regardless of race/ethnicity, and remains the most common cause of death from cancer among Hispanic women (U.S. Cancer Statistics: 1999–2013 Incidence and Mortality Report). In 2017, there will be an estimated 1,688,780 new cancer cases diagnosed and 600,920 cancer deaths in the U.S. (Breast Cancer Facts and Figures 2017, American Cancer Society (ACS)). ACS also estimated that overall there has been a decline in the mortality rate by almost 38% from its peak in 1998 to 2014 and this decline can be generally attributed to increased awareness and screening.

There is overwhelming evidence for decades on the importance of screening which offers the opportunity to detect cancers before symptoms appears. Early detection by screening plays a crucial role in reducing the overall burden of cancer by lowering the intensity of the treatments, improving the quality of life and ultimately reducing the costs of cancer care (Nelson et al. 2005). For breast cancer screening, mammography and clinical breast examination have remained as the principal tools for early detection. While there has been an overall increase in the uptake of mammograms, these patterns differ significantly across population sub-groups, where Hispanic women have significantly lower mammogram screening rates compared to Non-Hispanic whites and Non-Hispanic blacks. Thus, substantial disparities in breast cancer diagnosis and outcomes continue to persist in the U.S. by race/ethnicity, socio-economic status (SES) and insurance (Jones Patterson Calvocoressi 2003; Peek Haan 2004; Ross Bradley Busch 2006). Overall, evidence suggests that health insurance coverage plays a critical role in access to cancer screening; where women with health insurance are more than twice as likely to receive cancer screening (Rodriguez Ward Perez-Stable 2005; Selvin Brett 2003; Shi et al. 2008; Busch Duchovny 2005; Finkelstein et al. 2012; Wherry 2013).

The Affordable Care Act (2010), implements several strategies that potentially aim to expand access to health insurance coverage in the U.S. and improve access to care, including elimination of copayments for cancer screening. Several studies have explored the impact of the ACA on uptake of preventive care, including cancer screening but the evidence is mixed; where on one-hand no changes in uptake of preventive care were noted, and on the other, some studies found increases in receipt of preventive care. Additionally; it is not known to what extent racial and ethnic disparities have continued to persist in the light of these provisions to improving access to care. In this study, the focus is on mammogram screening because this screening modality is covered by insurance, is expensive and has required a copayment prior to the ACA. The paper examines racial and ethnic disparities in mammogram screening over time and assess the extent to which insurance coverage explains these differences in the light of the health care reform.

Disparities in Mammogram Use and the Role of Insurance

There are significant differences across racial/ ethnic and socio-economic groups in the U.S. regarding access to care, quality of care and health outcomes. For decades, the nation's overarching goal has been to reduce and ultimately eliminate disparities in health including cancers (Smedley Stith Nelson 2003). Although, much progress has been made in reduction of mortality from cancers, considerable gaps remain to achieve the Health People 2020 targets for cancer screening tests. For example, in 2013, Centers for Disease Control and Prevention published a report of an analysis using pooled data from the National Health Interview Survey (Cancer Screening Test Use, CDC 2013). It reported that after adjusting for age, 72.6% of women aged 50–74 years reported recent mammography which is below the Healthy People 2020 target of 81.1%. The analysis also suggested that race, ethnicity, SES were significantly associated with the screening rates. For example, mammography use was lower among Hispanics and was directly proportional to the level of education and income; where college graduates and women with income >400% of the federal poverty threshold met the target. Several other studies have documented comparatively lower uptake of mammogram screening among Hispanic women and older African-American women (Holt et al. 2006; Ryerson et al. 2006; Smith-Blindman Miglioretti Lurie 2006; Breen Cronin Meissner 2007; Breen Gentkeman Schiller 2011; Miranda Tarraf Gonzalez 2011; Clark et al. 2012).

Deciphering disparities is however challenging. In the report, Unequal Treatment: Confronting Racial and Ethnic Disparities in Health care by the Institute of Medicine in 2002, it is suggested that racial and ethnic disparities in health care exist even when insurance status, income, age, and severity of conditions are comparable. Further, it emphasized that disparities occur in the context of broader historic and contemporary social and economic inequality. The examination of disparities has been studied extensively in the context of the role of modifiable factors such as health insurance and access to care (O'Malley Earp Hawler 2001; Zapka Puleo Vickers-Lahti et al. 2002; Selvi Brett 2003). In fact, a major reason that been cited as to why patients do not seek medical care, including cancer screening is cost (Lohr Brook Kamberg 1986; Remler Greene 2009). Subsequently, the lack of insurance has been one of the most important barriers leading to disparities in screening (De Voe et al. 2003). Insurance is one of the key factors to improve access and this is particularly relevant in the context of breast cancer screening because mammograms are expensive, require a referral to a specialist and additional appointments to obtain. It is likely that women who lack insurance coverage may either delay obtaining a mammogram or even forgo it due to costs.

To address the challenge of high un-insurance in the U.S., the ACA aims to potentially improve access through several provisions to increase health insurance coverage. Through the insurance coverage expansions and eliminating costs associated with preventive care, the ACA is expected to improve cancer screening. A widely-implemented policy strategy to address costs has been to mandate benefits so that the service is more affordable. The Affordable Care Act (ACA, 2010), introduced large-scale changes by mandating coverage of preventive services including breast cancer screening with no cost-sharing (USPSTF 2013; Koh, Sebelius 2010). Prior to the ACA, individuals could be responsible for out-of-pocket costs in the form of copayments, co-insurance or deductibles for cancer screening services. ACA mandates the coverage of cancer screening services that are recommended by the USPSTF with a grade of A or B, with the exception of mammography where the required first dollar coverage is beyond the current recommendation by the USPSTF. With the law's provisions on implementing expansions for coverage and eliminating potential cost barriers for preventive services like mammogram, ACA can potentially impact breast cancer screening and diagnosis.

Several studies have examined the impact of ACA on preventive services, including mammograms. In one study that examined cancer screening using pooled survey data of Medicare and privately insured enrollees found no changes in breast cancer screening (Fedewa Goodman Flanders 2015). On the other hand, evidence from studies using administrative data, found increases in mammograms post-ACA among women in the recommended age range (Nelson et al. 2015; Hamman Kapinos 2015; Wan et al. 2015; Sabatino et al. 2016). A study using one post-implementation year data found no evidence of an impact of Medicaid expansions on mammograms (Simon Soni Cawley 2017). Thus, the evidence of the impact of ACA on mammograms is more mixed but suggests that impact on screening are likely among vulnerable populations with lower education and income. Additionally, the studies so far do not address changes in mammogram screening across racial and ethnic subgroups and the law's impact on addressing the long-standing racial and disparities in mammogram screening are not known.

Study Objectives and Aims

Racial and ethnic disparities in mammogram have persisted especially among Hispanic women and lack of insurance coverage has been identified as a key barrier. In spite of improvements in breast cancer screening; these benefits are not distributed equally and disparities in mammogram screening rates continue to persist especially among Hispanic women. Through insurance coverage expansions, mandated coverage and elimination of cost-sharing for preventive services, the ACA offers several opportunities to potentially impact racial and ethnic disparities in cancer screening, including for mammography. Thus, this study addresses the following two objectives:

1. To estimate racial disparities in mammogram screening from 2008-2014
    - Hypothesis: Hispanic women have lower mammogram screening rates compared to Non-Hispanic white women and Non-Hispanic black women
2. To examine the extent to which disparities explained by differences in insurance coverage have changed over time
    - Hypothesis: Disparities explained by differences in insurance coverage are likely to reduce over time

Conceptual Framework

This study is informed by the Anderson Behavioral Model which is widely used to study utilization of health services (Andersen, 1995; Andersen, Newman, 1973). The model includes three types of characteristics that can influence uptake of health care services – predisposing, enabling and need factors. Predisposing characteristics describes propensity of an individual to use health care services. This study includes following variables as predisposing characteristics determining utilization of mammogram: age and race, with race taken as primary independent variable. Enabling characteristics describes ability of an individual to get health care services and are of particular interest in this study. Health insurance is important for health care access and reduce financial burden from medical care. In this study, the primary interest is in examining the role of insurance in explaining racial – ethnic disparities in mammogram use. Thus, following variables are included as enabling factors in the model: education, income, health insurance, usual source of care and region. Finally, need characteristics describe perceived and actual health of an individual. It includes the following variables in the final model: self-reported health status and an indicator for chronic conditions.

Methods

Data

For this cross-sectional analysis, data of the Medical Expenditure Panel Survey (MEPS) from 2008-2014 are pooled as annual cross-sectional samples; pooling offers the advantage of generating larger sample sizes and assess the population subgroups more accurately. MEPS provides a nationally representative sample of the U.S. civilian non-institutionalized population. Public use files are made available annually by the Agency for Healthcare Research and Quality which sponsors and administers the survey. MEPS provides the most complete national database on health conditions, access to care, insurance status, health services use, and health status of the U.S. population. The data come from the household component (HC) that contains information on demographic, socio-economic characteristics, health insurance coverage, and utilization of health services. The National Health Interview Survey, conducted by the National Center for Health Statistics, is used in a sampling frame that consisted of a U.S. civilian noninstitutionalized population for MEPS. The survey uses a stratified multi-stage area probability design in which certain groups (e.g. low income racial minorities) are over-sampled. An over-lapping panel design is implemented where a new panel of sample households was selected each year and data for each panel are collected for two calendar years in five rounds of interviews. The survey is administered by Computer-assisted personal interviewing (CAPI) using a laptop computer, with each interview averaging about 90 minutes depending on the number of persons per household and their health care use. MEPS data have been widely used in population-based and health care studies related to use of health care services, expenditures, coverage and access (Cohen 2006; Smith 2012).

Study Population

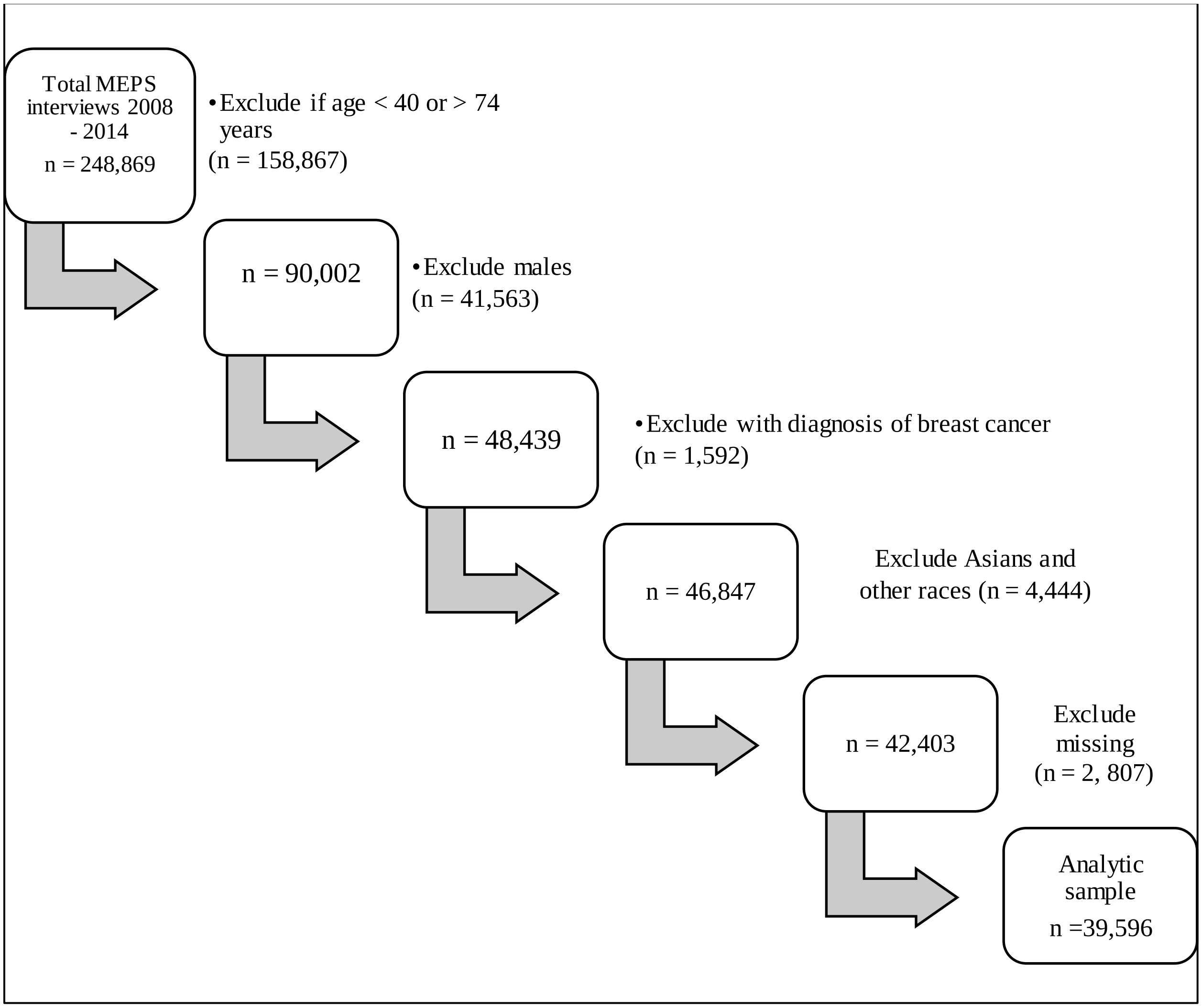
To examine receipt of mammograms, the cohort selection is guided by the breast cancer screening recommendations. The recommendations on the appropriate age to begin screening mammograms varies across several organizations and are summarized in Appendix Table 1. Most organizations support the use of mammography for average-risk women starting at age 40 years and older. In this study, females ages 40-74 years are included which also reflects the recommended ages for mammogram screening in the United States. The remaining study inclusion and exclusion criteria is described in Figure 3. The final pooled data file for 2008-2014 had an unweighted sample size of 248,869 with an average response of 56% over the study period. To distinguish between a screening versus a diagnostic mammogram, women with a diagnosis of breast cancer are excluded. Due to inadequate sample sizes, Asians and other races are also excluded. Finally, only respondents with complete data for all the study variables are included, leaving a final analytic sample of 39,596.

Study Variables

Dependent variable

The dependent variable of interest is the receipt of mammogram screening. As mentioned, the intervals and frequency for mammogram screening may vary. Additionally, under the ACA's preventive care coverage, first dollar coverage for mammograms extends beyond the USPSTF's recommendations and covers mammograms every one or two year for women starting at age 40. Therefore, the outcome variable of a timely or guideline concordant mammogram is defined by taking into account the variations in screening intervals. Receipt of mammogram is assessed in MEPS by asking the respondents the following question: "How long since you last received a mammogram? The responses are codes as 1 = within past year, 2 = within past 2 years, 3 = within past 3 years, 4 = within past 5 years, 5 = more than 5 years, 6 = never. Using the self-reported information on the receipt of screening, a dichotomous variable is created, where a concordant mammogram is defined as mammogram obtained within past 2 years and not concordant mammogram is the one obtained more than 2 years ago.

Figure 3: Study Sample Selection Algorithm



Explanatory Variables

Since the aim of this study is to examine racial and ethnic disparities in breast cancer screening, the primary explanatory variable is race and ethnicity. Thus, Non-Hispanic black (NHB) and Hispanics are compared to Non-Hispanic whites (NHW) which serve as the reference category.

The second explanatory variable of interest is insurance status. MEPS collects robust information on the respondent's insurance coverage, including the length of coverage and the type of insurance. Since the goal of this study is to examine if the contribution of insurance in explaining the racial and ethnic disparities has changed over time, the primary interest is in whether or the respondent has insurance coverage. Thus, a dichotomous variable is created to indicate whether the respondent is insured for the majority of the survey interview year.

Covariates

The control variables were identified using the Andersen Model, a behavioral model of health services utilization (Andersen, 1995). This model conceptualizes health service utilization and outcomes as the result of predisposing, enabling, and need factors. The predisposing factors included in this study are age in years categorized as (40-54, 55-64, 65-74), education status (no or some high school, high school graduate, some college, and college graduate or beyond) and region of residence in the U.S. (West, Northeast, Midwest, and South). Income at federal poverty level (FPL) (high >400% FPL, middle 200-400% FPL, low <200% FPL) and having a usual source of care are identified as enabling factors. Finally, various measures capture the need factors; first is the perceived need (perceived health status) and the evaluated need (number of chronic conditions). To assess self-rated health status, respondents are asked to rate their health by responding to the question, "In general, would you say that your health is excellent, very good,

good, fair, or poor?" A categorical variable is used to compare respondents reporting "fair or poor health", "good health" to reporting "excellent, very good health" in all rounds. Secondly, using the respondents self-reported data, a categorical comorbidity variable is created that indicates the presence of any of the priority conditions reported by MEPS, including high blood pressure, coronary heart disease, angina, myocardial infarction, stroke, emphysema, chronic bronchitis, high cholesterol, cancer, diabetes, arthritis, asthma, and attention deficit hyperactivity disorder.

Analytic Approach

Decomposition compared to other methods of assessing racial and ethnic differences

Gaps or differences in outcomes between certain characteristics, e.g. race/ethnicity can be assessed using multiple analytic methods. In a detailed analysis, Cook et.al (2012) compare various methods and their implications in examining racial and ethnic difference. For example, in a multivariate regression model after adjustment for potential observable covariates such as income, education or insurance status, the coefficient provided is a residual direct effect. For example, in this study, a multivariate analysis to assess racial and ethnic gaps in mammogram screening, cannot make a distinction between variables which may be potential sources of differences in screening versus those which likely represent a race-related disadvantage (e.g. insurance status or type of insurance). Thus, controlling for these factors absorbs some of the effect of race and ethnicity and the estimated difference in screening is only that part of racial differences not mediated through measurable disadvantage. Decomposition on the other hand, divides the estimates into two parts; one that is explained due to the differences in the means of the independent variables and the other that is unexplained and is due to the differences in the coefficients or the effects of those independent variables on the process generating the outcome. The method is particularly suitable to this study's context, where the question of interest is whether (and how much) group differences in health insurance contribute to the racial gap in mammogram screening. Additionally, whether the contribution of insurance in explaining the racial gap has changed before and after the implementation of the ACA, given the numerous provisions under the law that can potentially increase preventive care. Thus, the method allows to decompose the difference in an outcome variable between two groups into two components. The first component is referred as "explained" portion of the gap which captures differences in observed or measurable characteristics, known as endowments. The second component is referred as "unexplained" portion of the gap that cannot be explained and known as behavioral component, treatment effect or discrimination portion. Additionally, it also allows quantifying the contribution of each individual variable in the "explained" portion.

Statistical Analysis

To examine the first objective, descriptive analysis is conducted to describe the patterns of mammogram screening for each year in the study period, i.e. 2008-2014 by race and ethnicity for Non-Hispanic whites, Non-Hispanic blacks and Hispanics. To study the racial disparities and examine the role of the contribution of insurance in explaining the differences in mammogram screening, analysis is carried out in two steps. First, a bivariate analysis is conducted to study the association of mammogram with each explanatory and control variable. Next, the Oaxaca-Blinder and Fairlie approach using the set of study covariates is conducted to decompose the racial and ethnic disparities in mammogram screening. Thus, the probability of the outcome variable, i.e. mammogram screening is modeled as a function of the covariates as follows:

$$\mathrm{Logit}(Y_{it}) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \ldots\ldots\ldots\ldots\ldots\ldots + \beta_5 X_5$$

where $X_1 \ldots\ldots X_k$ includes the predictor variables and Y_{it} is the probability of the occurrence of the outcome i.e. mammogram screening for a respondent i at time t. The probability Y is then compared across the study periods and the individual contribution of insurance is estimated using the decomposition methods.

The Oaxaca-Blinder (OB) technique was originally developed to study gender and racial disparities in wages but now being increasingly utilized in health services research (Villani, Mortensen 2014; Jadav Rajan Abugosh 2015; Sebastian Hammarström Gustafsson 2015). One major distinction between a simple regression model and an OB method is that in the former model when examining a potential disparity in a dependent variable, the model concludes the presence of a racial disparity when the coefficient of a race variable is estimated to be statistically different from zero, after controlling for other covariates in the same regression model. The regression model usually does not include an interaction term between a race variable and each covariate, but rather implicitly assumes that the effect of each covariate (e.g., insurance) is the same between the two groups (e.g., Non-Hispanic whites and Hispanics). On the other hand, an OB method runs two regression models for each of the groups. Conceptually, these regressions are equivalent to the simple regression model with additional interaction terms between a race variable and each covariate. The differences in the coefficients partly explain the disparity of the dependent variable.

Thus, OB identifies the contribution of the independent variables that contribute toward group differences as well as quantifies the extent to which each independent variable affects the disparity. Additionally, the decomposition also predicts the percentage reduction or increase in disparity based on a change in each independent variable. Analytically, the technique decomposes the differences in the outcome variable (i.e. mammogram screening) between the two groups (Non-Hispanic whites – Hispanics and Non-Hispanic whites – Non-Hispanic blacks) into two components. The first component referred to as the “explained” portion of the disparity which is essentially the proportion of disparity that each observed independent variable (individual and contextual factors in this study) accounts for the differences in cancer screening compliance between the racial groups. The second component is the "unexplained" portion of the disparity that is not explained by the variables included.

Fairlie provides an extension of the original OB method that applies to logistic regression models for binary outcome variables (Fairlie 2006). Since the dependent variable in the study is a binary indicator for concordant screening, the Fairlie extension is also used for comparison. Both methods offer several advantages and disadvantages and are discussed further in the results section. To obtain the Fairlie, separate models are implemented for each racial and ethnic group, however further explanation is provided using Non-Hispanic whites and Hispanics as an example. The logistic regression models for NHW and Hispanics will take the following specifications:

$$Y_{NHW} = F(X_{NHW}\beta_{NHW}) \quad (1)$$

$$Y_{H} = F(X_{H}\beta_{H}) \quad (2)$$

To account for differences, 2 will be subtracted from 1, thus

$$Y_{NHW} - Y_{H} = \sum_{i=1}^{NHW} \frac{F(X_i^{NHW}\beta^{NHW})}{N^{NHW}} - \sum_{i=1}^{H} \frac{F(X_i^{H}\beta^{W})}{N^{H}} \quad \text{Explained Component}$$

$$= \sum_{i=1}^{H} \frac{F(X_i^{H}\beta^{NHW})}{N^{H}} - \sum_{i=1}^{H} \frac{F(X_i^{H}\beta^{H})}{N^{H}} \quad \text{Unexplained Component}$$

where Y is an indicator for receipt of mammography, X_i is a vector for all covariates. The regression results provide coefficient estimates for each predictor variable in the model, with percentage estimates for their contribution to the "explained gap" and a total disparity explained by observed characteristics.

The OB technique allows accounting for the complex survey design, the sampling strata and the primary sampling unit (PSU) are used. The STATA command: svyset is used to declare the dataset to be a complex survey data by specifying MEPS instructed survey design variables that included year-specific variables that identified the strata, the PSUs, and a variable containing the individual sampling weights. All analysis is conducted in STATA version 14.1. All analysis is conducted at a 0.5 alpha statistical significance level.

Results

Sample Characteristics

Table 1 provides descriptive statistics of the analytical cohort (weighted sample size= 386,515,723) by race and ethnicity. Approximately half the sample is non-Hispanic whites (50.71%) and a quarter is Hispanics (25.52%). The mean age of the women in the sample is 54.30 (± 0.05) and the Hispanic women are generally in the younger age group of 40-49 years. Non-Hispanic black and Hispanic women are more likely to be low-income compared to Non-Hispanic whites. Most of the women in the cohort have less than college education, but almost half the Hispanic women in this sample have less than high school education. Although, majority are generally insured, Hispanic women have the highest percent of uninsured (27%). Additionally, in this sample, compared to Non-Hispanic whites, racial and ethnic minority women are more likely to be on Medicaid. Although, majority report having a usual source of care, one-fourth of the Hispanic women indicated not having a usual source of care. Most women report their physical and mental health status to be excellent/very good/good. However, more than two-thirds of the women have a co-morbidity and 35% of the Non-Hispanic black women report having three or more comorbidities.

Table 1: Descriptive statistics of analytic cohort by race/ethnicity (percentages are listed as column percentage among each characteristics)

	Non-Hispanic white	Non-Hispanic black	Hispanic	p-value
% in sample	50.71	23.78	25.52	***
Age in years (%)				
40-49	30.5	37.4	44.14	**
50-64	49.42	46.98	41.83	**
65-74	20.08	15.62	14.03	**
Income (%)				
High (>400%FPL)	50.45	27.97	23.35	***
Middle (200-400% FPL)	28.02	28.78	30.56	***
Low (<200% FPL)	21.53	43.24	46.09	***
Education (%)				
Less than high school	20.79	29.12	49.6	***
GED/high school	19.19	22.05	16.9	***
Some College	38.28	35.37	24.55	***
College	21.74	13.46	8.945	***
Region (%)				
West	19.79	8.5	39.76	
Northeast	19.44	16.4	15.15	
Midwest	26.11	17.02	7.094	
South	34.66	58.06	37.99	
Insurance status (%)				
Uninsured	8.14	13.78	26.88	***
Medicare	7.8	6.97	5.985	***
Medicaid	7.24	19.29	18.56	***
Private	76.82	59.96	48.57	***
No usual source of care (%)	11.93	15.83	23.83	***
Physical health status (%)				
Fair	7.3	12.63	12.24	**
Good	19.09	26.95	28.51	**
Excellent	73.61	60.42	59.25	**
Mental health status (%)				
Fair	3.42	4.18	4.09	
Good	13.65	16.78	18.28	
Excellent	82.93	79.04	77.63	
Chronic conditions (%)				
0 comorbidities	26.67	20.66	31.83	
1 comorbidity	23.84	23.01	25.3	
2 comorbidities	20.99	21.46	17.82	
3 or more comorbidities	28.5	34.87	25.05	
Survey year (%)				

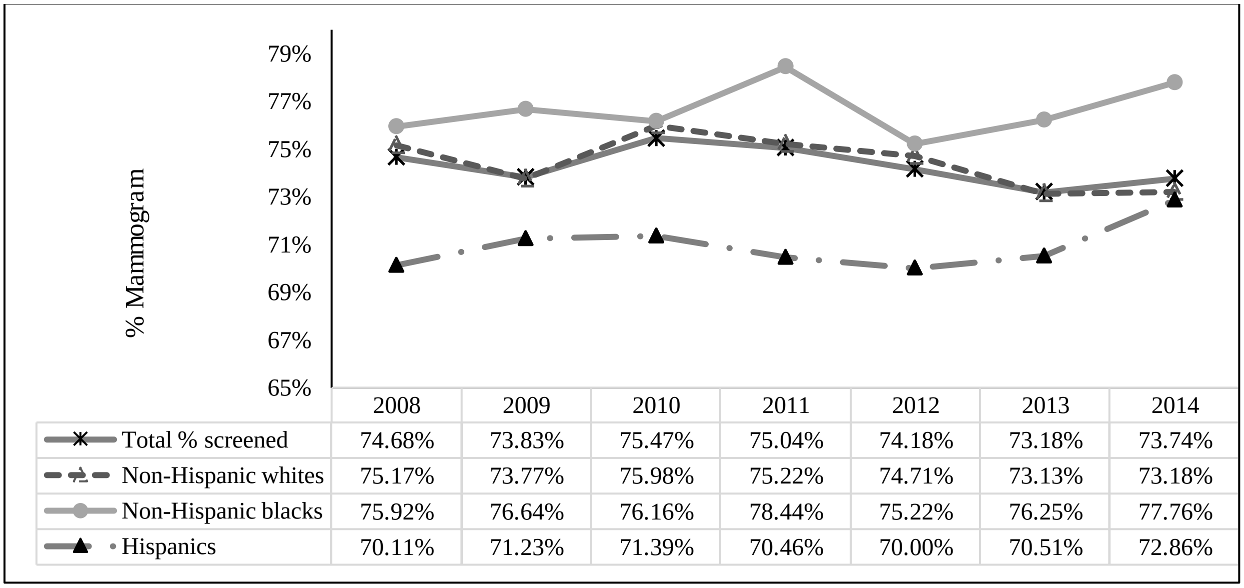
2008	14.26	13.18	12.87
2009	14.34	13.31	12.85
2010	14.17	14	13.21
2011	14.21	14.39	14.17
2012	14.41	14.59	14.9
2013	14.31	15.12	15.76
2014	14.32	15.41	16.23

Chi-square tests for equality in proportions across racial and ethnic groups. $^{*}p < 0.1$ $^{**}p < 0.05$ $^{***}p < 0.01$.

Utilization of Mammogram Screening

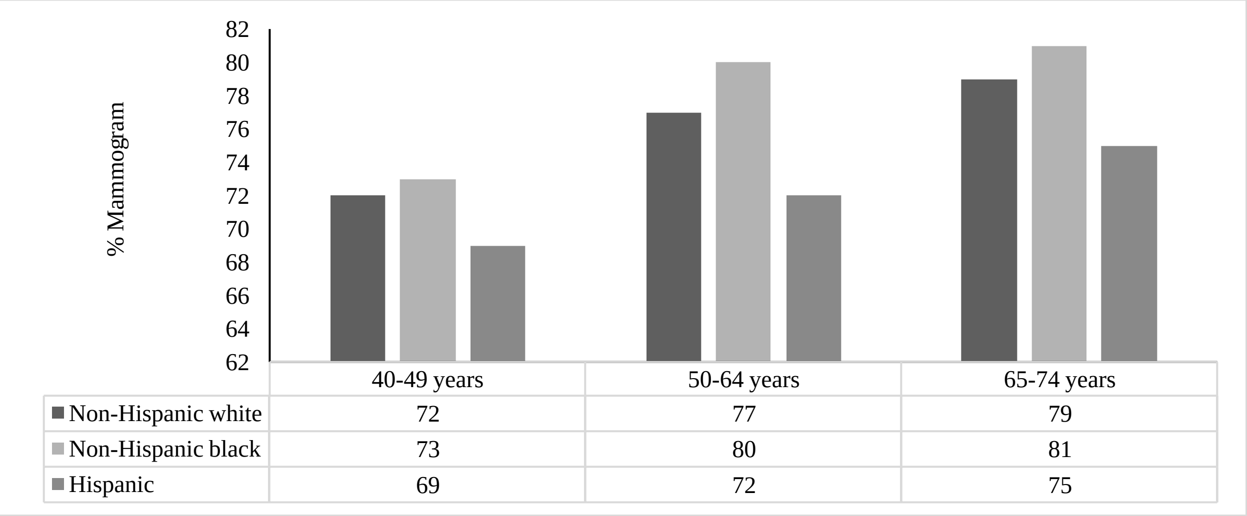
Utilization of guideline concordant mammogram screening from 2008-2014 is presented in Figure 4. Overall, the rates of mammogram screening seem to be plateaued over the study period, ranging from 75% in 2008 to 74% in 2014. Non-Hispanic blacks have the highest rates of mammogram screening compared to the other two groups, which peaked at 78% in 2011, dropped to 75% in 2012 but shows increases in 2013 and 2014. Among Non-Hispanic white women, the rates seem to be steady at approximately 75% until 2011, after which the percent screened decreases to 73% in 2014. Hispanics had the lowest rate of mammogram utilization compared to other groups. For Hispanics, mammogram screening rate trend is generally variable; it is 70% in 2008; 71% in 2009-2010, decreases to 70% between 2011-2013 but finally increases to 73% in 2014. Changes in screening rates over time were statistically significant for only Hispanic white women. Additionally, Non-Hispanic blacks continued to have the highest rates of screening while Hispanic women have the lowest percentage of timely screened regardless of the age category (Figure 5).

Figure 4: Utilization of Mammogram Screening by Race/Ethnicity from 2008 – 2014



	2008	2009	2010	2011	2012	2013	2014
Total % screened	74.68%	73.83%	75.47%	75.04%	74.18%	73.18%	73.74%
Non-Hispanic whites	75.17%	73.77%	75.98%	75.22%	74.71%	73.13%	73.18%
Non-Hispanic blacks	75.92%	76.64%	76.16%	78.44%	75.22%	76.25%	77.76%
Hispanics	70.11%	71.23%	71.39%	70.46%	70.00%	70.51%	72.86%

Figure 5: Mammogram Screening by Race/Ethnicity and Age-Group



	40-49 years	50-64 years	65-74 years
■ Non-Hispanic white	72	77	79
■ Non-Hispanic black	73	80	81
■ Hispanic	69	72	75

Bivariate Analysis

Table – 2 shows results for bivariate regression analysis. Mammogram use is slightly higher for Non-Hispanic black women (76.64%) compared to Non-Hispanic whites (74.45%); whereas Hispanics have the lowest mammogram screening rate (70.97%). Unadjusted logistic regression results indicate that Hispanics are significantly less likely to receive mammograms compared to Non-Hispanic whites (OR: 0.84 95% CI: 0.74- 0.94; p<0.004), whereas Non-Hispanic blacks have a significantly higher likelihood of reporting receipt of mammograms (OR: 1.13 95% CI: 1.03-1.23; p<0.009). Several other characteristics are significantly associated with mammogram use in the bivariate analysis. For example, increasing age is associated with significantly higher odds of receiving mammograms. Among enabling factors, having income above 400% FPL, higher education and having usual source of care are associated with higher odds of receiving mammogram screening. On the other hand, being uninsured is associated with lower odds of receiving mammograms. Among need characteristics, having fair or poor health status significantly reduces the odds of receiving mammograms, however having a chronic condition is associated with a higher likelihood of receiving mammograms.

Table 2: Bivariate Regression Analysis for Mammogram Screening

	Percentage of females who received mammogram	**Bivariate odds ratio (95% CI)**	**p-value**
Race			
Non-Hispanic whites	74.45%	Reference	
Non-Hispanic black	76.64%	1.13 (1.03-1.23)	0.009
Hispanics	70.97%	0.74 (0.64 - 0.94)	0.004
Age in years			
40-49	67.02%	Reference	
50-64	77.31%	1.68(1.55-1.81)	<0.001
65-74	79.37%	1.89 (1.7-2.10)	<0.001
Income			
High (>400%FPL)	83.18%	Reference	
Middle (200-400% FPL)	71.59%	0.51 (0.46-0.56)	<0.01
Low (<200% FPL)	62.70%	0.034 (0.31-0.37)	<0.01
Education			
Less than high school	66.40%	Reference	
GED/high school	70.98%	1.24(1.12-1.36)	<0.01
Some College	76.08%	1.61(1.47-1.76)	<0.01
College	84.73%	2.81(2.50-3.16)	<0.01

Region			
West	72.74%	Reference	
Northeast	79.80%	1.48(1.25-1.74)	<0.01
Midwest	73.50%	1.04(0.91-1.19)	0.547
South	72.90%	1.01(0.88-1.16)	0.9
Insurance status			
Uninsured	45.26%	Reference	
Medicare	75.22%	3.67 (3.13-4.31)	<0.01
Medicaid	67.89%	2.56(2.29-2.86)	<0.01
Private	79.67%	4.74 (4.33-5.18)	<0.01
Have usual source of care	78.08%	3.45(3.12-3.77)	<0.01
Physical health status			
Fair	65.45%	Reference	
Good	70.64%	1.27(1.13-1.42)	<0.01
Excellent	76.48%	1.71(1.54-1.90)	<0.01
Mental health status			
Fair	63.74%	Reference	
Good	67.97%	1.21(1.03-1.41)	<0.01
Excellent	75.89%	1.79(1.54-1.07)	<0.01
Chronic conditions			
0 comorbidities	67.08%	Reference	
1 comorbidity	75.10%	1.48 (1.32-1.65)	<0.01
2 comorbidities	78.62%	1.80(1.61-2.02)	<0.01
3 or more comorbidities	77.16%	1.66(1.50-2.21)	<0.01
Survey year			
2008	74.68%	Reference	
2009	73.83%	0.96(0.88-1.04)	0.306
2010	75.47%	1.04(0.93-1.17)	0.469
2011	75.04%	1.02(0.92-1.12)	0.693
2012	74.18%	0.97(0.88-1.08)	0.617
2013	73.18%	0.92(0.83-1.03)	0.162
2014	73.74%	0.95(0.85-1.06)	0.386

Decomposition

Since the unadjusted screening rate is similar between Non-Hispanic blacks and Non-Hispanic whites, the decomposition is obtained between Non-Hispanic whites and Hispanics and Non-Hispanic blacks and Hispanics due to the significant differences in their screening rates. The next set of tables include the decomposition results for mammogram screening applied separately within two sets of periods, 2008-2010 (pre-ACA) and 2011-2014 (post-ACA) as well as for each year separately. The goal of the decomposition is two-fold; first is to estimate the percent contribution of insurance in explaining the differences in mammogram screening between the two groups and assess if the percent contribution changes between the two-time periods.

There are several decomposition methods, but Oaxaca-Blinder (OB) and Fairlie decomposition are commonly used to examine disparities. Both the methods offer several advantages but also pose some limitations. The OB method is primarily used for linear outcome variables but offers the advantage of usability with the statistical commands to account for complex survey design. On the other hand, Fairlie decomposition is more suited for a binary dependent variable and also offers two important advantages; 1) randomize the order of the variables which accounts for the indexing issue, 2) draws random samples for the estimates to account for the differences in the sample sizes between the two groups. However, a limitation of Fairlie is that it cannot be implemented with complex survey design commands; although it does allow use of survey weights in the estimation. In a review by Fairlie (2005) comparing the estimates from OB and Fairlie decomposition, the author suggested that in most cases it can be expected that the OB decomposition will approximate the non-linear decomposition results. However, to obtain the standard errors adjusted for the complex survey design with Fairlie, the following method is implemented. First, a "correction factor" is created for each variable in the model by taking a ratio of its standard errors estimated using OB models without adjusting for the complex survey design and the standard errors estimated using OB models by adjusting for the complex survey design. Next the standard errors obtained by the Fairlie method are multiplied by the correction factor for that specific variable. The main results discussed are from the Fairlie decomposition while the OB decomposition is presented as robustness checks.

The decomposition results for mammogram use in 2008-2010 between Non-Hispanic whites and Hispanics are presented in Appendix Table 2. In the tables, several estimates are presented; including the predicted probability of receiving mammogram for the two comparison groups and the difference in the predicted probabilities. Generally, the decomposition coefficients have a positive sign indicating that observed characteristics in the model are successfully able to explain the differences in screening between Non-Hispanic whites and Hispanics. In the pre-ACA data (2008-2010), the predicted probability of mammogram use is 0.7497 for non-Hispanic white women and 0.7091 for Hispanics. Therefore, a gap of 0.041 or 4.1% exists between these two groups. The total gap explained by measurable/observed covariates is found to be approximately 136% which suggests that the variables in the model are able to account for a significant portion of the differences in screening. Finally, estimates, standard errors and percent contribution of each variable are presented. The percent contribution is the total amount of difference in screening that is explained by the specific variable. Thus, the results suggest that if a higher number of Hispanic females are insured, then the likelihood of receiving mammograms may increase, which may reduce the disparity by 27%. Similarly, if higher Hispanic females have access to a usual source of care, this may increase screening reducing the existing disparities in mammogram by 19%. The other two covariates that are significant in explaining the differences in screening are income and education which together explain about 38% of the gap.

Decomposition results from 2011-2014 are presented in Appendix Table 3. Overall, the results seem fairly similar compared to 2008-2010 with mostly positive coefficients on all the variables. The predicted probability of receiving mammograms for Non-Hispanic whites is 0.74059 compared to 0.70998 among Hispanics, therefore a gap of 0.0306 or 3.1% continues to persist between the two groups. The percent contribution of insurance status suggests that if

Hispanic females are insured, then the likelihood of receiving mammograms may increase, which may reduce the disparity by 33%. The coefficients on education, income and usual source of care continue to remain positive and highly significant in explaining the differences in mammogram screening.

Next, decomposition models are estimated for each year within the study period in contrast to the aggregated results from the pre-and post ACA periods (Figure 6 and Table 3). Several provisions under the ACA were implemented over time, and the goal of this analysis is to examine if the difference in mammogram use between the Non-Hispanic white and Hispanic women and the percent contribution of insurance changed over time. It can be expected that as insurance expansions and copayment provisions went into effect, the difference in mammogram screening and the percent contribution of insurance in explaining the differences in mammogram use will show a decline. In Table 3, predicted probabilities of mammogram use among Non-Hispanic white and Hispanic women are presented along with the difference in mammogram use, explained and unexplained differences in use and the percent contribution of each variable in the model.

Figure 6: Difference in Mammogram Use and Insurance Contribution 2008-2014

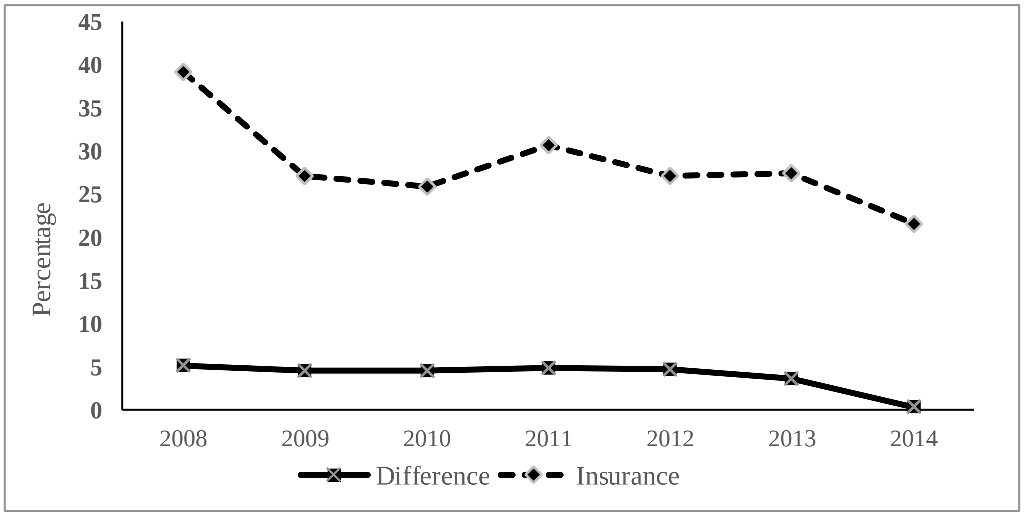


Table 3: Year-specific Fairlie Decomposition Results for Mammogram Use between Non-Hispanic whites and Hispanics

	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Predicted probability of Mammogram use among non-Hispanic whites	0.752	0.738	0.760	0.752	0.747	0.731	0.732
Predicted probability of Mammogram use among Hispanics	0.701	0.712	0.714	0.705	0.700	0.705	0.729
Difference in use	0.051	0.025	0.046	0.048	0.047	0.036	0.003
Total Explained gap (%)	133	134	141	124	130	128	106
Total Unexplained gap (%)	8.3	10.9	9.5	7.6	8.3	9.1	10.3
Percent Contribution (%)							
Have Insurance	39.17	27.65	25.77	30.68	26.88	27.34	21.61
Age	5.98	5.66	6.98	6.63	6.38	6.04	9.28
Income	24.52	21.19	25.39	31.59	24.37	14.34	25.72
Education	15.21	12.65	17.11	1.83	17.17	13.72	3.73
Region	-2.85	-0.90	-3.19	-1.46	-0.99	-5.03	-0.21
Chronic Conditions	7.14	4.88	3.58	2.92	3.17	5.52	4.31
Have a usual source of care	20.30	22.48	13.33	18.76	16.36	22.77	16.58
Physical health status	2.11	5.73	7.75	7.96	6.11	5.31	3.50
Mental health status	1.07	1.53	3.18	1.09	0.31	1.07	0.12

As expected the differences in the mammogram use among Non-Hispanic whites and Hispanics appear to decline over time. Additionally, the variables included explain more than 100% of the difference, which means that the differences between Non-Hispanic white and Hispanic women in the included variables accounts for differences in mammogram use between the two groups. In 2008, there is an approximately 5.1 percent difference in mammogram use between the two groups compared to a 0.3 percent difference 2014. Overall, insurance continues to contribute to a significant portion of the explained gap; where insurance status contributes to almost 39% of the explained gap in mammogram use in 2008 compared to 22% contribution to the gap in mammogram use in 2014. In addition to insurance, having a usual source of care and socio-economic differences contribute to the majority of the explained differences. In other words, it means that if Hispanic women had the same level of insurance, income and education and had a usual source of care, it can reduce the gap in mammogram use. The estimates are relatively comparable across the OB and the Fairlie decomposition models.

Finally, decomposition models compare the differences in mammogram use between Non-Hispanic blacks and Hispanics. Descriptive and bivariate analysis suggest that although there are no significant differences in predisposing, enabling or need characteristics, there is a significantly higher rate of mammogram screening among Non-Hispanic blacks. Pre-ACA (Appendix table 4), the predicted probability of receiving mammogram for Non-Hispanic black women is 0.76 compared to 0.71 among Hispanic women; a 5.3 percentage points difference. However, unlike the previous decompositions, only 53% of this gap in screening is explained by the factors in the model. Insurance contribute to 23% of this gap, however the percent contribution of income and education is significantly lower (5% and 11%, respectively). Having a usual source of care and chronic conditions contributed to nearly 50% of the explained difference in mammogram use. Similar patterns were noted in the post-ACA decomposition of the mammogram screening between Non-Hispanic blacks and Hispanics (Appendix table 5), where the predicted probability of receiving mammogram for Non-Hispanic black women is 0.77 compared to 0.71 among Hispanic women; a 5.6 percentage points difference. The variables in the models explain only 60% of the difference in mammogram use, however the percentage contribution of insurance is 37% which is higher compared to the pre-ACA study period. Usual source of care and having chronic conditions explain approximately 18% of the difference in mammogram use.

The examination of year-specific decomposition results between Non-Hispanic black and Hispanic women are presented in Table 4 below. Non-Hispanic black women have higher predicted probabilities in mammogram use compared to Hispanic women over the study period.

Generally, variables in the model explain approximately 50% of this difference but another 50% remains unexplained. Of the explained difference in mammogram use, differences in insurance contributes to almost one-third of the gap. However, having chronic conditions and a usual source of care together explain about more than half of the difference in mammogram use.

Table 4: Year-specific Fairlie Decomposition Results for Mammogram Use between Non-Hispanic blacks and Hispanics

	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Predicted probability of Mammogram use among non-Hispanic whites	0.759	0.766	0.762	0.784	0.752	0.762	0.778
Predicted probability of Mammogram use among Hispanics	0.701	0.712	0.714	0.705	0.700	0.705	0.729
Difference in use	0.058	0.054	0.048	0.080	0.052	0.057	0.049
Total Explained gap (%)	78	60	50	52	58	65	51
Total Unexplained gap (%)	22	40	50	48	42	35	49
				Percent Contribution (%)			
Have Insurance	24.78	17.46	26.08	26.34	38.51	41.16	38.75
Age	1.90	0.82	10.40	4.45	3.71	8.44	10.00
Income	1.55	4.38	10.07	8.94	6.59	3.75	10.95
Education	8.21	9.78	20.68	9.32	17.37	7.34	7.26
Region	2.25	-5.44	-17.52	1.63	-7.62	5.93	8.95
Chronic Conditions	36.39	32.68	18.83	28.05	23.73	13.70	11.89
Have a usual source of care	26.96	42.66	26.70	25.53	17.64	20.34	10.26
Physical health status	-2.69	-0.78	1.09	-4.39	-0.82	-0.59	0.11
Mental health status	0.47	-1.18	3.42	-0.22	0.35	0.00	1.92

Finally, study estimates for the decomposition between Non-Hispanic whites and Hispanics and the decomposition between Non-Hispanic blacks and Hispanics are robust to OB decomposition used with and without account for the complex survey design (i.e. svy stata command) (Appendix tables 6,7,8,9).

Discussion

This study examines patterns of mammogram utilization from 2008-2014 by race and ethnicity using a nationally representative sample from the Medical Expenditure Panel Survey (MEPS). Additionally, the role of insurance in explaining in these differences is quantified using data prior to and after the passage of the ACA. Overall trend from 2008-2014 suggests that for most females, the Health People 2010 mammography goals of 70% is achieved and has remained relatively steady over the study period, this is consistent with previous studies (Jadav et al. 2015, Rao Breen Graubard 2016). The study also confirms that racial-ethnic disparities exist in utilization for breast cancer (Miranda, Tarraf, Gonzalez, 2012; Miranda et al. 2012, Sabatino et al. 2008). Differences in mammogram screening continue to persist between Non-Hispanic whites and Hispanics; Hispanic women have significantly lower rates of screening. However, mammogram rates are the highest for Non-Hispanic black women. These results are similar to previous findings which have suggested higher self-reported rates of mammogram among Non-Hispanic black women (Miller et al. 2012). Year-specific comparisons of rates show that the largest declines in racial-ethnic difference among Non-Hispanic whites and Hispanics are in 2014. While, this study is unable to examine whether these changes are associated with any specific ACA provision, prior work has suggested significant gains in the rates of insured since the ACA which likely have improved access to care (Morrow, Polsky, 2016).

Decomposition estimates from the Non-Hispanic white – Hispanic model and Non-Hispanic black – Hispanic comparisons show contrasting findings, where differences in insurance status played a large role in explaining the Non-Hispanic white – Hispanic gap but a significant portion of the Non-Hispanic black – Hispanic difference is unexplained by the variables included in this study. For example, the decomposition estimates comparing mammogram use between

Non-Hispanic white and Hispanic women suggests that largest gains in mammogram screening were in 2014 which as a result also saw the largest decline in the racial-ethnic difference (0.3 percent). The variables included in the study explained more than 90% of the difference in mammogram use. Insurance status however, contributed to majority of the difference explained, which suggests that it remains as one of the most important factors in receiving mammogram screening. Hispanic women are more likely to be low-income and financial barriers can be challenging to access preventive care. Prior work has found that only 20% of Latinos have public health insurance and a significant number of Latinos work for employers who do not provide health insurance coverage (Smedley, Stith, Nelson, 2002; Selvin, Brett, 2003). Given that in this study, insurance coverage and access to care are the biggest drivers of disparities, in order to enhance screening among Hispanics, national program/interventions should target enabling factors such as insurance coverage and access to care. These findings corroborate previous research using the NHIS suggest that programs or policies to ensure that everyone has health insurance that is readily usable to obtain timely, convenient services, covers standard care, and reimburses at going rates (i.e. Medicare or higher) and a usual source of health care would help reduce disparities in cancer screening. Therefore, policies such as Medicaid expansions or subsidies to purchase health insurance under the ACA can be especially important for improving access among low-income racial and ethnic minorities.

In this sample, Non-Hispanic blacks and Hispanic women have similar socio-demographic characteristics, however, Non-Hispanic black women have significantly higher rates of mammograms. Unlike the results from the Non-Hispanic white – Hispanic comparisons, the decomposition estimates between Non-Hispanic blacks and Hispanics suggest that only half of the difference is explained by the variables in the study. Additionally, the contribution of insurance, income and education in explaining the differences is relatively low. Thus, the results suggest that there is a significant portion of the disparity between Non-Hispanic blacks and Hispanics that remains unexplained and several plausible explanations can be offered. First, prior studies examining disparities have found that while overall rates of mammography remain high for Non-Hispanic blacks, there could be difference across age-groups where African Americans have lower screening among women less than 65 years of age (Ahmed et al. 2017). However, this is in contrast to the findings in this study which suggest that Non-Hispanic black women have higher mammogram rates regardless of the age category. Second, differences in cultural beliefs and preferences can play an important factor. Third, patient-provider communication is crucial for improving uptake of preventive care and women who report not speaking English well have lower rates of screening. Moreover, these differences are not accounted for by being native to the U.S., having different social or demographic factors, and/or the length of residence in the U.S., which suggests a communication barrier to access (Jacobs et al. 2005). Therefore, use of culturally-sensitive information materials, translator and patient-navigation services are crucial to increase awareness and knowledge of cancer screening, Finally, provider characteristics influence screening rates and the probability of having a screening mammogram is greater in women who have personal physicians, who seek health care at their physician's offices, and who have health care coverage. Hispanic/Latino women are less likely to have these protective factors (Aldrige, Daniels, Jukic, 2006).

Several limitations should be considered. Given the observational study design, causality cannot be established. Some of the inherent problems associated with using OB decomposition are variable ordering, index problem, observation matching problem, and choice of sample weights (Fairlie, 2005). To overcome these limitations, this study randomized the order of the variables in the model and random samples of matched women were generated for the observation matching. Additionally, with Fairlie, standard errors cannot be estimates accounting for complex survey design. However, to account for that a correction factor was developed and the standard errors from Fairlie were adjusted for the complex survey design. Additionally, robustness of the results was examined using OB models using complex survey design. Since in MEPS, the use of mammogram is a self-reported measure, it may have recall and social desirability biases and over-reporting. Even though cultural beliefs, preferences, and provider characteristics influence screening rates, these factors were not incorporated in the analyses in this study because of database limitations.

In conclusion, mammogram screening rates continue to remain low among Hispanic women compared to Non-Hispanic blacks and Non-Hispanic whites. Insurance status and usual source of care are the most important contributing factors in this disparity. Thus, as coverage expansions continue, further research is needed to monitor breast cancer screening uptake. Policies that remove financial barriers such as elimination of copayment for preventive services are important to improve access. However, differences in income and education are important to consider as broader social constructs that can impact uptake of preventive care.

Appendices

Appendix Table 1: Mammogram Screening Recommendations

American Cancer Society	Women with an average risk of breast cancer should undergo regular screening mammography starting at age 45 years (strong recommendation). Women aged 45 to 54 years should be screened annually (qualified recommendation). Women 55 years and older should transition to biennial screening or have the opportunity to continue screening annually (qualified recommendation). Women should have the opportunity to begin annual screening between the ages of 40 and 44 years (qualified recommendation)
USPSTF	Women, Before the Age of 50 Years: The decision to start regular, biennial screening mammography before the age of 50 years should be an individual one and take patient context into account, including the patient's values regarding specific benefits and harms (Grade C) Women, Age 50-74 Years: The USPSTF recommends biennial screening mammography for women 50-74 years (Grade B)
American College of Obstetricians and Gynecologists (ACOG)	Annual mammograms beginning at age 40
National Comprehensive Cancer Network (NCCN)	Annual beginning at age 40

Sources:

1. American Cancer Society: American Cancer Society guidelines for the early detection of cancer. American Cancer Society, update, 2015.
2. Final Update Summary: Breast Cancer: Screening. U.S. Preventive Services Task Force. January 2016. https://www.uspreventiveservicestaskforce.org/Page/Document/UpdateSummaryFinal/breast-cancer-screening
3. American College of Obstetricians and Gynecologists: ACOG Committee on Practice Bulletins-Gynecology. ACOG Practice Bulletin Number 42: breast cancer screening. ACOG Pract Bull, 2003;101, 821-831, Update 2015.
4. National Comprehensive Cancer Network: NCCN GUIDELINES FOR DETECTION, PREVENTION, & RISK REDUCTION: Breast Cancer Screening and Diagnosis. Version 1. 2013. Update 2015.

Appendix Table 2: Decomposition Estimates of Mammogram Screening between Non-Hispanic whites and Hispanics, 2008-2010

Probability of receiving Mammogram for NHW	0.74971807		
Probability of receiving Mammogram for Hispanics	0.70914858		
Difference in use	0.0405695		
Total Explained	0.13627381		
	Decomposition	SE$^{\$}$	% Contribution
Having Insurance	0.0365443	0.002884034	26.82
Age	0.0084812	0.001636624	6.22
Income	0.0323221	0.00280828	23.72
Education	0.0202418	0.002510393	14.85
Region	-0.0026952	0.002775526	-1.98
Comorbidities	0.0072475	0.001180277	5.32
Have Usual Source of Care	0.0247869	0.00181392	18.19
Physical Health Status	0.0067387	0.00146508	4.94
Mental Health Status	0.0026201	0.000601507	1.92

*p<0.1, **p<0.05, ***p<0.01. All variables are significant at p<0.01 except region which is not statistically significant. SE = standard error. $^{\$}$ SE corrected by multiplying the SE obtained from Fairlie decomposition by a ratio of SE obtained from OB without svy and SE obtained from OB with svy to account for complex survey design.

Appendix Table 3: Decomposition Estimates of Mammogram Screening between Non-Hispanic whites and Hispanics, 2011-2014

Probability of receiving Mammogram for NHW	0.7405905		
Probability of receiving Mammogram for Hispanics	0.70997658		
Difference in use	0.03061392		
Total Explained	0.12216329		
	Decomposition	SE$	% Contribution
Having Insurance	0.0402406	0.002486636	32.94
Age	0.0084213	0.001446027	6.89
Income	0.0288083	0.002653928	23.58
Education	0.0106964	0.003935864	8.76
Region	-0.0021954	0.002139989	-1.80
Comorbidities	0.005066	0.00077209	4.15
Have Usual Source of Care	0.0224486	0.001435035	18.38
Physical Health Status	0.0076284	0.001262516	6.24
Mental Health Status	0.0009669	0.000407169	0.79

*p<0.1, **p<0.05, ***p<0.01. All variables are significant at p<0.01 except region which is not statistically significant. SE = standard error. $ SE corrected by multiplying the SE obtained from Fairlie decomposition by a ratio of SE obtained from OB without svy and SE obtained from OB with svy to account for complex survey design.

Appendix Table 4: Decomposition Estimates of Mammogram Screening between Non-Hispanic blacks and Hispanics, 2008-2010

Probability of receiving Mammogram for NHW	0.76242815		
Probability of receiving Mammogram for Hispanics	0.70914858		
Difference in use	0.05327958		
Total Explained	0.06276519		
	Decomposition	SE$^{\$}$	% Contribution
Having Insurance	0.0146848	0.002298844	23.40
Age	0.0025942	0.001782225	4.13
Income	0.0029696	0.000569482	4.73
Education	0.0072165	0.001747663	11.50
Region	-0.0029094	0.004203946	-4.64
Comorbidities	0.0186117	0.002522153	29.65
Usual Source of Care	0.0199658	0.00152962	31.81
Physical Health Status	-0.000307	0.000280311	-0.49
Mental Health Status	0.0001911	0.000245993	0.30

*p<0.1, **p<0.05, ***p<0.01. All variables are significant at p<0.01 except region which is not statistically significant. SE = standard error. $^{\$}$ SE corrected by multiplying the SE obtained from Fairlie decomposition by a ratio of SE obtained from OB without svy and SE obtained from OB with svy to account for complex survey design.

Appendix Table 5: Decomposition Estimates of Mammogram Screening between Non-Hispanic blacks and Hispanics, 2011-2014

Probability of receiving Mammogram for NHW	0.76916626		
Probability of receiving Mammogram for Hispanics	0.70997658		
Difference in use	0.05918968		
Total Explained	0.05597836		
	Decomposition	SE$^{\$}$	% Contribution
Having Insurance	0.0205512	0.001901947	36.71
Age	0.0038588	0.000861336	6.89
Income	0.0039302	0.000622233	7.02
Education	0.0056515	0.002598338	10.10
Region	0.0019174	0.003258638	3.43
Comorbidities	0.0105333	0.001798461	18.82
Usual Source of Care	0.0103182	0.001124432	18.43
Physical Health Status	-0.000748	0.000370963	-1.34
Mental Health Status	-0.00010	0.000211523	-0.18

*p<0.1, **p<0.05, ***p<0.01. All variables are significant at p<0.01 except region which is not statistically significant. SE = standard error. $^{\$}$ SE corrected by multiplying the SE obtained from Fairlie decomposition by a ratio of SE obtained from OB without svy and SE obtained from OB with svy to account for complex survey design.

Appendix Table 6: Decomposition Estimates of Mammogram Screening between Non-Hispanic whites and Hispanics, Oaxaca-Blinder 2008-2010

Variables	Oaxaca-Blinder without svy			Oaxaca-Blinder with svy			
Probability of receiving Mammogram for NHW	0.7259101			0.7497181			
Probability of receiving Mammogram for Hispanics	0.6931967			0.7091486			
Difference in use	0.0327133			0.0405695			
Total Explained	0.1524302			0.1451355			
	Decomposition	SE	% Contribution	Decomposition	SE	% Contribution	Correction Factor
Having Insurance	0.0375847	0.0031698	24.66	0.0384681	0.003534	26.50	0.896943973
Age	0.0083059	0.0014684	5.45	0.0066363	0.0013809	4.57	1.063364472
Income	0.0394074	0.0029809	25.85	0.0373749	0.0034209	25.75	0.871378877
Education	0.0242129	0.0024669	15.88	0.0231729	0.0026034	15.97	0.947568564
Region	-0.0024541	0.0012133	-1.61	-0.0010411	0.0012073	-0.72	1.004969767
Comorbidities	0.0092553	0.0012649	6.07	0.0058482	0.0011674	4.03	1.083518931
Have Usual Source of Care	0.0273327	0.0022911	17.93	0.0238885	0.0025207	16.46	0.908914191
Physical Health Status	0.0065226	0.0015697	4.28	0.0084396	0.0019745	5.81	0.794986072
Mental Health Status	0.0022627	0.0007023	1.48	0.0023481	0.0008647	1.62	0.812189199

*$p<0.1$, **$p<0.05$, **$p<0.01$. SE = standard error. All variables are significant at $p<0.01$ except region which is not statistically significant. Correction factor is calculated by taking a ratio of the SE from OB without svy and SE from OB with svy.

Appendix Table 7: Decomposition Estimates of Mammogram Screening between Non-Hispanic whites and Hispanics, Oaxaca-Blinder 2011-2014

Variables	Oxaca-Blinder without svy			Oxaca-Blinder with svy			
Probability of receiving Mammogram for NHW	0.7216421			0.7405905			
Probability of receiving Mammogram for Hispanics	0.6874702			0.7099766			
Difference in use	0.0341719			0.0306139			
Total Explained	0.1464722			0.1450133			
	Decomposition	SE	% Contribution	Decomposition	SE	% Contribution	Correction Factor
Having Insurance	0.0398225	0.0027227	27.19	0.0408572	0.0030922	28.17	0.880505789
Age	0.0107224	0.0013848	7.32	0.0072727	0.0014249	5.02	0.971857674
Income	0.0375155	0.0027507	25.61	0.033217	0.0031324	22.91	0.878144554
Education	0.0252974	0.0034573	17.27	0.0292348	0.0037971	20.16	0.910510653
Region	-0.001779	0.0009442	-1.21	0.0004088	0.0010831	0.28	0.871756994
Comorbidities	0.006034	0.0008651	4.12	0.0042173	0.0008864	2.91	0.975970217
Have Usual Source of Care	0.0234216	0.0017914	15.99	0.0215226	0.0020585	14.84	0.870245324
Physical Health Status	0.0047509	0.0012758	3.24	0.0075125	0.0016711	5.18	0.763449225
Mental Health Status	0.0006869	0.0003781	0.47	0.0007705	0.0005736	0.53	0.659170153

*p<0.1, **p<0.05, **p<0.01. SE = standard error. All variables are significant at p<0.01 except region which is not statistically significant. Correction factor is calculated by taking a ratio of the SE from OB without svy and SE from OB with svy.

Appendix Table 8: Decomposition Estimates of Mammogram Screening between Non-Hispanic blacks and Hispanics, Oaxaca-Blinder 2008-2010

Variables	Oxaca-Blinder without svy			Oxaca-Blinder with svy			
Probability of receiving Mammogram for NHW	0.746373			0.7691663			
Probability of receiving Mammogram for Hispanics	0.6874702			0.7099766			
Difference in use	0.0589028			0.0591897			
Total Explained	0.0678623			0.0541096			
	Decomposition	SE	% Contribution	Decomposition	SE	% Contribution	Correction Factor
Having Insurance	0.02236	0.002146	32.95	0.0191967	0.0021174	35.48	1.013507131
Age	0.004599	0.0009416	6.78	0.0026307	0.0007684	4.86	1.225403436
Income	0.0049283	0.0008971	7.26	0.0046047	0.0011508	8.51	0.779544665
Education	0.0098366	0.0024124	14.49	0.0069496	0.0025157	12.84	0.95893787
Region	-0.0025021	0.0029859	-3.69	0.0009844	0.0032329	1.82	0.923598008
Comorbidities	0.0141989	0.0017684	20.92	0.0097038	0.0016413	17.93	1.077438616
Have Usual Source of Care	0.0142489	0.0015546	21.00	0.0099788	0.0014781	18.44	1.051755632
Physical Health Status	0.00019	0.0002572	0.28	-0.0000208	0.0003389	-0.04	0.758925937
Mental Health Status	0.000002	0.0000793	0.00	0.00008	0.0001401	0.15	0.566024268

*$p<0.1$, **$p<0.05$, **$p<0.01$. SE = standard error. All variables are significant at $p<0.01$ except region which is not statistically significant. Correction factor is calculated by taking a ratio of the SE from OB without svy and SE from OB with svy.

Appendix Table 9: Decomposition Estimates of Mammogram Screening between Non-Hispanic blacks and Hispanics, Oaxaca-Blinder 2011-2014

Variables	Oxaca-Blinder without svy			Oxaca-Blinder with svy			
Probability of receiving Mammogram for NHW	0.7487138			0.7624282			
Probability of receiving Mammogram or Hispanics	0.6931967			0.7091486			
Difference in use	0.055517			0.0532796			
Total Explained	0.0592865			0.0593483			
	Decomposition	SE	% Contribution	Decomposition	SE	% Contribution	Correction Factor
Having Insurance	0.0163615	0.0024698	27.60	0.0141662	0.0024112	23.87	1.024303251
Age	0.0020024	0.0013409	3.38	0.0010463	0.0009665	1.76	1.387377134
Income	0.0026785	0.001052	4.52	0.0031015	0.0013234	5.23	0.79492217
Education	0.0097348	0.0018269	16.42	0.0095152	0.0020958	16.03	0.871695772
Region	-0.011422	0.0036846	-19.27	-0.0057333	0.0039184	-9.66	0.940332789
Comorbidities	0.0203235	0.0025816	34.28	0.017621	0.0027055	29.69	0.954204398
Have Usual Source of Care	0.0191729	0.0023202	32.34	0.0188712	0.002656	31.80	0.873569277
Physical Health Status	0.0002468	0.0002696	0.42	0.0004466	0.0004581	0.75	0.588517791
Mental Health Status	0.0001882	0.0002394	0.32	0.0003135	0.0003413	0.53	0.701435687

*p<0.1, **p<0.05, **p<0.01. SE = standard error. All variables are significant at p<0.01 except region which is not statistically significant. Correction factor is calculated by taking a ratio of the SE from OB without svy and SE from OB with svy.

Chapter 4: Paper III

Perceptions of Providers' Communication among the Low-Income: Does Race and Gender Concordance matter?

"Medicine is an art whose magic and creative ability have long been recognized as residing in the improvement in the interpersonal aspects of patient-physician relationship." – Hall et al, 1981

Abstract

Research Objective: To encourage providers to involve patients in care, a popular policy tool has been to publicly report and incentivize patient satisfaction scores. However, compelling evidence highlights disparities in patient satisfaction among racial/ethnic minorities and low income populations. The role of concordance or shared identities such as race or sex between patient and their provider has been explored as a means to improve patient-provider communication. It is unknown to what extent concordance improves satisfaction among low income. This analysis assesses whether perceptions of provider's communication differ by income and if race and/or sex concordance moderates this relationship.

Study Design: A cross-sectional study design is implemented using annual pooled samples of 2008-2014 Medical Expenditure Panel Survey. Perceptions of provider's communication are measured on four dimensions; how often provider listens carefully, explains medical care in an understandable way, shows respect and spends enough time during consultation. The dependent variable is a binary outcome of perceiving that provider either "always" or "not always" communicates on each of the four dimensions. Respondents report their own and provider's race/ethnicity and sex. Race or sex concordance is established if respondent and their provider

have the same race/ethnicity or sex, respectively. Using total family income at federal poverty level, income is categorized as “low” (<200%), “middle” (200%-400%) and “high” (>400%). Logistic regression models are used to examine association between perceptions and concordance and the analysis are stratified by income.

Population Studied: Analytic sample of 39,175 includes respondents aged 18 years older, who report having a usual source of care (USC) in a setting other than emergency department and with at least one visit to their USC in the previous 12 months of the survey.

Principal Findings: Approximately 40% have dual concordance, 33% indicate being racially concordant and a relatively lower percent (14%) have sex concordance with their USC. Discordance is more common among low to middle income respondents. Compared to high income, low income respondents are less likely to report that their provider “always” communicated on all the four dimensions. The largest differences are detected in perceiving that the USC always explains medical care (4.5 percentage points, $p<0.001$) and shows respect (4.8 percentage points, $p<0.001$). However, perceptions of communication do not differ between middle and low income respondents. Both race/ ethnicity and sex concordance are associated with reporting that provider “always” communicates on all dimensions, however neither race nor sex concordance moderate the association between low income and negative perception of provider communication.

Conclusions: Vulnerable low income populations may experience ineffective patient-provider communication even when they have a concordant USC. This can result in greater dissatisfaction with care received relative to more advantaged populations. Concordance is multidimensional and patient’s perception of similarity to their provider extends to aspects beyond demographic characteristics like personal beliefs and values.

Implications: With a growing emphasis on patient satisfaction scores, a key policy challenge is enhancing provider skills to elicit patient communication preferences especially among the poor that can transcend issues of race and sex to foster positive experiences of care.

Introduction

In the complex modern healthcare environment, it can be challenging for many patients to obtain, process and communicate basic healthcare information which may result in not fully understanding their medical conditions and the treatments provided. Additionally, practitioners may fail to provide adequate information that the patients might need to make the best possible decisions about their own healthcare and treatment. In light of these problems, the 2001 Institute of Medicine report, Crossing the Quality Chasm: A New Health System for the 21st Century, envisioned a healthcare system that is patient-centered and provides care that is "respectful of and responsive to individual patient preferences and needs, and values, and ensuring that patient values guide all clinical decisions." To emphasize patient engagement, there is a growing focus at both the federal and state-level on incentivizing healthcare providers through pay-for-performance policies that include measures of patient's satisfaction with quality of care received. An integral part of measuring patient's experience of care is assessing how patients perceived the quality of communication with their providers; a key element of assessing whether information was delivered effectively (Charles, Gafni, Whelan,1997; Francis, Korsch, Morris, 1969).

Nonetheless, establishing effective patient-provider communication is challenged by many barriers such as patient's anxiety and fear, provider stereotypes, linguistic and cultural barriers (Ferguson, Candib, 2002; Ashton et al. 2003; Balsa, McGuire, 2003). Ineffective communication can introduce disparate experiences of care especially among racial and ethnic minorities and patients with low socioeconomic status (SES) (Van Ryn, Burke, 2000; Van Wieringen, Harmsen, Bruijnzeels, 2002; Ratanawongsa et al. 2009). To address the differential patient-provider communication, examination of factors within the patient-provider relationship such as race, gender, education or other shared social or cultural characteristics is gaining importance (Ackerson, Viswanath, 2009; Shim, 2010). The inquiry in patient-provider communication disparities has extensively studied the role of concordance as an important dimension of the patient-provider relationship. The term concordance has been used to indicate shared identities between patients and their providers on visible demographic characteristics such as race, ethnicity and sex (Cooper et al. 2006). Race/ethnicity and sex concordance stems from the notion that optimal alignment of these characteristics between a patient and provider acts as a mechanism to enhance trust and mutual respect through perceptions of relational similarity. This can encourage more active patient participation and reduce mutual overt stereotyping; thus, potentially improving communication between patients and providers (Street, O'Malley, Cooper, 2008).

The salutary effects of concordance on patient-provider communication through enhanced patient-centered care have demonstrated increases in patient satisfaction with care as well as improvements in overall health. Thus, having the option of race and/ or sex concordant healthcare providers might help mitigate health disparities (Saha et al. 1999; LaVeist, Nuru-Jeter, 2002; Meghani et al. 2009; Traylor et al. 2010). Studies have primarily explored concordance in racial and ethnic minority populations but its potential role in addressing disparities in patient-provider communication among the low-income populations is not known. The aim of this analysis is to examine if race/ethnicity and sex concordance influences perceptions of provider communication in low income patients.

Concordance and Patient Perceptions of Health Care Experiences

The 2010 Patient Protection and Affordable Care Act (ACA) emphasizes delivery of patient-centered, high quality and value-based health care (Reineck, Kahn, 2013). An important and widely accepted component of measuring health care quality is the assessment of patient satisfaction with their health care experience through the use of standardized surveys (Sequist et al. 2008; Buhlman, Matthes, 2011). Additionally, satisfaction with care is regarded as an important component of health services utilization; where higher levels of patient satisfaction have shown to be associated with positive health behaviors, timely use of preventive care and compliance with medical regimen (LaVeist, Nuru-Jeter, 2002; Villani, 2012). Various aspects of the clinical encounter, including quality of provider communication are measured as a part of the patients' perceptions of their health care experience. However, there is compelling evidence suggesting disparities in satisfaction with provider communication and although potential mechanisms have been explored, it is not entirely clear why disparities exist.

Observational studies have investigated patient and provider level factors using population-level data as well as audit of clinical interactions. For example, favorable perceptions of providers' communication were found among individuals with a usual source of care (USC) (Rutten, Auguston, Wanke, 2006; DeVoe, Wallace, Pandhi, 2008), the elderly (DeVoe, Wallace, Fryer, 2009), males (Dearborn, 2006) and those residing in rural areas (Wallace et al. 2008). At the provider level, recent literature has been exploring the role of concordance between a patient and their provider. The emergence of the concordance hypothesis rests on the social idea that people are able to identify, understand, and interact more with those who may share their values and culture. Thus, postulating that mutual respect, trust, communication and satisfaction may exist more in concordant patient-provider interactions (Meghani et al. 2009). Additionally, social theory suggests that the relational similarity due to the shared identities such as race and gender decreases the social distance and enhances the ways in which patients and providers relate to one another (Street, O'Malley, Cooper, 2008).

Stemming out of the need to diversify the healthcare workforce and ultimately reduce racial and ethnic disparities in patient-provider interactions, race concordance has been widely examined as a potential mechanism. Due to the under-representation of Hispanics, African Americans and Native Americans in the health care workforce, patients belonging to the minority groups are being treated by professionals from a different ethnic background in what is called a “race-discordant” relationship. Furthermore, evidence suggests that race concordance decreases miscommunication and stereotyping, thus on the one hand enabling patients to be more assertive (Schnittker, Liang, 2006) and on the other, allowing minority providers to interpret symptoms of concordant patients more clearly or ask more questions during clinical uncertainty (Saha et al. 1999). Early literature suggests higher ratings for satisfaction with provider’s communication styles and for overall quality of care received in racial/ethnic and sex concordant dyads (Cooper-Patrick et al. 1999; Saha et al. 1999; LaVeist, Nuru-Jeter, 2002; Franks Bertakis, 2003). However, subsequent studies found limited evidence or smaller magnitudes of positive association between concordance and satisfaction with provider communication (Flocke, Gilchrist, 2005; Chan et al. 2006; Meghani et al. 2009; Sandhu et al. 2009).

The mixed evidence on concordance is largely driven by the datasets used, the study samples and analytic methods. Majority of the studies examined smaller sample sizes and were conducted at local or regional levels limiting generalizability of the findings and not allowing meaningful comparisons. Thus, skepticism regarding the positive effects of concordance is suggestive of two possibilities; first, the likelihood that effects of concordance differ across patient subpopulations. This highlights the need to examine concordance in the context of other patient demographics such as age groups, education and income levels. Secondly, findings could suggest that one dimension of concordance (e.g. race) does not occur in isolation from the other (e.g. sex).

This provides an opportunity to further investigate the association of both race and sex concordance and patient perceptions of provider interactions. Only one study to date examined the role of both race and sex concordance on health care provider communication but found a negative association (Jerant, Bertakis, Fenton, 2011). Given the new policy environment that increasingly focuses on incorporating patient satisfaction scores as a measure of healthcare quality and pay-for-performance metrics, many gaps remain in understanding the context in which concordance matters. Additionally, further research is needed in examining if concordance can be effective in reducing inequity especially in delivery of effective patient-provider communication among disadvantaged populations.

Disparities in healthcare experiences of low income populations

Although, health care disparities are multidimensional, their most fundamental causes are differences in socioeconomic status (Link, Phelan, 1995). Socioeconomic status (SES), whether assessed by income, education, or occupation is linked to a wide range of health problems and disparate experiences in health care, including patient-provider interactions (Adler, Newman, 2002). Available evidence suggests that low-income populations report lower satisfaction with provider communication (DeVoe, Wallace, Fryer, 2009). Additionally, in recent years, examination of differences in patient-provider relationship has extended beyond race and ethnicity to addressing social inequalities in the provider-patient relationship (DeVoe, Wallace, Fryer, 2009; Jensen, King, Gutzviller, 2010). In a meta-analysis by Willems et al (2005) higher SES was associated with increased likelihood of receiving complete overall medical care information from the provider and more likely to have expectations of care met. Another review found that patients from lower social classes (measured by income, education or occupation) received a less participatory consulting style which was characterized by less patient involvement in treatment decisions, lower patient control over communication and receipt of incomplete diagnostic and treatment information (Verlinde et al. 2012).

Thus, disparities in patient-provider communication continue to persist due to differences in SES. Patient's perceptions of interactions with their physicians as well as variability in physicians' communication may be related to the patients' demographic characteristics (Burgess, Fu, Van-Ryn, 2004). As discussed previously, the concordance hypothesis suggests that shared identities could improve communication and perhaps it's role among the low-income populations might provide an interesting insight. Although, recent literature has examined patient-provider communication across SES, it did not account for the role of concordance and whether its presence is associated with positive perceptions of provider communication and increased satisfaction with care among the low income. Thus, in spite of the vast empirical work on concordance, it is not known to what extent perception of provider communication skills differ among socioeconomic groups in the presence of race and sex concordance.

Study Objectives

The specific aim of this research is to examine the association between patient SES as measured by income and their perceptions of provider's communication. Further, the study assesses if this relationship is moderated by patient-provider concordance. To understand disparities in health care experiences, there is a movement away from understanding patient characteristics in isolation toward a multi-level exploration of the factors affecting patient-provider interaction. Communication is assumed to be clearer in concordant encounters and the concordance hypothesis supports favorable perceptions of provider's communication ability (Cooper, Roter, 2003). However, it is theorized that the effect of concordance would vary based on certain patient characteristics such as income. Thus, the following research questions (RQ) are examined:

RQ1. Do perceptions of provider communication differ across patient's income levels?

RQ2. Is concordance associated with positive patient perceptions of provider communication?

RQ3. Does concordance moderate the association between income and perceptions of provider communication?

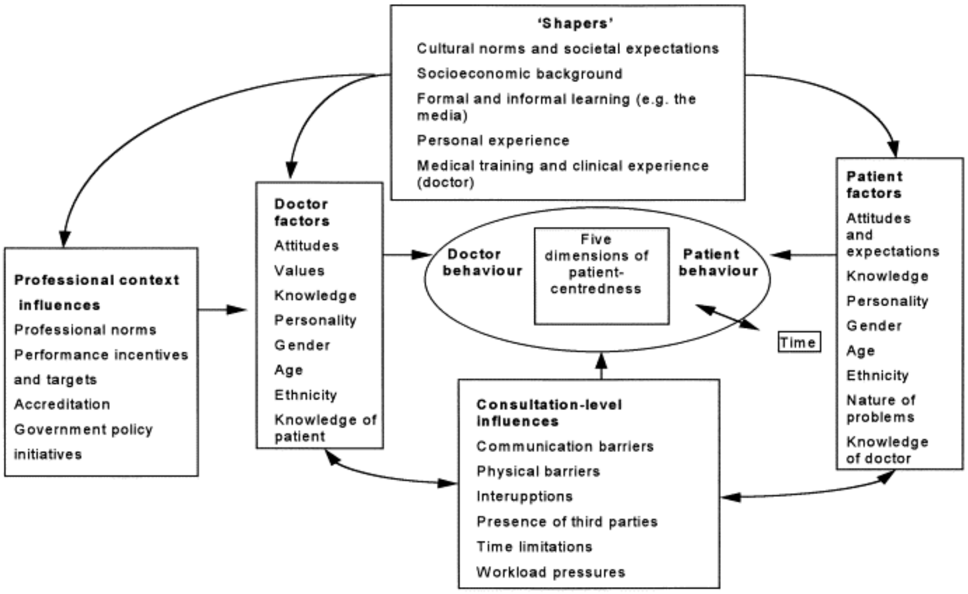
Conceptual Framework

Evidence suggests that differences in quality of care occur during the patient-provider interaction or from clinical processes of delivering care. The increased emphasis on providing patient centered care has shifted the focus to understanding patient-provider interaction and its mediating role in disparities. In his seminal paper, Arrow (1963) discussed the uncertainty of the health care markets arising from the role of physician agency as well as the asymmetry of the information. However, it can be argued that the uncertainty of health care information is two-sided where in some aspects of medical care, the physician knows more and in others the patient. For example, while a provider would know more about the effectiveness of a treatment, the patient has more information about his or her medical histories and preferences for diagnostic tests which could largely vary based on patient's social characteristics such as income, race or education. Thus, without effective and active exchange of information between a patient and provider, medical decisions would not be optimal due to incomplete information (Haas, Wilson, 2001). Additionally, lack of information could lead to decreased patient utility from the health care experience and ultimately lead to negative health consequences. On the other end, without an open communication a multitude of factors could influence a providers' medical decision making including stereotypes or biases based on patient characteristics.

The conceptualization of mechanisms influencing patient provider interaction is primarily derived from sociology and behavioral models (Mead, Bower 2000; Schrop, 2011). In two classic papers, Balsa and McGuire (2001, 2003) identified the role of priors, prejudice, clinical uncertainty and stereotyping as distinct mechanisms that can operate within a clinical encounter and lead to disparities in care. While, one would publicly disclaim prejudice, an individual may possess implicit attitudes of discrimination towards another individual's race or socio-economic status. Thus, the existence of stereotypes and prejudice is particularly common toward two social categories that are also the focus of the current study, i.e. low SES and racial / ethnic minorities.

Many factors have been identified that influence patient provider interaction (Mead, Bower,2000) and are illustrated in Figure 7. The key measurable features important to this study are: 1) socioeconomic background of the patient, which often determines resources available for medical care including type of health insurance or limited choice in selecting a provider, 2) provider factors, 3) patient factors including gender, age, and ethnicity, and 4) features of the consultation including communication. The figure also demonstrates the intricate nature and complexity of the interactions between patients and their providers.

Figure 7: Factors Influencing Patient Centeredness (Mead and Bower 2000)



Another model (Figure 8) that depicts the complexity of patient-provider interactions was described by Street et al. (2007) using ecological theory that takes into account the interplay of multiple provider, patient and contextual factors, suggesting that the influence of any variable may vary depending on the presence of other factors (e.g., the patients' level of education, income, doctors' communication style). The ecological approach also recognizes communication styles of patients and providers, patients' characteristics and provider-patient demographic concordance as important sources that could influence patient-provider interaction. For example, every provider may communicate with a patient differently where some provide more information or ask more questions leading to partnership building which can be measured by questions that assess various aspects of provider communication as captured by the satisfaction surveys. Additionally, providers' communication and perceptions may vary based on the patient demographics which can be examined by the quality of provider communication across patient demographic characteristics. Finally, the core of a provider-patient relationship lies in trust; where patients may perceive a concordant provider to exercise a greater sense of agency and to act in the patient's best interest (Mechanic, Schlesinger, 1996). Thus, an effective patient-provider interaction is co-dependent on provider behavior, patient's characteristics and their preferences for concordance.

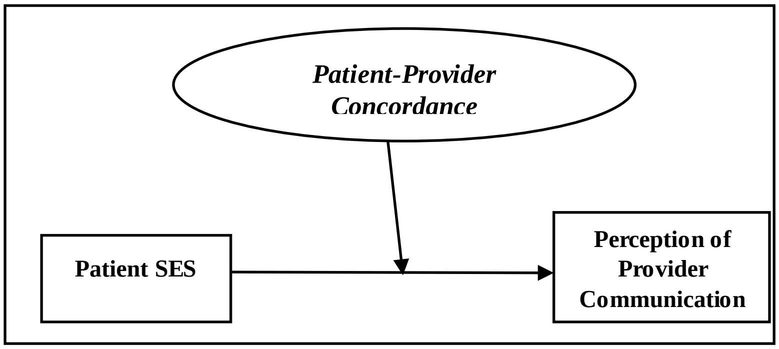
Figure 8: Ecological Approach by Street et al (2007) – Four Important Sources Influencing Patient-Provider Interaction

Providers' communication style	Patients' characteristics	Patients' communication	**Provider-patient demographic concordance**
• Varying communication styles • Provide more information or ask more questions leading to partnership building	• May vary based on the patients' demographic • Examined by the quality of provider communication across patient demographic characteristics	• Varying communication styles • Traditional sick-role versus actively engaged in shared-decision making	• Relationship's crux lies in trust, where patients may perceive a concordant provider to exercise a greater sense of agency and to act in the patient's best interest

This interplay of factors affecting patient-provider interaction is further complicated for patients who are from lower social class due to the following reasons. First, patients who are from a lower social class may more often suffer from (multiple) chronic conditions but also often have lower levels of health literacy limiting their capacity to process basic health information needed to make appropriate health decisions (Droomers, Westert, 2004; Parkar, Gazmararian, 2003). Secondly, lower sense of personal control or external locus leading to feeling less capable of interaction during consultation and may explain lower levels of participation (Kraus, Piff, Keltner, 2009). Third, patients' behavior can be shaped by their social position while providers' behavior could be configured by the expectations of society, health care system, and their specialized training (Becker et al. 2008). Thus, in clinical settings, a complex yet special dyad is formed where providers could hold a position of expert and authority. Patients who are poor are more likely to experience difficulties in communication with professionals due to differences in linguistic and cultural backgrounds. This can be particularly challenging for interactions between providers and those belonging to lower SES if appropriate adjustments to communication styles during a clinical encounter are lacking; leading to incongruence between low income patients and providers.

Given the research and theoretical perspectives, it is imperative to examine the various aspects of patient-provider interaction versus assuming that concordance could have positive effects among the low income. Since optimal patient-provider communication requires an alignment of multitude of factors, it is hypothesized that when concordance is achieved, low SES groups are more likely to perceive positive perceptions of providers' communication skills and report higher ratings of satisfaction with care than low SES groups without a concordant provider. Figure 9 illustrates a conceptual model that demonstrates that specific patient factors such as low SES can have independent effects on the perception of provider communication and this relationship could potentially be mediated by the concordance between the patient and the physician.

Figure 9: Conceptual model for moderation of patient-provider communication and SES by patient-provider concordance



Research Hypothesis

Social science and clinical research confirms that SES (whether measured as income, education or occupation) influences health care quality and health outcomes (Meer, Rosen, 2004; Sudano, Bake,r 2006). An individual's status and social position determines their expectations of others as well their interactions in social environments. This is particularly challenging for patients with lower SES due to the socioeconomic and power differentials between these patients and their providers. Additionally, while patients from lower SES groups are more likely to be "guarded in their communications" (Starr, 1982), evidence also suggests that providers perceive patients of lower SES less likely to desire active participation during clinical encounters (Van Ryn, Burke, 2000). Thus, the likely mismatch in expectations of behaviors between the patient and provider, different communication styles and difficulties in communication can lead to less satisfying or unsatisfying experiences for both the patient and the provider. While, it could be challenging to match providers and patients on socioeconomic levels, it remains to be seen if the race or sex concordance affects the relationship between income and report of provider communication. This leads to the consideration of the first aim and hypothesis;

Aim 1: To examine whether report of provider communication during their clinical encounters is different across patient income levels

H_1: Perceptions of provider communication are reported to be less positive by low income patients compared to patients with middle and high incomes.

The patient-provider relationship involves interactions between patients and their provider which can be related to a social environmental context, where each have their own expectations of him/herself as well as the other (Lazare, 1995); presumably without deference to patients' SES. The success and outcomes of a patient-provider encounter depends on both patient and provider related factors (Rutten, Auguston, Wanke, 2006; DeVoe, Wallace, Pandhi, 2008; DeVoe, Wallace, Fryer, 2009; Dearborn, 2006; Wallace et al. 2008, Frank, Bertakis, 2003). The presence of relational similarity when characteristics such as race, ethnicity or sex are shared between the provider and patient decreases the social distance and builds a trusting relationship. Cooper et al. (2003) found that when there was concordance between the patient and the physician, patients demonstrated a significantly more positive affect and rated their physicians as allowing more patient participation. Given these theoretical perspectives, the following hypotheses are considered;

Aim 2: To examine whether race/ ethnicity or sex concordance is associated with positive perceptions of provider communication

H_2: Patients who have race/ ethnicity or sex concordance with their providers report positive perceptions of their provider's communication compared those patients who are discordant with their providers.

Aim 3: To examine whether race/ethnicity or sex concordance moderates the association between income and perceptions of provider communication

H_3: In the presence of concordance, low income patients report positive perceptions of their provider's communication compared to middle and high income patients.

Methods

Data

The study is a secondary analysis of the Medical Expenditure Panel Survey (MEPS) which provides a nationally representative sample of the U.S. civilian non-institutionalized population. Public use files are made available annually by the Agency for Healthcare Research and Quality which sponsors and administers the survey. MEPS provides the most complete national database on health conditions, access to care, insurance status, health services use, and health status of the

U.S. population. The data come from Access to Care (AC) section of the household component (HC) which is administered in two rounds. HC contained information on demographic, socio-economic characteristics, health insurance coverage, and utilization of health services, while the measures on respondent's perceptions of their health care providers' communication skills were obtained from the AC section. The National Health Interview Survey, conducted by the National Center for Health Statistics, was used as a sampling frame and the survey used a stratified multi-stage area probability design in which certain groups (e.g. low income racial minorities) were over-sampled. An over-lapping panel design was implemented where a new panel of sample households was selected each year and data for each panel were collected for two calendar years in five rounds of interviews; where the AC section is fielded in round 2 and round 4 of MEPS. The survey was administered by computer-assisted personal interviewing (CAPI) using a laptop computer, with each interview averaging about 90 minutes depending on the number of persons per household and their health care use. MEPS data have been widely used in population-based and health care studies related to use of health care services, expenditures, coverage and access (Cohen 2006; Smith 2012). For this analysis, the 2008-2014 full-year consolidated MEPS data files are pooled as annual cross-sectional samples to analyze the respondent's report on their perceptions of providers' communication. Pooling offers the advantage of generating larger sample sizes and an assessment of population subgroups more accurately.

Study Sample

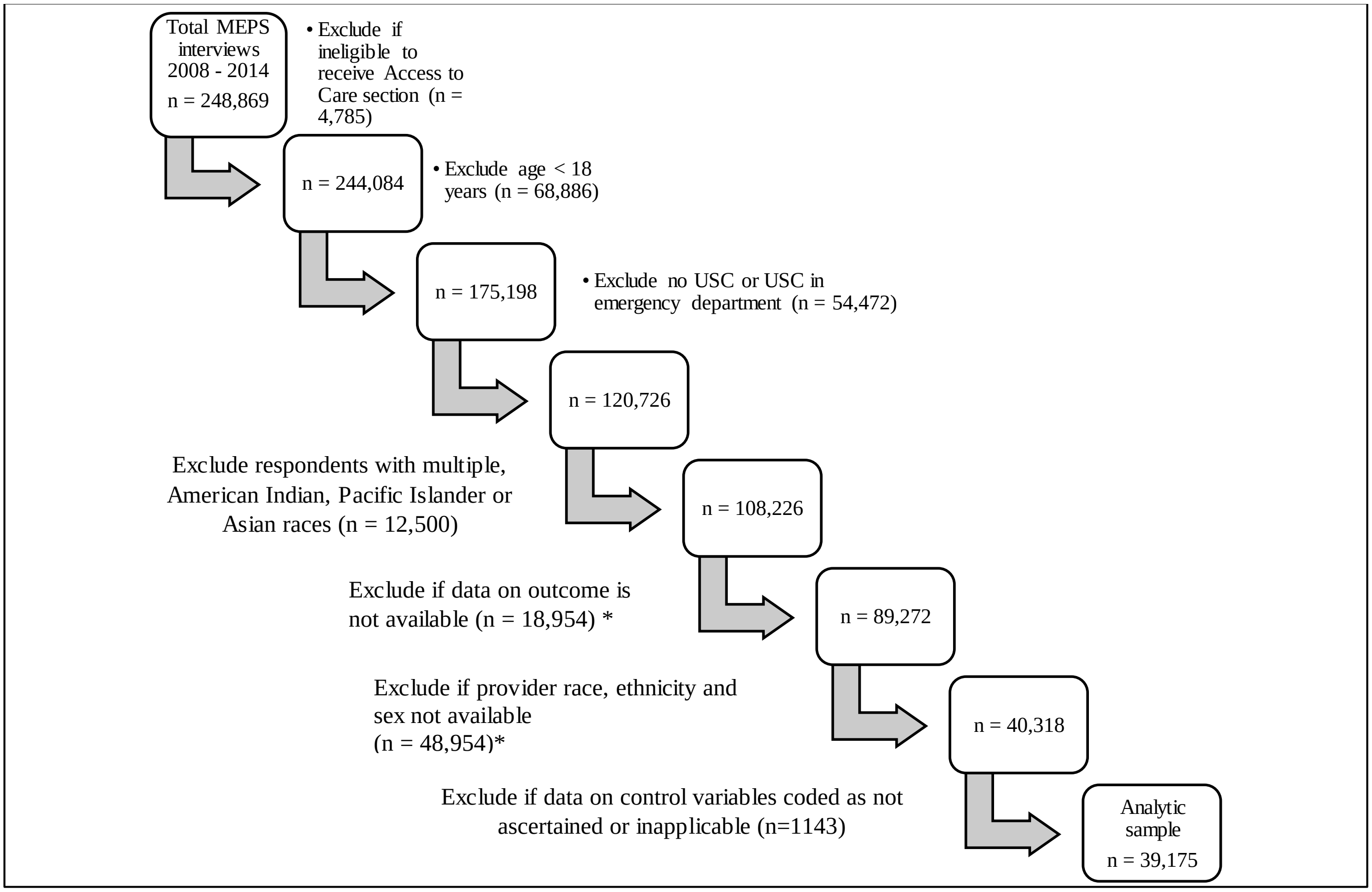
A total of 248,869 interviews were conducted during the study period. The average response rate was 56% over the study period. Several inclusion and exclusion criteria are applied to obtain the study sample (Figure 10). First, as indicated in MEPS, only those respondents who are eligible to receive the AC section are included (n = 244,084). Second, adults aged 18 years and older (n = 175,198) are included for two reasons: 1) decisions about health care for the pediatric population are based on their parents and 2) perceptions about communication with the providers are driven by parent experiences. Third, the survey ascertains whether there is a particular doctor's office, clinic, health center or other place that the individual usually goes to if he/she is sick or needs advice health (i.e. their usual source of care (USC). It is known that those with a USC are more likely to perceive positive health care interactions (De Voe et al; 2008, De Voe Wallace Fryer; 2009). Additionally, it is likely that individuals with a USC are systematically different from those who do not have a USC as provider choice is not random. Therefore, those respondents who indicated having a USC in a practice setting other than a hospital emergency room (n = 120,726) are included. Fourth, to identify concordance, the presence of same race and ethnicity needs to be established between a patient and their USC. Therefore, respondents who indicated having multiple races are not included. Due to inadequate sample sizes for subgroup analysis, respondents with American Indian, Asian and Pacific Islander race are also not included (n = 12,500). Fifth, observations where responses for dependent variables are missing either because they are coded as "inapplicable" or "not ascertained- interviewer did not report" or "don't know" or "refused" are excluded (n = 18,954). Sixth, respondents who do not have data available on provider characteristics and are coded as "inapplicable" or "not ascertained- interviewer did not report" or "don't know" or "refused" are also excluded (n = 48,954). Thus, approximately half the sample did not have provider characteristics, however further assessment suggested that there are generally no systematic differences between those with and without provider characteristics (Appendix table 1). Finally, if any of the covariates are coded as not ascertained or not applicable, these observations are also dropped (n = 1,143). Thus, the final analytic sample is a total of 39,175 adults 18 years and older and with a USC in an office or a hospital setting.

Study Variables

Dependent variable (Table 1)

The selection of the outcome variable is based on the theoretical framework of shared decision making which describes important domains related to patient-provider communication (Cheraghi-Sohi et al. 2006). The four dependent variables capture perceptions of different aspects of patient provider communication pertaining to interpersonal relationships, information exchange and patient involvement during the clinical encounter using four survey items. These questions are adapted from the health plan version of the Consumer Assessment of Healthcare Providers and Systems (CAHPS) surveys (Agency for Healthcare Research and Quality, 2004) that collects patient reports of their health care experience at provider or hospital level. For each individual family member, the access to care (AC) section of MEPS ascertains whether there is a particular doctor’s office, clinic, health center, or other place that the individual usually goes to if he/she is sick or needs advice about his/her health (i.e. has a usual source of care).

Figure 10: Study Sample Inclusion and Exclusion Criteria



*Data not available if indicated by MEPS as "Not ascertained- interviewer did not report", "question inapplicable", don't know or refused to respond

The AC supplement fielded in rounds 2 and 4 asks adults aged 18 and older their level of satisfaction with the USC provider's communication which is examined in four ways: Does the USC provider; 1) usually asks about prescription medications and treatments other doctors may give them, 2) explains all options to the person, 3) asks about and shows respect for medical, traditional, and alternative treatments that the person is happy with, 4) asks the person to help make decisions between a choice of treatments. The responses to questions 1 and 2 are a "yes" or "no" option, whereas responses to questions 3 and 4 are rated on a 4-point Likert scale including never, sometimes, usually, or always (Agency for Healthcare Research and Quality, 2004). However, the response distribution is highly skewed where approximately half of the respondents report "always" to each of the four questions, and the other half are distributed over the other three responses. Consistent with literature, responses are dichotomized as "always" and "not always," thus, constructing two relatively equal groups (Saha 1999; Wallace, DeVoe, Bennet et al. 2008; Villani 2012). Additionally, since it is optimal to "always" communicate well in health care settings, this response is isolated rather than the "never" response (De Voe, Wallace, Fryer 2009).

Primary Explanatory Variables (Table 1)

The primary explanatory variable of interest is the respondent's income level. MEPS uses definitions of income, family, and poverty categories to construct the related income variables taken from the corresponding survey year poverty statistics developed by the Current Population Survey (CPS). A continuous variable of the poverty status is then computed by MEPS by dividing CPS family income by the applicable poverty line (based on family size and composition). Finally, the income variable is available in MEPS as a percentage for each person and classifies it into one of five poverty categories: poor (less than 100%), near poor (100% to less than 125%), low income (125% to less than 200%), middle income (200% to less than 400%), and high income (greater than or equal to 400%). For the missing income data, MEPS utilizes the hot-deck method by deriving information the NHIS and all income is top-coded to preserve respondent's confidentiality. For the purpose of this analysis, income status is further categorized as "low SES" (< 200%, which included poor, near poor and low income), "middle SES" (200% - < 400%) and "high SES" (> = 400%) based on the distribution of the data and to allow sufficient sample sizes for each income category analysis.

The second explanatory variable of interest is the concordance of race and sex between the respondent and their provider. Provider race, ethnicity and sex is reported by the survey respondent and reflected the patient's perception of their provider's characteristics. This is constructed using

MEPS data on the respondents' and their providers' race, ethnicity and sex. Separate variables are created to indicate race/ ethnicity concordance and sex concordance between the respondent and their USC. Both providers' and patients' race and ethnicity are captured using four categories and was specified as Non-Hispanic white, Non-Hispanic black, Hispanic and Asian. Thus, race concordance is created as a binary variable to indicate the same race/ethnicity between respondent and provider (race concordance) or different race/ethnicity between respondent and provider (race discordance). Similarly utilizing respondent reported providers' sex and their own sex, gender concordance is constructed.

Covariates

The control variables (Table 1) are identified using the Andersen Model, a behavioral model of health services utilization (Andersen, 1995). This model conceptualizes health service utilization and outcomes as the result of predisposing, enabling, and need factors. Additionally, the variables included as controls have been previously demonstrated to influence patient reported experiences of care.

Predisposing Factors

This study identifies age in years categorized as (18–24, 25–44, 45–64, 65+), education status (no or some high school, high school graduate, some college, and college graduate or beyond), region of residence in the U.S. (West, Northeast, Midwest, and South), and urbanicity (urban versus rural as defined by Metropolitan Statistical Area (MSA) status) as predisposing factors. MSAs are defined by the U.S. Office of Management and Budget (OMB), and used by federal government agencies for statistical purposes (Nussle, 2008). Prior to 2013, urbanicity was available in the public use files, however for the 2013 and 2014 urbanicity is included only in the MEPS restricted data files. To test the sensitivity of the results to urbanicity, a separate regression model is implemented by restricting the sample to 2008-2012 that included MSA as a control variable.

Enabling Factors

Enabling factors included health insurance status (no health insurance, only publicly funded, and any private), language of the survey interview and provider characteristics. Given that language barrier can be a major impediment in establishing effective patient-provider communication, including a control for the language spoken is important. Although MEPS asks the respondents if their USC speaks the same language as their own, more than half the respondents have missing data for that variable and there is no information of whether translator services are available at the USC. Therefore, to assess language proficiency, an indicator for whether the interview is conducted in English or other another language is used. The study also controls for available provider characteristics such as the practice location (office versus hospital) and provider specialty (MD primary care, MD specialist, non-MD).

Need Factors

The need variables are captured as perceived need (perceived health status) and the evaluated need (number of chronic conditions). To assess self-rated health status, respondents were asked to rate their health by responding to the question, “In general, would you say that your health is excellent, very good, good, fair, or poor?” A categorical variable is used to compare respondents reporting “fair or poor health”, “good health” to reporting “excellent, very good health” in all rounds. Using the respondents self-reported data, a categorical comorbidity variable is created that indicates the presence of any of the priority conditions reported by MEPS, including high blood pressure, coronary heart disease, angina, myocardial infarction, stroke, emphysema, chronic bronchitis, high cholesterol, cancer, diabetes, arthritis, asthma, and attention deficit hyperactivity disorder.

Analytic Approach

The analytic approach explores differences in perceptions of provider's communication across income levels in adults with a USC. Additionally, the study also assesses if having a provider with similar race/ ethnicity or sex i.e. concordant characteristics is likely to moderate the association between perceptions of care and income. The analytic approach is anchored on the postulated research hypotheses with an individual as the unit of analysis.

Hypothesis 1

H_1: Perceptions of provider communication are reported to be less positive by low income patients compared to patients with middle and high incomes.

Given the theoretical framework of disparities, low income groups face differential and negative perceptions of the health care they experience. Thus, it can be expected that modelling income or poverty status with perception of provider communication would give significantly different marginal effects for perception across the income groups. The general form of the econometric specification is given by

$$\text{Logit}(Y_i) = \beta_0 + \beta_1 \text{ income}_i + X_i \beta_2 + \alpha_i \beta_3 + \varepsilon_i$$

where the dependent variable Y_i is a measure of perception of each domain of provider communication skill for individual i. The variable income_i indicates the respondents' income status. Individual level controls of age, sex, race, education level, region of residence, health insurance status, interview language and health status are represented in the vector X_i. α_i represents provider characteristics such as providers' practice setting, specialty, race and sex. The coefficient of interest is β_1 obtained by estimating multiple logistic regression models to assess the effect of the differences in income levels on the reported perceptions of provider communication.

Hypothesis 2

H_2: Perceptions of provider communication are reported to be more positive by patients who have racial/ ethnicity or sex concordance with their providers compared to patients who are discordant

Relational similarity between the patient and provider may reduce the social distance, improve patient-provider encounters, and therefore result in positive perceptions of providers' communication. The next set of analysis examines if having same race/ ethnicity or sex as the provider, is associated with the patients' perceptions of provider communication. Therefore, in the specification below it can be expected that H_2: $\beta_1 > 0$. Logistic regression models of the form

$\text{Logit}(Y_i) = \beta_0 + \beta_1 \text{ concordance}_i + X_i\beta_2 + \alpha_i\beta_3 + \varepsilon_i$

is estimated for each outcome Y_i for the four domains of provider communication. Concordance_i indicates either race/ ethnicity or sex concordance, where 0 = discordant, 1 = concordant. Individual level controls of age, sex, race, education level, region of residence, health insurance status, interview language and health status are represented in the vector X_i. α_i represents provider characteristics such as providers' practice setting, specialty, race and sex. Separate models will test the effect of race and sex concordance for each question of provider communication. The coefficient of interest is β_1 obtained by estimating multiple logistic regression models to assess the effect of concordance on the reported perceptions of provider communication

Hypothesis 3

H_3: In the presence of concordance, low income patients report positive perceptions of their provider's communication compared to middle and high income patients.

Theory suggests that shared identities through concordance are associated with positive perceptions. Therefore, it is expected that respondents who are concordant with their provider are more likely to perceive that their provider "always" communicates with them and it is postulated that concordance could influence the association between perception of provider communication and income. Individuals with low socio-economic status have limited access to care either from being uninsured or reduced availability of providers who accept public insurance. The poor may not always have a choice in terms of the provider's specialty, practice setting or even provider characteristics such as, race and gender. Therefore, it is likely that they also may not be able to select providers to achieve concordance. On the other hand, differential interactions could arise when low income patients are concordant with their provider, thus increasing the likelihood of positive perceptions of providers' communication. The final set of regression models test for the moderating effect of concordance on the association between perceptions of communication and income. The general specification for the model is;

$$\text{Logit}(Y_i) = \beta_0 + \beta_1 \text{income}_i + \beta_2\, \text{concordance}_i + \beta_3\, \text{income}_i * \text{concordance}_i + X_i\beta_4 + \alpha_i\beta_5 + \varepsilon_i$$

where the dependent variable Y_i is a measure of perception of each domain of provider communication skill for individual i. The variable income_i indicates the respondents' income status. Individual level controls of age, sex, race, education level, region of residence, health insurance status, interview language and health status are represented in the vector X_i. α_i represents provider characteristics such as providers' practice setting, specialty, race and sex. Separate models will test the effect of race and sex concordance across income levels for each question of provider communication. The coefficient of interest is the interaction between concordance variables and income, i.e. β_3 which if statistically significant suggests that having concordance with the provider affects perceptions of communications differently across income groups. To account for the complex survey design and obtain the correct standard errors, the sampling strata and the primary sampling unit (PSU) was used. Additionally, use of survey weights provided estimates representative of the national population. All analyses are conducted in STATA version 14.1 and at a 0.5 alpha statistical significance level.

Sensitivity analysis

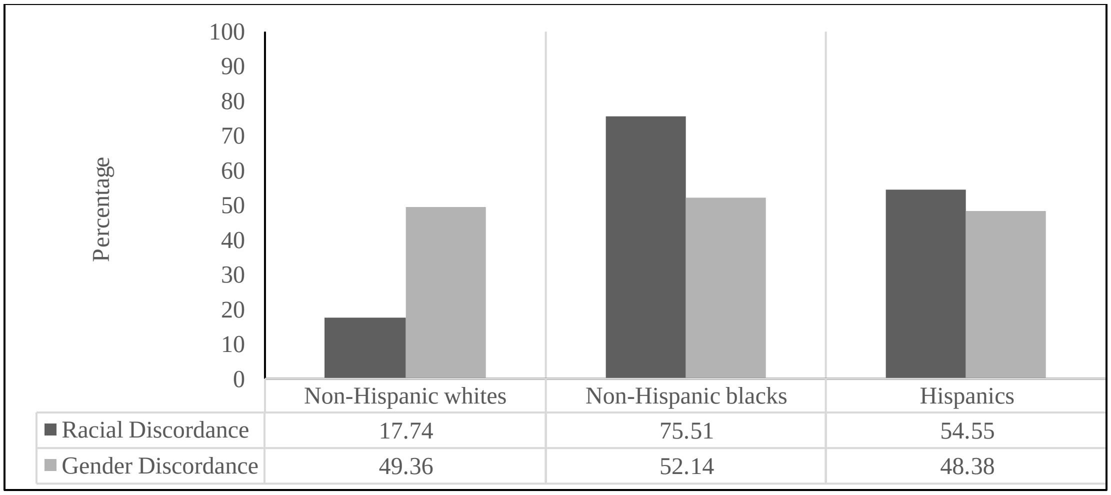
Due to data limitations, it was not possible to assess if patient's selection of their USC was based on their preference for choosing a provider with a certain race and sex characteristic. However, it is likely that individuals whose expectations about their providers are met, are more likely to report positive ratings on their overall satisfaction with care. MEPS asks respondents to rate on a scale of 0 to 10 the overall satisfaction from all their health care providers (from the worst to the best health care possible). To test the sensitivity of the results, a separate regression model includes overall satisfaction with healthcare as a covariate. Also, it is likely that among individuals in rural areas who in general may have decreased access to healthcare providers, it might be particularly challenging for women or minorities to find providers with concordant characteristics. To assess this possibility, the sample was restricted to include data from 2008 through 2012 study periods for which urbanicity information was available and regression models were estimated with MSA as a control variable. Finally, the analysis is extended to examine differential effects of concordance by race and ethnicity of the respondent. While income disparities cannot be examined in isolation of race/ethnicity, it is likely that low income respondents of minority groups perhaps value concordance more than Non-Hispanic whites. Therefore, further stratification of models by patient's race would identify effects of concordance that may vary by race among the low-income populations and findings can inform policy recommendations that can be better focused for certain groups at risk for experiencing poor quality of care, especially the poor and those belonging to racial and ethnic minorities.

Results

The majority of the respondents are in the high-income group (i.e. > 400% FPL) and about a quarter have incomes less than 200% FPL. Overall, 42% have both race and gender concordance, one-third of the sample indicates having the same race and ethnicity as their provider and about 13% have gender concordance. Table 2 presents characteristics of the sample by respondent's income levels. Among individuals with high-incomes approximately half the respondents are 45-64 years, are non-Hispanic whites, have at least a Bachelor's degree and have private insurance. More than two-thirds (78%) have racial concordance and 59% have gender concordance with their provider. Comparatively, almost a third of the low income belongs to minority groups (i.e. non-Hispanic black and Hispanic), have less than high school education and are more likely to be either uninsured or have public insurance (46%). There are also significant differences in both the evaluated and the perceived health status between the income groups. For example, compared to individuals with high income, those with low income are more likely to perceive that their physical and mental health status is fair (16% and 7% respectively) and a majority (43%) have 3 or more comorbidities. Additionally, about one-third report racial discordance and half report being gender discordant with their provider. Although, there is no statistical difference in gender discordance, racial discordance is significantly higher ($p<0.001$) among low-income Non-Hispanic blacks (75%) and Hispanics (55%) compared to Non-Hispanic whites (18%) (Figure 11).

Overall the sample reports positive perceptions of provider communication; however individuals with low income are more likely to perceive that their provider did not always communicate on all four domains. For example, compared to those with high and middle income, 35% of the low income perceive that their provider does not always ask to help make treatment decisions and about 20% report that the provider does not always ask them about prescription medications or treatments from other providers. There are no notable differences in distribution of provider characteristics among the low-income, however low income individuals report seeing a higher percentage of providers who are Non-Hispanic blacks, Hispanics or Asians.

Figure 11: Race and Gender Discordance among Low-Income by Race and Ethnicity



	Non-Hispanic whites	Non-Hispanic blacks	Hispanics
■ Racial Discordance	17.74	75.51	54.55
▒ Gender Discordance	49.36	52.14	48.38

Table 3 reports results from the multivariate logistic regression analysis that assess the association between respondent income and perceptions of provider communication. Low income is associated with lower odds of reporting that the provider always communicates on all four domains; statistically significant differences are found for two of the four communication items. Compared to those with high incomes, low income individuals are more likely to report that their provider does not always ask them about prescription medications (adjusted odds ratio [AOR] 0.82; 95% confidence interval [CI] 0.72 - 0.92; p <0.01). They also have significantly lower odds of reporting that their provider always asks them to be involved in decision-making (AOR 0.89;

95% CI 0.79 – 1.00; $p < 0.1$). No significant differences are found between individuals with middle and high incomes except in the domain on asking to participate in decision-making; where individuals in the middle-income category have lower odds of perceiving a participatory communication style (AOR 0.89; 95% CI 0.80 - 0.98, $p <0.05$).

Overall, race/ethnicity and sex concordance is associated with positive perceptions of provider communication for all the domains (Appendix tables 2, 3). For example, having a race concordant provider increases the odds of reporting that the provider always explains all treatment options by 29% among those who are race/ ethnicity concordant with their provider (AOR 1.29; 95% CI 1.00 – 1.67, $p < 0.05$). Similarly, having sex concordance is also associated with higher odds of reporting that the provider always asks about all treatment options and shows respect (AOR 1.21; 95% CI 1.04 – 1.34, $p < 0.01$ and AOR 1.30; 95% CI 1.06 – 1.40, $p < 0.01$, respectively).

Generally, no statistically significant interactions are found between race concordance and income as well as gender concordance and income (Appendix tables 4, 5). Marginal effects obtained from these logistic regression models are presented in Tables 4 and 5. These analyses examine if concordance moderates the association between income and perceptions of communication. Overall, there is an increase in the predicted probability of reporting that the provider always communicates on all four domains when respondents are racially concordant with their provider; however, these effects are statistically significant only in two cases. First, individuals with low income who are racially concordant have a 96% probability of perceiving that their provider explains all treatment options whereas those who are racially discordant are predicted to have a 95% probability, representing a marginal effect of 1.3 percentage points. Second, the largest effect of concordance (4.2 percentage points) is among individuals with high income with a race concordant provider who report that they are always asked to help decide between treatment options compared to those who were racially discordant. Gender concordance shows mixed effects on perceptions across income levels where on one hand it leads to positive perceptions and on the other individuals with the same sex as their provider report negative perceptions of their provider's communication. Although, among low income individuals gender concordance generally leads to more positive perceptions of provider communication; these results are not statistically significant.

The findings remain robust after including an indicator for urbanicity and an overall indicator of satisfaction with quality of care. To further examine if the effect of race concordance is different across racial and ethnic minorities in the low-income population, stratified analysis is conducted (Appendix table 6). Generally, having race concordance does not have a statistically significant association with communication measures among low-income racial and ethnic minorities, except in two circumstances. Having a race concordant provider increases the probability of reporting that the provider always explains all treatment options among low-income Non-Hispanic blacks by 2.4 percentage points (p = 0.007). Similarly, among low-income Hispanics, race concordance increases the probability of reporting that the provider always includes in decision-making and showes respect for patient preferences (7.5 percentage points, p = 0.07; 8.5 percentage points, p = 0.0030 respectively). Finally, the association of having both race and gender concordance with provider communication is examined across income levels, however these results are not significant (Appendix table 7). Essentially, having both race and gender concordance is not associated with statistically significant improvements in perceptions of provider communication among the low-income.

Discussion

Across the health care system, disparities exist for stigmatized populations, including patients with low socioeconomic status (SES) and racial/ethnic minorities. Patient-provider communication is one aspect of the medical encounter that has been connected to healthcare quality and outcomes. Empirical evidence has provided conflicting results regarding the factors associated with effective patient-provider communication. This study utilizes a nationally representative data over a 7-year study period to disentangle the complex relationship between a patient and their healthcare provider. SES measured as income is hypothesized to be a crucial factor affecting the patient's perception of provider's communication even when racial concordance is achieved; wherein poor individuals have a higher probability of negative perceptions of their usual source of care's (USC) communication skills. The findings suggest negative perceptions among the low income in particularly two domains of provider communication; asking about prescription medications and involving in decision-making between treatment choices. The findings are consistent with previous studies that examined the role of social gradient in the patient-provider relationship and found that patients with low social class measured by income, education or occupation were less likely to experience a participatory consulting style (DeVoe et al; 2009, Verlinde et al; 2012).

Previous literature has found a positive association between race and sex concordance and perceptions of provider communication. In this study, although individuals with low income who are racially concordant with their provider show relatively positive perceptions compared to racially discordant patients, the findings are not statistically significant. Sex concordance on the other hand shows mixed evidence. One plausible explanation is that having a USC establishes a continuum of care and individuals in this sample reported their perceptions regardless of the provider's race/ethnicity or gender. Second, it is likely that irrespective of the provider's race or ethnicity, low income patient's expectations of the provider communication are not met. Beck, Daughtridge, and Sloan (2002) examined the relationship between patient-physician communication and outcomes with the assumption that better communication leads to better outcomes. They found that patients of racial/ethnic minority groups and lower SES were seen by physicians as less likely to be compliant, less likely to desire an active lifestyle, and to be at risk for inadequate social support. The authors stressed that although patient race was associated with negative perception; SES appeared to have a broader effect on physicians' perceptions and affects a wider array of domains than race. Thus, the consistent negative perceptions of provider communication even in the presence of race and ethnicity concordance suggest that SES discordance may widen disparities in patient-provider communication more than racial/ ethnic discordance. Therefore, a low income Hispanic patient may not feel they have the same shared experience just because they are also seeing a Hispanic provider and differences due to social stratification may further contribute to increasing the social distance and may lead to communication breakdown. Additionally, research on patient provider communication has shown that subtle forms of bias are more common than blatant prejudice (Dovidio, Gaertner 2004). The low-income in this study were more likely to be less educated, uninsured or on public insurance, racial and ethnic minority and in poorer health. The patient-provider interaction can be further complicated when a patient has multiple stigmatized identities which is important to address in order to implement any interventions. While interventions to improve cultural sensitivity and competency among providers is important, these results also highlight the need for communication styles to be altered to meet patient's expectations and preferences so that patient engagement and activation is maximized.

Discordance is significantly higher among the racial and ethnic minorities who were low-income. But, overall race concordance is not associated with positive perceptions among racial and ethnic minorities with low income. However, improvements in perceptions are seen only in one or two domains of provider communication and could be suggestive of the following possibilities. First, among the low-income racial and ethnic minorities, race concordance rather than gender concordance may decrease the social distance and improve their experiences of care. Second, positive perceptions could be suggestive that some healthcare providers simply communicate better and are better able to engage patients. Third, variations in how patients perceive healthcare communication could be largely influenced by patient expectations rather than their actual experience of care or differences among minorities in assessing and reporting communication. In a recent study using MEPS, it was found that provider communication was driven by patient race rather than provider race and suggests that racial and ethnic minorities have lower expectations of care and this may comparatively inflate their response to satisfaction questions (Sweeney et al. 2016). If either of these explanations is true, then addressing disparities to improve all aspects of patient-provider communication may need to extend beyond prioritizing cultural competency and include training on communication skills to assess patient preferences for autonomy in decision-making.

Communication between low income patients and their doctors is inherently fraught with difficulties, but being concordant with the provider doesn’t necessarily make the patient experience more positive. While concordance implies a point of commonality that can enhance ways in which patients and their providers communicate, it is likely that concordance extends beyond demographic characteristics such as race and sex. Thus, mechanisms through which demographic characteristics may contribute to better patient-provider relationships may not occur in isolation or may not be restricted to only race and sex. While race concordance may appear to orient patients toward a more common ground with the physician, particularly with respect to ethnic similarity, other factors may be more influential determinants of perceived personal similarity such patient's age, education, social class and even the extent to which physicians incorporate shared-decision making or encourage patients to communicate their preferences and values. As discussed previously, the concordance literature has primarily focused on race and sex but future studies may need to incorporate alternative measures of concordance such as preference, cultural or language concordance to fully understand the extent to complex dynamics of a patient-provider interaction and its role in influencing patient satisfaction.

Finally, in this study, concordance is considered to be a moderator variable, where in it was hypothesized that concordance may influence the strength of the relationship between income and perceptions of communication. However, the role of concordance may also be considered within a mediation framework wherein; concordance may explain the relationship between income and perceptions of communication. Although, this analysis did not directly examine concordance as a mediator variable, it is unlikely that concordance mediates the relationship between income and communication because the relation between income and communication continued to remain similar in direction and magnitude even in the presence of concordance.

Overall, the results highlight the intertwined and complex nature of a medical encounter and the multitude of factors that can affect a patient's perceptions. Thus, any ratings obtained on patient's perceptions of care received or overall satisfaction could reflect three elements: 1) personal preferences of the patient, 2) patient's expectations, and 3) realities of the care received. Therefore, the satisfaction rating is as much a measure of care as it is a reflection of the patient who is responding to the survey.

Study Strengths and Limitations

The findings of this study should be viewed in the light of its strengths and limitations. First, the study utilizes a nationally-representative data and findings have important practical and policy implications to improve healthcare communication experiences of patients with low incomes in the US. Second, given an observational study design, causality cannot be established but the findings highlight interesting associations and complexities of assessing perceptions especially among vulnerable populations. This is particularly important for risk-adjustment strategies for payment models in which financial incentives are based on patient satisfaction scores and their interpretation especially in the safety-net healthcare settings. Second, MEPS does not collect information on patient and provider expectations, preferences or encounter characteristics such as length of consultation and provider time pressures. Given that these factors are likely to be key determinants of patient ratings of healthcare providers' communication styles, studies that include information on these items can be valuable to evaluate disparities in patient-provider communication. However, the measures of satisfaction used in this study are adapted from the CAHPS survey which are standardized metrics used by payment agencies to determine patient-centered care. Additionally, the richness of MEPS, which includes several key predictors of perceptions of providers' communication, still allowed a comprehensive assessment after adjusting estimates to account for the effect of each influential characteristic. Third, satisfaction could be examined only for those respondents who have a usual source care; thus limiting generalizability of findings to those that have an established USC. Nevertheless, the study has an impetus for understanding patient experiences of health care with a USC which is important to maintain a continuum of care. Fourth, the study could not examine patient preferences for selecting the USC; specifically, whether or not patients had a choice in selecting their USC and if they had a choice, whether the provider's race/ethnicity and sex were considered in the decision-making. It is likely that patient perceptions of communication are driven by the selection of their USC, thus future concordance studies may want to consider questions that can identify patient preferences to draw conclusions about whether race/ethnicity and sex concordance indeed leads to positive perceptions and/or more satisfaction. Finally, measurement bias is a possibility due to the patients' self-report of the provider characteristics. Perhaps future studies could link provider characteristic data files obtained from the providers' direct report for a more accurate measurement of particularly race and ethnicity.

Practical and Policy Implications

Patient satisfaction is a key outcome for measuring the delivery of health services to ensure that patients find their care acceptable and there are continued efforts to bolster patient-provider communication. Patient satisfaction surveys allow incorporating patient perspectives of their health care experience including quality of provider communication. The ACA has placed a huge emphasis on health care value and quality which is often linked to patient satisfaction. For example, The Center for Medicare & Medicaid Services (CMS) ties Medicare reimbursements with patient satisfaction, as measured by the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey which measures various aspects of patient satisfaction including provider communication. The stakes are high with patient satisfaction as CMS not only ties reimbursements to satisfaction scores, it also publicly reports these metrics for Medicaid-certified hospitals, primary care and other ambulatory providers. But the predictors of patient satisfaction are unclear and disparities in satisfaction persist especially for patients with low income populations. This study examines patient perceptions of provider communication among the low-income populations, whose medical care is often stymied by financial barriers leaving them fewer choices with provider selection and is of poor quality. The findings have practical implications in addressing low satisfaction scores especially within the safety-net care-delivery setting that disproportionately serves the low income. While complicated risk-adjustment strategies set different levels of compensation under quality programs, it is known from this study that patient demographic characteristics can play a role in influencing reports of patient satisfaction. Therefore, it is important to take into account specific characteristics such as the demographic composition of the patient panel when interpreting what their communication ratings mean. At the practice level, the findings can assist individual providers in the identification of potential subgroups of patients at risk for facing communication difficulties and thus experiencing suboptimal communication. Additionally, education efforts to improve communication and elicit patient preferences for communication will need to be targeted to not only the future generation of healthcare providers but must also reach the current workforce. Promoting effective patient provider communication will require massive policy efforts towards integrating a patient-centric approach that transcends issues of race and sex to foster positive experiences of care

An important aspect of the health care experience is the interaction between a patient and provider which is a powerful tool to promote positive experiences of care. Thus, utilizing patient-provider communication, a provider should aim to facilitate information exchange to maintain the continuity of care (Makoul 2001). While, early evidence suggests that concordance between patient and provider may generally establish a therapeutic relationship that enhances patient health care experiences, the findings from this study confirm that that low-income patients may continue to feel dissatisfied with provider communication even in the presence of concordance. There is increasing pressure on medical schools and residency programs to train a workforce that matches the gender and ethnic distribution of the diversifying US population (Garcıa, Paterniti, Romano

2003). These efforts may increase physicians from racial and ethnic groups which may have a larger societal benefit of giving racial and ethnic minority patients a greater choice in selecting a provider with their same racial and ethnic background, if they feel more comfortable. However, concordance does not seem to be crucial in ensuring that low-income racial and ethnic group patients get high quality care. While efforts to encourage a racial and ethnically diverse workforce should continue, it is also important to examine to what extent it plays a role in reducing disparate healthcare experiences among vulnerable populations and the context in which concordance has the potential to improve patient’s experience of care.

Table 1: Key Variables

Measure	**Operational Definition**	**Type of Variable**	**Variable Names in MEPS**
Dependent Variable			
Perception of Providers' Communication	Does the USC provider: usually ask about prescription medications and treatments other doctors may give them, ask about and show respect for medical, traditional, and alternative treatments that the person is happy with, ask the person to help make decisions between a choice of treatments, present and explain all options to the person	Binary Not Always Always	TREATM42 RESPCT42 DECIDE42 EXPLOP42
Explanatory Variables			
Income status	Family income adjusted to federal poverty level (FPL)	Categorical Low (< 200% FPL) Middle (200-400% FPL) High (> 400% FPL)	POVCAT
Concordance	Race concordance constructed when provider and respondent race ethnicity were similar	Binary Race Concordant Race Discordant	Respondent Race: RACEX Provider Race WHITPR42 (white) BLCKPR42(Black/African American) HSPLAP42 (Hispanic or Latino)
	Sex concordance constructed when provider and respondent sex were similar	Binary Sex Concordant Sex Discordant	GENDRP42
Control Variables			
Predisposing Factors			
Age	Measured in years	Categorical (18–24, 25–44, 45–64, 65+)	AGE42X
Education	Number of years of education	Categorical (no or some high school, high school graduate, some college, and	EDUYRDG

		college graduate or beyond)	
Residence location	Region of the U.S.	Categorical (West, Northeast, Midwest, and South)	REGION42
Urbanicity	Rural or Urban Metropolitan Statistical Area	Binary Rural Urban	Used only for data from 2008-2012 MSA42
Enabling Factors			
Health insurance status	Coverage reported for the survey period	Categorical Public Insurance (Medicaid, Medicare) Private (Any private, Tricare) Uninsured	INSCOV13/14
Language spoken	Language of interview	Binary English Non-English language	INTVLANG
Practice location of usual source of care	Respondents' report of where the usual source of care practices	Binary Office setting Office but in Hospital	LOCATN42
Provider specialty	Respondents' report of whether the provider is a MD primary care (included MD family practice, MD internal medicine, MD Ob-Gyn), MD specialist or non-MD (Nurse practitioner, physician assistant or other)	Categorical MD Primary Care MD Specialist Non-MD	TYPEPE42
Need Factors			
Perceived Need	Respondents' report of perceived physical and mental health status asked by, "In general, would you say that your health is excellent, very good, good, fair, or poor?	Categorical for mental and physical health status fair or poor health good health very good to excellent health"	Perceived health status (RTHLTH31, RTHLTH42, and RTHLTH53) Perceived mental health status (MNHLTH31, MNHLTH42, and MNHLTH53)
Evaluated Need	Number of chronic conditions reported by asking the question, "Have you ever been told or had a diagnosis of"; included common 8 conditions: diabetes,	Categorical No comorbidity 1 comorbidity 2 comorbidities	STRKDX MIDX HIBPDX EMPHDX

	hypertension, coronary heart disease, myocardial infarction, stroke, asthma, emphysema and arthritis.	3+ comorbidities	ADHDADDX ANGIDX ARTHDX ASTHDX CANCERDX CHDDX CHOLDX DIABDX CHBRON31 CHBRON53

Table 2: Descriptive characteristics of the sample by respondent's income levels MEPS 2008-2014

	High Income	**Middle Income**	**Low Income**
N	13,791	12,116	13,268
Does not always (%)			
Ask about prescription medications***	15.03	16.64	18.77
Asks to help make treatment decisions***	29.71	33.08	34.46
Shows respect	25.66	26.1	27.00
Explain all treatment options*	3.61	3.38	4.55
Race Discordance (%)***	23.07	26.04	32.04
Gender Discordance (%)***	41.34	44.96	49.67
Respondent Characteristics			
Age (%)***			
18-24yrs	6.37	7.19	8.55
25-44yrs	22.99	29.51	23.86
45-64yrs	48.12	35.77	31.57
65yrs and older	22.52	27.53	36.02
Female***	51.96	57.64	63.36
Race/Ethnicity (%)			
Non-Hispanic white	86.58	78.84	70.28
Non-Hispanic black	7.36	10.87	16.02
Hispanic	6.06	10.28	13.7
Education (%)***			
Less than high school	15.43	28.64	50.98
GED/high school	14.19	21.76	24.39
Some College	39.40	36.01	27.5
College	30.99	13.6	7.12
Insurance coverage (%)***			
Uninsured	2.81	5.80	10.38
Public insurance only	7.80	17.16	46.16
Any private insurance	89.39	77.02	43.46
Perceived physical health status (%)***			
Fair	3.58	7.41	16.7
Good	15.13	20.82	27.60
Very good to excellent	81.30	71.77	55.70
Perceived mental health status (%)***			
Fair	1.42	3.05	7.25
Good	8.75	14.11	20.81
Very good to excellent	89.83	82.84	71.94

Comorbidities (%)***			
No comorbidity	28.70	29.32	21.74
1comorbidity	23.9	21.07	17.89
2comorbidities	20.01	17.29	16.47
3+comorbidities	27.38	32.32	43.90
Respondent's region (%)***			
West	17.31	15.51	15.39
Northeast	24.73	21.39	20.10
Midwest	22.14	24.82	22.32
South	35.82	38.27	42.19
Interview completely in English (%)***	98.47	95.55	91.91
Provider Characteristics			
Provider Type (%)***			
MD Family physician	91.63	90.67	88.45
MD Specialty	3.98	4.09	5.71
Non-MD practitioner	4.38	5.23	5.83
Provider race (%)***			
Non-Hispanic white	80.65	77.15	70.44
Non-Hispanic black	3.05	4.1	5.84
Hispanic	5.04	8.84	10.04
Asian	8.67	8.84	10.06
Native American	1.99	2.16	2.76
Pacific Islander	0.61	0.98	0.85
Male providers (%)	71.77	70.54	71.40
Provider location (%)**			
Office setting	91.65	90.16	89.36
Office in hospital	8.35	9.84	10.64

*p<0.1, **p<0.05, ***p<0.01. Weighed proportions. All tests were based chi-square.

Table 3: Logistic regression estimations for perceptions of provider communication

	Asks about treatment		**Explains all treatment options**		**Asks to help decide between choices**		**Shows respect**	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Income (Ref: High Income)								
Middle Income	0.93	(0.83 - 1.05)	1.10	(0.89 - 1.36)	0.89**	(0.80 - 0.98)	0.97	(0.87 - 1.07)
Low Income	0.82***	(0.72 - 0.92)	0.90	(0.71 - 1.13)	0.89*	(0.79 - 1.00)	0.96	(0.86 - 1.08)
Age (Ref: 18-24 yrs)								
25-44yrs	0.89	(0.76 - 1.04)	0.77	(0.56 - 1.06)	1.05	(0.91 - 1.20)	1.03	(0.89 - 1.18)
45-64yrs	0.88	(0.75 - 1.04)	0.87	(0.64 - 1.18)	1.11*	(0.98 - 1.26)	0.97	(0.85 - 1.11)
65yrs and older	0.74***	(0.61 - 0.88)	1.20	(0.85 - 1.70)	1.09	(0.94 - 1.26)	1.07	(0.91 - 1.26)
Gender (Ref: Male)								
Female	1.01	(0.95 - 1.07)	0.95	(0.84 - 1.08)	1.03	(0.98 - 1.09)	1.01	(0.96 - 1.07)
Race/Ethnicity (Ref: NH white)								
Non-Hispanic black	1.09	(0.97 - 1.22)	1.20*	(0.97 - 1.49)	0.91*	(0.82 - 1.01)	1.06	(0.95 - 1.17)
Hispanics	1.07	(0.95 - 1.21)	1.03	(0.78 - 1.36)	0.81***	(0.72 - 0.91)	0.93	(0.82 - 1.05)
Education (Ref: Less than high school)								
GED/high school	1.05	(0.93 - 1.18)	0.97	(0.80 - 1.17)	1.06	(0.98 - 1.16)	1.14**	(1.02 - 1.27)
Some College	1.17***	(1.07 - 1.29)	0.94	(0.78 - 1.13)	1.03	(0.94 - 1.14)	1.09	(0.98 - 1.21)
College Graduate	1.35***	(1.20 - 1.53)	0.87	(0.68 - 1.10)	0.94	(0.85 - 1.05)	0.87**	(0.77 - 0.99)
Insurance coverage (Ref: Uninsured)								
Public Only	1.10	(0.93 - 1.31)	0.88	(0.65 - 1.20)	0.92	(0.79 - 1.07)	1.14	(0.97 - 1.33)
Any private Insurance	1.10	(0.92 - 1.31)	1.06	(0.79 - 1.42)	0.96	(0.83 - 1.11)	1.15*	(0.99 - 1.32)
Perceived physical health status (Ref: Fair)								
Good	0.99	(0.85 - 1.15)	1.11	(0.85 - 1.44)	0.96	(0.85 - 1.09)	1.00	(0.86 - 1.15)
Very good to Excellent	0.92	(0.79 - 1.06)	1.16	(0.89 - 1.53)	1.12**	(1.00 - 1.26)	1.16*	(1.00 - 1.34)

Table 3: Logistic regression estimations for perceptions of provider communication (Continued)

Perceived mental health status (Ref: Fair)								
Good	0.99	(0.80 - 1.23)	1.01	(0.71 - 1.44)	1.01	(0.85 - 1.20)	1.06	(0.88 - 1.29)
Very good to Excellent	1.08	(0.87 - 1.33)	1.41*	(0.97 - 2.05)	1.23**	(1.04 - 1.45)	1.27**	(1.05 - 1.54)
Comorbidities (Ref: No comorbidity)								
1comorbidity	1.08	(0.98 - 1.19)	0.82*	(0.65 - 1.02)	1.07	(0.98 - 1.18)	1.03	(0.93 - 1.14)
2comorbidities	1.08	(0.97 - 1.21)	0.84	(0.65 - 1.07)	1.09*	(0.99 - 1.20)	1.04	(0.94 - 1.15)
3+comorbidities	1.15**	(1.02 - 1.29)	0.73***	(0.58 - 0.92)	1.00	(0.89 - 1.12)	1.04	(0.93 - 1.18)
Region (Ref: West)								
Northeast	1.25**	(1.05 - 1.48)	1.15	(0.88 - 1.50)	0.97	(0.83 - 1.15)	1.18**	(1.01 - 1.38)
Midwest	1.13	(0.95 - 1.34)	1.22	(0.92 - 1.61)	1.09	(0.95 - 1.25)	1.35***	(1.16 - 1.56)
South	1.50***	(1.27 - 1.77)	1.07	(0.84 - 1.36)	1.09	(0.96 - 1.23)	1.27***	(1.10 - 1.47)
Provider Location (Ref: Office)								
Office in Hospital	1.04	(0.91 - 1.19)	1.24	(0.95 - 1.62)	0.93	(0.83 - 1.04)	0.94	(0.82 - 1.08)
Provider type (Ref: MD Family Medicine)								
MD Specialty	1.08	(0.89 - 1.30)	1.87***	(1.34 - 2.61)	1.13*	(0.99 - 1.30)	1.20**	(1.02 - 1.41)
Non-MD	1.13	(0.92 - 1.40)	1.10	(0.76 - 1.60)	1.39***	(1.14 - 1.69)	1.60***	(1.33 - 1.93)
Provide race/ethnicity (Ref: NH white)								
NH black	0.85	(0.69 - 1.04)	0.74	(0.50 - 1.10)	1.00	(0.86 - 1.15)	1.13	(0.98 - 1.30)
Hispanic	1.10	(0.90 - 1.34)	0.78	(0.51 - 1.18)	0.88*	(0.76 - 1.01)	0.84**	(0.70 - 0.99)
Asian	0.80***	(0.69 - 0.92)	0.60***	(0.47 - 0.76)	0.74***	(0.66 - 0.84)	0.78***	(0.70 - 0.87)
Native American	0.95	(0.69 - 1.30)	0.72	(0.47 - 1.11)	0.86	(0.70 - 1.05)	0.82	(0.64 - 1.04)
Pacific Islander	1.06	(0.62 - 1.81)	0.70	(0.33 - 1.50)	0.94	(0.64 - 1.38)	0.98	(0.61 - 1.58)
Provider Gender (Ref: Male)								
Female	1.18***	(1.06 - 1.31)	1.36***	(1.13 - 1.63)	1.00	(0.92 - 1.09)	1.05	(0.96 - 1.14)
*** p<0.01, ** p<0.05, * p<0.1								

Table 4: Predicted Probabilities of Provider Communication for each Income level by Race Concordance

	Race Discordant		**Race Concordant**		
Asks about prescription medications					
Income	Probability	95% CI	Probability	95% CI	Marginal effect (Δ in probability)
High income	0.836	(0.813 - 0.859)	0.848	(0.837 - 0.859)	0.012
Middle income	0.828	(0.807 - 0.850)	0.839	(0.826 - 0.852)	0.011
Low income	0.823	(0.803 - 0.842)	0.814	(0.798 - 0.830)	-0.009
Explains all treatment options					
High income	0.956	(0.945 - 0.967)	0.967	(0.961 - 0.972)	0.011*
Middle income	0.968	(0.960 - 0.975)	0.969	(0.962 - 0.974)	0.001
Low income	0.951	(0.940 - 0.963)	0.964	(0.957 - 0.970)	0.013**
Asks to help decide between choices					
High income	0.663	(0.637 - 0.689)	0.705	(0.688 - 0.722)	0.042***
Middle income	0.651	(0.624 - 0.679)	0.672	(0.654 - 0.690)	0.021
Low income	0.662	(0.635 - 0.689)	0.666	(0.644 - 0.687)	0.004
Shows respect					
High income	0.731	(0.706 - 0.756)	0.746	(0.731 - 0.760)	0.015
Middle income	0.724	(0.699 - 0.749)	0.742	(0.727 - 0.758)	0.018
Low income	0.731	(0.705 - 0.757)	0.735	(0.716 - 0.754)	0.004

*p<0.1, **p<0.05, ***p<0.01

Table 5: Predicted Probabilities of Provider Communication for each Income level by Gender Concordance

	Gender Discordant		**Gender Concordant**		
Asks about prescription medications					
Income	Probability	95% CI	Probability	95% CI	Marginal effect (Δ in probability)
High income	0.843	(0.829 - 0.856)	0.847	(0.835 - 0.859)	0.004
Middle income	0.838	(0.825 - 0.852)	0.835	(0.822 - 0.847)	-0.003
Low income	0.813	(0.799 - 0.828)	0.82	(0.802 - 0.837)	0.007
Explains all treatment options					
High income	0.959	(0.952 - 0.967)	0.967	(0.962 - 0.972)	0.008**
Middle income	0.971	(0.966 - 0.976)	0.965	(0.959 - 0.972)	-0.006*
Low income	0.957	(0.949 - 0.965)	0.964	(0.957 - 0.971)	0.007*
Asks to help decide between choices					
High income	0.683	(0.671 - 0.696)	0.675	(0.664 - 0.686)	-0.008***
Middle income	0.655	(0.642 - 0.668)	0.66	(0.648 - 0.671)	0.005
Low income	0.657	(0.644 - 0.670)	0.658	(0.644 - 0.669)	0.001
Shows respect					
High income	0.735	(0.723 - 0.747)	0.738	(0.728 - 0.748)	0.003
Middle income	0.736	(0.724 - 0.748)	0.737	(0.725 - 0.746)	0.001
Low income	0.735	(0.723 - 0.746)	0.724	(0.712 - 0.735)	-0.011

*p<0.1, **p<0.05, ***p<0.01

Appendix Table 1: Comparison of Characteristics between those with Missing and Non-Missing Provider Race and Gender

Variable	**Missing**	**Not Missing**
Does not always (%)		
Ask about prescription medications	16.49	19.43
Asks to help make treatment decisions	34.02	36.46
Shows respect	26.27	28.59
Explain all treatment options	3.83	4.70
Age (%)		
18-24yrs	7.15	7.36
25-44yrs	25.15	26.75
45-64yrs	40.30	37.20
65yrs and older	27.41	28.69
Female (%)	58.46	61.35
Race/Ethnicity (%)		
Non-Hispanic white	70.04	68.06
Non-Hispanic black	15.36	19.59
Hispanic	14.60	12.35
Education (%)		
Less than high school	25.65	30.21
GED/high school	19.05	21.62
Some College	35.53	31.22
College	19.77	16.95
Income (%)		
High	43.26	42.05
Middle	29.65	29.44
Low	27.09	28.51
Insurance coverage (%)*		
Uninsured	6.58	7.91
Public insurance only	27.23	29.65
Any private insurance	66.19	62.44
Perceived physical health status (%)**		
Fair	8.03	11.58
Good	20	25.25
Very good to excellent	71.98	63.18
Perceived mental health status (%)**		
Fair	3.37	3.92
Good	13.42	19.82
Very good to excellent	83.21	76.26
Comorbidities (%)		

No comorbidity	27.09	25.03
1comorbidity	21.54	21.52
2comorbidities	18.31	17.27
3+comorbidities	33.06	36.19
Respondent's region (%)		
West	16.33	14.64
Northeast	22.52	22.65
Midwest	23.03	22.68
South	38.13	40.03
Interview completely in English (%)	95.96	96.38
Mean number of visits to doctor (SE)	2.29 (0.02)	2.01 (0.11)
Provider Type (%)**		
MD Family physician	90.57	88.88
MD Specialty	4.48	8.17
Non-MD practitioner	4.95	3.03
Provider location (%)		
Office setting	90.58	89.95
Office in hospital	9.42	10.15

*p<0.1, **p<0.05, ***p<0.01. All tests were based chi-square.

Appendix Table 2: Full regression results of logistic regression models for race concordance and communication

	Asks about treatment		**Explains all treatment options**		**Asks to help decide between choices**		**Shows respect**	
	95%CI	**OR**	**95%CI**	**OR**	**95%CI**	**OR**	**95%CI**	**OR**
Race/ Ethnicity Concordance	1.14**	(1.01 - 1.28)	1.29**	(1.00 - 1.67)	1.20*	(1.03 - 1.34)	1.10*	(1.04 - 1.44)
Age (Ref: 18-24 yrs)								
25-44yrs	0.89	(0.76 - 1.04)	0.77	(0.56 - 1.06)	1.05	(0.91 - 1.20)	1.03	(0.89 - 1.18)
45-64yrs	0.88	(0.75 - 1.04)	0.86	(0.63 - 1.18)	1.11*	(0.98 - 1.26)	0.97	(0.85 - 1.11)
65yrs and older	0.73***	(0.61 - 0.88)	1.19	(0.85 - 1.68)	1.08	(0.93 - 1.26)	1.07	(0.91 - 1.26)
Gender (Ref: Male)								
Female	1.01	(0.95 - 1.07)	0.97	(0.86 - 1.10)	1.04	(0.98 - 1.09)	1.00	(0.95 - 1.06)
Race/Ethnicity (Ref: NH white)								
Non-Hispanic black	1.16**	(1.01 - 1.34)	1.35**	(1.06 - 1.72)	0.97	(0.86 - 1.08)	1.11	(0.98 - 1.27)
Hispanics	1.12*	(0.98 - 1.28)	1.09	(0.83 - 1.44)	0.84**	(0.74 - 0.96)	0.95	(0.83 - 1.09)
Education (Ref: Less than high school)								
GED/high school	1.05	(0.94 - 1.18)	0.98	(0.81 - 1.18)	1.07	(0.98 - 1.16)	1.14**	(1.02 - 1.27)
Some College	1.17***	(1.07 - 1.29)	0.94	(0.78 - 1.14)	1.04	(0.94 - 1.14)	1.09	(0.98 - 1.21)
College Graduate	1.35***	(1.20 - 1.53)	0.87	(0.68 - 1.10)	0.94	(0.85 - 1.05)	0.87**	(0.77 - 0.99)
Patient Income (Ref: High income)								
Middle Income	0.93	(0.83 - 1.04)	1.09	(0.88 - 1.35)	0.88**	(0.80 - 0.98)	0.96	(0.87 - 1.07)
Low Income	0.81***	(0.72 - 0.92)	0.90	(0.71 - 1.13)	0.89*	(0.79 - 1.00)	0.96	(0.86 - 1.08)
Insurance coverage (Ref: Uninsured)								
Public Only	1.10	(0.93 - 1.31)	0.89	(0.65 - 1.20)	0.92	(0.79 - 1.07)	1.14	(0.97 - 1.33)
Any private Insurance	1.10	(0.93 - 1.31)	1.07	(0.80 - 1.43)	0.96	(0.83 - 1.11)	1.15*	(0.99 - 1.33)
Perceived physical health status (Ref: Fair)								
Good	0.99	(0.85 - 1.15)	1.11	(0.85 - 1.44)	0.96	(0.85 - 1.09)	1.00	(0.86 - 1.15)
Very good to Excellent	0.92	(0.79 - 1.06)	1.17	(0.89 - 1.54)	1.13**	(1.00 - 1.27)	1.16*	(1.00 - 1.34)

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 2: Full regression results of logistic regression models for race concordance and communication (continued)

Perceived mental health status (Ref: Fair)								
Good	0.99	(0.80 - 1.23)	1.01	(0.71 - 1.44)	1.01	(0.85 - 1.20)	1.06	(0.88 - 1.28)
Very good to Excellent	1.07	(0.87 - 1.32)	1.40*	(0.97 - 2.04)	1.22**	(1.03 - 1.45)	1.27**	(1.04 - 1.54)
Comorbidities (Ref: No comorbidity)								
1comorbidity	1.08	(0.98 - 1.19)	0.82*	(0.65 - 1.02)	1.07	(0.98 - 1.18)	1.03	(0.93 - 1.13)
2comorbidities	1.08	(0.97 - 1.21)	0.84	(0.65 - 1.08)	1.09*	(0.99 - 1.20)	1.04	(0.94 - 1.15)
3+comorbidities	1.15**	(1.02 - 1.29)	0.73***	(0.58 - 0.93)	1.00	(0.90 - 1.12)	1.04	(0.93 - 1.18)
Region (Ref: West)								
Northeast	1.24**	(1.05 - 1.48)	1.14	(0.88 - 1.49)	0.97	(0.83 - 1.14)	1.18**	(1.00 - 1.38)
Midwest	1.12	(0.94 - 1.33)	1.20	(0.91 - 1.60)	1.09	(0.95 - 1.24)	1.34***	(1.16 - 1.56)
South	1.50***	(1.27 - 1.77)	1.07	(0.84 - 1.36)	1.09	(0.96 - 1.23)	1.27***	(1.10 - 1.47)
Provider Location (Ref: Office)								
Office in Hospital	1.04	(0.91 - 1.20)	1.24	(0.95 - 1.63)	0.93	(0.83 - 1.04)	0.94	(0.82 - 1.08)
Provider type (Ref: MD Family Medicine)								
MD Specialty	1.08	(0.90 - 1.30)	1.88***	(1.34 - 2.62)	1.14*	(0.99 - 1.31)	1.20**	(1.02 - 1.41)
Non-MD	1.13	(0.91 - 1.40)	1.10	(0.75 - 1.59)	1.39***	(1.14 - 1.69)	1.60***	(1.33 - 1.93)
Provide race/ethnicity (Ref: NH white)								
NH black	0.84*	(0.69 - 1.03)	0.76	(0.53 - 1.10)	0.99	(0.86 - 1.14)	1.12	(0.97 - 1.29)
Hispanic	1.12	(0.93 - 1.36)	0.83	(0.59 - 1.18)	0.89*	(0.78 - 1.02)	0.85*	(0.72 - 1.00)
Asian	0.88	(0.75 - 1.04)	0.74**	(0.54 - 1.00)	0.81***	(0.70 - 0.94)	0.84**	(0.74 - 0.97)
Native American	1.05	(0.76 - 1.46)	0.89	(0.56 - 1.42)	0.93	(0.75 - 1.16)	0.88	(0.69 - 1.13)
Pacific Islander	1.18	(0.69 - 2.02)	0.88	(0.41 - 1.87)	1.02	(0.69 - 1.52)	1.07	(0.68 - 1.67)
Provider Gender (Ref: Male)								
Female	1.18***	(1.07 - 1.31)	1.36***	(1.14 - 1.64)	1.00	(0.92 - 1.09)	1.05	(0.96 - 1.15)

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 3: Full regression results of logistic regression models for sex concordance and communication

	Asks about treatment		**Explains all treatment options**		**Asks to help decide between choices**		**Shows respect**	
	95%CI	**OR**	**95%CI**	**OR**	**95%CI**	**OR**	**95%CI**	**OR**
Sex Concordance	1.21***	(1.04- 1.34)	1.11**	(1.02 - 1.27)	1.14**	(1.05 - 1.23)	1.3***	(1.06 - 1.40)
Age (Ref: 18-24 yrs)								
25-44yrs	0.89	(0.76 - 1.04)	0.77	(0.56 - 1.06)	1.05	(0.91 - 1.20)	1.03	(0.89 - 1.18)
45-64yrs	0.88	(0.75 - 1.04)	0.87	(0.64 - 1.18)	1.11*	(0.98 - 1.26)	0.97	(0.85 - 1.11)
65yrs and older	0.74***	(0.61 - 0.88)	1.20	(0.85 - 1.70)	1.09	(0.94 - 1.26)	1.07	(0.91 - 1.26)
Gender (Ref: Male)								
Female	1.02	(0.95 - 1.09)	1.04	(0.90 - 1.20)	1.02	(0.96 - 1.09)	0.98	(0.92 - 1.05)
Race/Ethnicity (Ref: NH white)								
Non-Hispanic black	1.09	(0.97 - 1.22)	1.20*	(0.97 - 1.48)	0.91*	(0.82 - 1.01)	1.06	(0.95 - 1.17)
Hispanics	1.07	(0.95 - 1.21)	1.03	(0.78 - 1.36)	0.81***	(0.72 - 0.91)	0.93	(0.82 - 1.05)
Education (Ref: Less than high school)								
GED/high school	1.05	(0.93 - 1.18)	0.97	(0.80 - 1.17)	1.06	(0.98 - 1.16)	1.14**	(1.02 - 1.27)
Some College	1.17***	(1.07 - 1.29)	0.94	(0.78 - 1.13)	1.03	(0.94 - 1.14)	1.09	(0.98 - 1.21)
College Graduate	1.35***	(1.19 - 1.53)	0.86	(0.68 - 1.10)	0.94	(0.85 - 1.05)	0.87**	(0.77 - 0.99)
Patient Income (Ref: High income)								
Middle Income	0.93	(0.83 - 1.05)	1.10	(0.89 - 1.36)	0.89**	(0.80 - 0.98)	0.97	(0.87 - 1.07)
Low Income	0.82***	(0.72 - 0.92)	0.90	(0.72 - 1.13)	0.89*	(0.79 - 1.00)	0.96	(0.86 - 1.08)
Insurance coveraege (Ref: Uninsured)								
Public Only	1.10	(0.93 - 1.31)	0.88	(0.65 - 1.19)	0.92	(0.79 - 1.07)	1.14	(0.97 - 1.33)
Any private Insurance	1.10	(0.92 - 1.31)	1.06	(0.79 - 1.42)	0.96	(0.83 - 1.11)	1.15*	(0.99 - 1.33)
Perceived physical health status (Ref: Fair)								
Good	0.99	(0.85 - 1.15)	1.11	(0.85 - 1.44)	0.96	(0.85 - 1.09)	1.00	(0.86 - 1.15)
Very good to Excellent	0.92	(0.79 - 1.06)	1.16	(0.89 - 1.53)	1.12**	(1.00 - 1.26)	1.16*	(1.00 - 1.34)

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 3: Full regression results of logistic regression models for sex concordance and communication (continued)

Perceived mental health status (Ref: Fair)								
Good	0.99	(0.80 - 1.23)	1.01	(0.71 - 1.45)	1.01	(0.85 - 1.20)	1.06	(0.88 - 1.29)
Very good to Excellent	1.08	(0.87 - 1.33)	1.42*	(0.98 - 2.06)	1.22**	(1.04 - 1.45)	1.27**	(1.05 - 1.54)
Comorbidities (Ref: No comorbidity)								
1comorbidity	1.08	(0.98 - 1.19)	0.82*	(0.65 - 1.02)	1.07	(0.98 - 1.18)	1.03	(0.93 - 1.13)
2comorbidities	1.08	(0.97 - 1.21)	0.84	(0.65 - 1.08)	1.09*	(0.99 - 1.20)	1.04	(0.94 - 1.15)
3+comorbidities	1.15**	(1.02 - 1.29)	0.73***	(0.58 - 0.92)	1.00	(0.89 - 1.12)	1.04	(0.92 - 1.17)
Region (Ref: West)								
Northeast	1.25**	(1.05 - 1.48)	1.15	(0.89 - 1.50)	0.97	(0.83 - 1.15)	1.18**	(1.00 - 1.38)
Midwest	1.13	(0.95 - 1.34)	1.22	(0.92 - 1.61)	1.09	(0.95 - 1.25)	1.35***	(1.16 - 1.56)
South	1.50***	(1.27 - 1.77)	1.07	(0.84 - 1.36)	1.09	(0.96 - 1.23)	1.27***	(1.09 - 1.47)
Provider Location (Ref: Office)								
Office in Hospital	1.04	(0.91 - 1.19)	1.24	(0.95 - 1.62)	0.93	(0.83 - 1.04)	0.94	(0.82 - 1.08)
Provider type (Ref: MD Family Medicine)								
MD Specialty	1.08	(0.89 - 1.30)	1.86***	(1.33 - 2.60)	1.14*	(0.99 - 1.30)	1.20**	(1.02 - 1.41)
Non-MD	1.13	(0.92 - 1.40)	1.10	(0.76 - 1.59)	1.39***	(1.14 - 1.69)	1.60***	(1.33 - 1.93)
Provide race/ethnicity (Ref: NH white)								
NH black	0.85	(0.69 - 1.04)	0.74	(0.50 - 1.10)	1.00	(0.86 - 1.15)	1.13	(0.97 - 1.30)
Hispanic	1.10	(0.90 - 1.34)	0.78	(0.51 - 1.18)	0.88*	(0.76 - 1.01)	0.84**	(0.70 - 0.99)
Asian	0.80***	(0.69 - 0.92)	0.60***	(0.47 - 0.76)	0.74***	(0.66 - 0.84)	0.78***	(0.70 - 0.87)
Native American	0.95	(0.69 - 1.30)	0.73	(0.47 - 1.11)	0.86	(0.70 - 1.05)	0.82	(0.64 - 1.04)
Pacific Islander	1.06	(0.62 - 1.81)	0.71	(0.33 - 1.51)	0.94	(0.63 - 1.38)	0.98	(0.61 - 1.59)
Provider Gender (Ref: Male)								
Female	1.17***	(1.06 - 1.31)	1.32***	(1.09 - 1.60)	1.01	(0.92 - 1.10)	1.06	(0.97 - 1.16)

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 4: Full regression results of logistic regression models with interaction between race concordance and income

	Asks about treatment		**Explains all treatment options**		**Asks to help decide between choices**		**Shows respect**	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Patient Income (Ref: High income)								
Middle Income	0.86	(0.71 - 1.05)	1.19	(0.90 - 1.58)	0.96	(0.81 - 1.14)	0.93	(0.79 - 1.09)
Low Income	0.89	(0.73 - 1.09)	0.89	(0.64 - 1.23)	1.03	(0.88 - 1.20)	0.97	(0.82 - 1.15)
Race concordance (Ref: Race discordance)	1.15	(0.97 - 1.37)	1.32	(0.92 - 1.90)	**1.22*** **	(1.05 - 1.40)	1.09	(0.93 - 1.28)
Race concordance # middle income	1.11	(0.89 - 1.38)	0.88	(0.61 - 1.28)	0.90	(0.74 - 1.09)	1.05	(0.87 - 1.26)
Race concordance # low income	0.87	(0.71 - 1.07)	1.02	(0.69 - 1.51)	**0.82** **	(0.70 - 0.97)	0.98	(0.83 - 1.17)
Age (Ref: 18-24 yrs)								
25-44yrs	0.88	(0.75 - 1.04)	0.77	(0.56 - 1.06)	1.05	(0.91 - 1.20)	1.03	(0.89 - 1.18)
45-64yrs	0.88	(0.74 - 1.03)	0.86	(0.63 - 1.18)	1.11*	(0.98 - 1.26)	0.97	(0.85 - 1.10)
65yrs and older	0.73***	(0.61 - 0.88)	1.19	(0.85 - 1.68)	1.08	(0.93 - 1.26)	1.07	(0.91 - 1.26)
Gender (Ref: Male)								
Female	1.01	(0.95 - 1.07)	0.97	(0.86 - 1.10)	1.04	(0.98 - 1.09)	1.00	(0.95 - 1.06)
Race/Ethnicity (Ref: NH white)								
Non-Hispanic black	1.16**	(1.01 - 1.33)	1.35**	(1.06 - 1.71)	0.96	(0.85 - 1.07)	1.11	(0.98 - 1.27)
Hispanics	1.12*	(0.99 - 1.28)	1.09	(0.83 - 1.43)	0.84***	(0.73 - 0.96)	0.96	(0.84 - 1.09)
Education (Ref: Less than high school)								
GED/high school	1.05	(0.94 - 1.19)	0.98	(0.81 - 1.18)	1.07	(0.98 - 1.17)	1.14**	(1.02 - 1.27)
Some College	1.18***	(1.07 - 1.29)	0.94	(0.78 - 1.14)	1.04	(0.94 - 1.15)	1.09	(0.98 - 1.21)
College Graduate	1.35***	(1.20 - 1.53)	0.87	(0.68 - 1.10)	0.95	(0.85 - 1.05)	0.87**	(0.77 - 0.99)
Insurance coverage (Ref: Uninsured)								
Public Only	1.10	(0.93 - 1.31)	0.88	(0.65 - 1.20)	0.92	(0.79 - 1.06)	1.14	(0.97 - 1.33)
Any private Insurance	1.10	(0.93 - 1.31)	1.07	(0.80 - 1.43)	0.96	(0.84 - 1.11)	1.15*	(1.00 - 1.33)

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 4: Full regression results of logistic regression models with interaction between race concordance and income (continued)

Perceived physical health status (Ref: Fair)								
Good	0.99	(0.85 - 1.15)	1.11	(0.86 - 1.44)	0.96	(0.85 - 1.09)	1.00	(0.86 - 1.15)
Very good to Excellent	0.92	(0.80 - 1.06)	1.17	(0.89 - 1.53)	1.13**	(1.00 - 1.26)	1.16*	(1.00 - 1.34)
Perceived mental health status (Ref: Fair)								
Good	0.99	(0.80 - 1.23)	1.01	(0.71 - 1.43)	1.01	(0.85 - 1.20)	1.06	(0.88 - 1.28)
Very good to Excellent	1.07	(0.87 - 1.33)	1.40*	(0.97 - 2.04)	1.22**	(1.03 - 1.45)	1.27**	(1.04 - 1.54)
Comorbidities (Ref: No comorbidity)								
1comorbidity	1.08	(0.98 - 1.20)	0.82*	(0.65 - 1.02)	1.07	(0.98 - 1.18)	1.03	(0.93 - 1.13)
2comorbidities	1.08	(0.97 - 1.21)	0.84	(0.65 - 1.08)	1.09*	(0.99 - 1.20)	1.04	(0.94 - 1.15)
3+comorbidities	1.15**	(1.02 - 1.29)	0.73***	(0.58 - 0.93)	1.00	(0.90 - 1.12)	1.04	(0.93 - 1.18)
Region (Ref: West)								
Northeast	1.24**	(1.05 - 1.48)	1.14	(0.88 - 1.49)	0.97	(0.83 - 1.14)	1.18**	(1.00 - 1.38)
Midwest	1.12	(0.94 - 1.33)	1.21	(0.91 - 1.60)	1.09	(0.95 - 1.24)	1.34***	(1.16 - 1.56)
South	1.50***	(1.27 - 1.77)	1.07	(0.84 - 1.36)	1.09	(0.96 - 1.23)	1.27***	(1.10 - 1.47)
Provider Location (Ref: Office)								
Office in Hospital	1.04	(0.91 - 1.19)	1.24	(0.95 - 1.63)	0.93	(0.83 - 1.04)	0.94	(0.82 - 1.08)
Provider type (Ref: MD Family Medicine)								
MD Specialty	1.08	(0.90 - 1.30)	1.87***	(1.34 - 2.62)	1.13*	(0.99 - 1.30)	1.20**	(1.03 - 1.41)
Non-MD	1.13	(0.91 - 1.40)	1.09	(0.75 - 1.59)	1.39***	(1.14 - 1.69)	1.60***	(1.33 - 1.93)
Provide race/ethnicity (Ref: NH white)								
NH black	0.85	(0.69 - 1.04)	0.76	(0.53 - 1.10)	1.00	(0.86 - 1.16)	1.12	(0.97 - 1.29)
Hispanic	1.13	(0.94 - 1.36)	0.83	(0.59 - 1.17)	0.90	(0.79 - 1.03)	0.85*	(0.72 - 1.00)
Asian	0.89	(0.76 - 1.05)	0.74**	(0.55 - 0.99)	0.81***	(0.70 - 0.94)	0.84**	(0.74 - 0.97)
Native American	1.06	(0.76 - 1.46)	0.89	(0.56 - 1.42)	0.94	(0.75 - 1.17)	0.88	(0.69 - 1.13)
Pacific Islander	1.20	(0.71 - 2.04)	0.87	(0.41 - 1.86)	1.02	(0.69 - 1.52)	1.07	(0.69 - 1.67)
Provider Gender (Ref: Male)								
Female	1.18***	(1.06 - 1.31)	1.37***	(1.14 - 1.64)	1.00	(0.92 - 1.09)	1.05	(0.96 - 1.15)
*** p<0.01, ** p<0.05, * p<0.1								

Appendix Table 5: Full regression results of logistic regression models with interaction between gender concordance and income

	Asks about treatment		**Explains all treatment options**		**Asks to help decide between choices**		**Shows respect**	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Patient Income (Ref: High income)								
Middle Income	0.96	(0.83 - 1.11)	1.40***	(1.09 - 1.78)	0.91**	(0.84 - 0.99)	1.01	(0.92 - 1.10)
Low Income	0.81***	(0.71 - 0.93)	0.95	(0.72 - 1.24)	0.93*	(0.86 - 1.01)	1.03	(0.94 - 1.12)
Gender concordance (Ref: gender discordance)	1.03	(0.94 - 1.13)	1.28**	(1.05 - 1.56)	0.97	(0.90 - 1.05)	1.02	(0.94 - 1.11)
Gender concordance # middle income	0.94	(0.83 - 1.07)	0.64***	(0.50 - 0.84)	1.03	(0.93 - 1.15)	0.97	(0.86 - 1.08)
Gender concordance # low income	1.00	(0.88 - 1.15)	0.92	(0.70 - 1.19)	1.03	(0.93 - 1.14)	0.90*	(0.81 - 1.01)
Age (Ref: 18-24 yrs)								
25-44yrs	0.89	(0.76 - 1.04)	0.77	(0.56 - 1.05)	1.05	(0.96 - 1.15)	0.96	(0.87 - 1.06)
45-64yrs	0.88	(0.75 - 1.04)	0.87	(0.64 - 1.18)	1.08	(0.98 - 1.18)	0.91*	(0.83 - 1.01)
65yrs and older	0.74***	(0.61 - 0.88)	1.20	(0.85 - 1.70)	1.06	(0.96 - 1.18)	1.01	(0.91 - 1.13)
Gender (Ref: Male)								
Female	1.02	(0.95 - 1.09)	1.03	(0.90 - 1.19)	1.04	(0.99 - 1.10)	1.02	(0.96 - 1.07)
Race/Ethnicity (Ref: NH white)								
Non-Hispanic black	1.09	(0.97 - 1.22)	1.20*	(0.97 - 1.48)	0.92***	(0.86 - 0.98)	1.08**	(1.01 - 1.15)
Hispanics	1.07	(0.95 - 1.21)	1.03	(0.78 - 1.36)	0.81***	(0.76 - 0.86)	0.92**	(0.85 - 0.98)
Education (Ref: Less than high school)								
GED/high school	1.05	(0.93 - 1.18)	0.97	(0.80 - 1.18)	1.01	(0.95 - 1.07)	1.07**	(1.00 - 1.15)
Some College	1.17***	(1.07 - 1.29)	0.94	(0.78 - 1.13)	1.05	(0.99 - 1.11)	1.06*	(0.99 - 1.12)
College Graduate	1.35***	(1.19 - 1.53)	0.86	(0.68 - 1.10)	0.94	(0.88 - 1.01)	0.86***	(0.80 - 0.93)
Insurance coverage (Ref: Uninsured)								
Public Only	1.10	(0.93 - 1.31)	0.88	(0.65 - 1.20)	0.98	(0.89 - 1.08)	1.15***	(1.04 - 1.27)
Any private Insurance	1.10	(0.92 - 1.31)	1.06	(0.79 - 1.42)	0.99	(0.91 - 1.08)	1.13***	(1.03 - 1.23)

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 5: Full regression results of logistic regression models with interaction between gender concordance and income (continued)

Perceived physical health status (Ref: Fair)								
Good	0.99	(0.85 - 1.15)	1.11	(0.85 - 1.44)	0.95	(0.88 - 1.04)	0.98	(0.89 - 1.07)
Very good to Excellent	0.92	(0.79 - 1.06)	1.16	(0.89 - 1.53)	1.10**	(1.01 - 1.20)	1.09*	(0.99 - 1.20)
Perceived mental health status (Ref: Fair)								
Good	0.99	(0.80 - 1.23)	1.01	(0.71 - 1.45)	1.02	(0.91 - 1.15)	1.05	(0.93 - 1.20)
Very good to Excellent	1.08	(0.87 - 1.33)	1.42*	(0.98 - 2.06)	1.26***	(1.11 - 1.41)	1.27***	(1.12 - 1.44)
Comorbidities (Ref: No comorbidity)								
1comorbidity	1.08	(0.98 - 1.19)	0.82*	(0.66 - 1.03)	1.07**	(1.01 - 1.15)	1.05	(0.98 - 1.12)
2comorbidities	1.08	(0.97 - 1.21)	0.84	(0.65 - 1.08)	1.07*	(1.00 - 1.15)	1.07*	(0.99 - 1.16)
3+comorbidities	1.15**	(1.02 - 1.29)	0.73***	(0.58 - 0.92)	1.01	(0.94 - 1.09)	1.07*	(0.99 - 1.15)
Region (Ref: West)								
Northeast	1.25**	(1.05 - 1.48)	1.15	(0.88 - 1.50)	1.00	(0.93 - 1.07)	1.06	(0.98 - 1.14)
Midwest	1.12	(0.95 - 1.34)	1.21	(0.92 - 1.61)	1.09**	(1.02 - 1.17)	1.31***	(1.22 - 1.42)
South	1.50***	(1.27 - 1.77)	1.07	(0.84 - 1.36)	1.13***	(1.06 - 1.20)	1.21***	(1.14 - 1.30)
Provider Location (Ref: Office)								
Office in Hospital	1.04	(0.91 - 1.19)	1.24	(0.95 - 1.62)	0.98	(0.91 - 1.05)	1.00	(0.92 - 1.07)
Provider type (Ref: MD Family Medicine)								
MD Specialty	1.08	(0.89 - 1.30)	1.86***	(1.33 - 2.60)	1.05	(0.95 - 1.15)	1.17***	(1.05 - 1.30)
Non-MD	1.13	(0.92 - 1.40)	1.10	(0.76 - 1.59)	1.40***	(1.25 - 1.56)	1.52***	(1.34 - 1.72)
Provide race/ethnicity (Ref: NH white)								
NH black	0.85	(0.69 - 1.04)	0.74	(0.50 - 1.10)	0.97	(0.89 - 1.07)	1.04	(0.94 - 1.16)
Hispanic	1.10	(0.90 - 1.34)	0.78	(0.51 - 1.17)	0.94	(0.87 - 1.02)	0.95	(0.88 - 1.04)
Asian	0.80***	(0.69 - 0.92)	0.60***	(0.47 - 0.76)	0.77***	(0.72 - 0.83)	0.79***	(0.73 - 0.85)
Native American	0.95	(0.69 - 1.30)	0.73	(0.47 - 1.11)	0.88*	(0.77 - 1.00)	0.79***	(0.69 - 0.90)
Pacific Islander	1.06	(0.62 - 1.81)	0.71	(0.33 - 1.51)	1.18	(0.93 - 1.50)	1.23	(0.95 - 1.60)
Provider Gender (Ref: Male)								
Female	1.17***	(1.05 - 1.31)	1.33***	(1.09 - 1.61)	1.00	(0.95 - 1.05)	1.05*	(1.00 - 1.11)
*** p<0.01, ** p<0.05, * p<0.1								

Appendix Table 6: Full Regression Results of Stratified Analysis of Low Income and Race Concordance

	Asks about treatment		**Explains all treatment options**		**Asks to help decide between choices**		**Shows respect**	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Race Concordance	0.91	(0.64 - 1.30)	1.43	(0.86 - 2.37)	0.98	(0.75 - 1.28)	0.99	(0.72 - 1.35)
Race/Ethnicity (Ref: NH white)								
Non-Hispanic black (NHB)	1.09	(0.79 - 1.51)	1.40	(0.86 - 2.28)	0.99	(0.78 - 1.24)	1.15	(0.88 - 1.50)
Hispanics	1.16	(0.84 - 1.59)	1.07	(0.68 - 1.67)	0.72**	(0.55 - 0.95)	0.78*	(0.58 - 1.05)
Race concordance # NHB	1.64	(0.73 - 3.68)	1.75	(0.58 - 5.33)	1.05	(0.54 - 2.04)	1.16	(0.59 - 2.29)
Race concordance # Hispanics	1.13	(0.57 - 2.22)	0.55	(0.18 - 1.66)	1.35	(0.81 - 2.24)	1.52	(0.84 - 2.78)
Age (Ref: 18-24 yrs)								
25-44yrs	1.14	(0.85 - 1.52)	0.83	(0.50 - 1.36)	1.03	(0.83 - 1.28)	1.02	(0.80 - 1.30)
45-64yrs	0.91	(0.67 - 1.24)	0.95	(0.59 - 1.55)	1.04	(0.85 - 1.26)	0.87	(0.68 - 1.11)
65yrs and older	0.76*	(0.55 - 1.05)	1.29	(0.77 - 2.18)	1.07	(0.85 - 1.35)	0.99	(0.75 - 1.29)
Gender (Ref: Male)								
Female	0.97	(0.86 - 1.08)	0.86	(0.70 - 1.06)	1.05	(0.96 - 1.15)	1.07	(0.96 - 1.19)
Education (Ref: Less than high school)								
GED/high school	1.00	(0.83 - 1.19)	1.05	(0.80 - 1.37)	1.03	(0.90 - 1.19)	1.10	(0.94 - 1.28)
Some College	1.09	(0.92 - 1.29)	0.85	(0.65 - 1.11)	1.00	(0.85 - 1.17)	0.95	(0.81 - 1.11)
College Graduate	0.98	(0.76 - 1.26)	0.80	(0.49 - 1.30)	1.08	(0.86 - 1.35)	0.78**	(0.62 - 0.97)
Insurance coverage (Ref: Uninsured)								
Public Only	1.25*	(0.99 - 1.59)	0.84	(0.58 - 1.22)	0.87	(0.72 - 1.05)	1.17	(0.96 - 1.41)
Any private Insurance	1.46***	(1.15 - 1.86)	1.02	(0.68 - 1.55)	0.98	(0.79 - 1.21)	1.26**	(1.04 - 1.53)

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 6: Full Regression Results of Stratified Analysis of Low Income and Race Concordance (continued)

Perceived physical health status (Ref: Fair)								
Good	1.03	(0.84 - 1.25)	1.12	(0.82 - 1.55)	1.01	(0.87 - 1.18)	1.08	(0.89 - 1.30)
Very good to Excellent	0.91	(0.73 - 1.12)	1.18	(0.81 - 1.72)	1.17*	(0.98 - 1.39)	1.16	(0.95 - 1.41)
Perceived mental health status (Ref: Fair)								
Good	1.13	(0.87 - 1.46)	0.97	(0.63 - 1.51)	1.01	(0.82 - 1.24)	1.08	(0.85 - 1.38)
Very good to Excellent	1.19	(0.93 - 1.52)	1.19	(0.75 - 1.90)	1.26**	(1.01 - 1.58)	1.31**	(1.01 - 1.70)
Comorbidities (Ref: No comorbidity)								
1comorbidity	0.99	(0.81 - 1.20)	1.22	(0.85 - 1.74)	1.12	(0.96 - 1.30)	1.11	(0.92 - 1.34)
2comorbidities	1.16	(0.93 - 1.44)	0.88	(0.63 - 1.23)	1.16*	(0.97 - 1.39)	1.17*	(0.97 - 1.40)
3+comorbidities	1.17	(0.95 - 1.44)	0.78	(0.54 - 1.13)	1.18*	(1.00 - 1.41)	1.20*	(0.99 - 1.46)
Region (Ref: West)								
Northeast	0.95	(0.74 - 1.21)	1.19	(0.73 - 1.95)	0.89	(0.70 - 1.13)	0.95	(0.76 - 1.19)
Midwest	1.08	(0.87 - 1.34)	1.15	(0.71 - 1.84)	1.09	(0.88 - 1.35)	1.31**	(1.06 - 1.61)
South	1.18	(0.94 - 1.46)	1.01	(0.65 - 1.59)	1.04	(0.87 - 1.24)	1.12	(0.90 - 1.38)
Provider Location (Ref: Office)								
Office in Hospital	0.91	(0.74 - 1.12)	1.01	(0.68 - 1.49)	0.90	(0.76 - 1.06)	0.86	(0.71 - 1.05)
Provider type (Ref: MD Family Medicine)								
MD Specialty	0.86	(0.66 - 1.13)	2.32***	(1.32 - 4.07)	1.08	(0.87 - 1.33)	1.10	(0.86 - 1.40)
Non-MD	1.24	(0.94 - 1.65)	0.87	(0.49 - 1.55)	1.50***	(1.12 - 2.03)	1.59***	(1.20 - 2.10)
Provide race/ethnicity (Ref: NH white)								
NH black	0.68	(0.39 - 1.18)	0.51*	(0.24 - 1.06)	1.12	(0.68 - 1.84)	1.06	(0.63 - 1.77)
Hispanic	1.18	(0.78 - 1.80)	1.40	(0.68 - 2.91)	0.91	(0.66 - 1.24)	0.81	(0.55 - 1.19)
Asian	0.83	(0.62 - 1.11)	0.76	(0.52 - 1.10)	0.93	(0.75 - 1.14)	0.84	(0.67 - 1.05)
Native American	1.03	(0.66 - 1.61)	1.11	(0.58 - 2.11)	0.81	(0.55 - 1.20)	0.70*	(0.49 - 1.01)
Pacific Islander	1.03	(0.44 - 2.39)	0.81	(0.27 - 2.43)	1.66*	(0.92 - 2.99)	1.50	(0.70 - 3.25)
Provider Gender (Ref: Male)								
Female	1.28***	(1.11 - 1.48)	1.61***	(1.25 - 2.07)	0.99	(0.86 - 1.13)	1.08	(0.93 - 1.24)
*** p<0.01, ** p<0.05, * p<0.1								

Appendix Table 7: Full Regression Results Race and Gender Concordance by Income

	Asks about treatment		**Explains all treatment options**		**Asks to help decide between choices**		**Shows respect**	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Income (Ref: high income)								
Middle Income	0.81*	(0.64 - 1.03)	1.45*	(0.97 - 2.18)	0.89	(0.74 - 1.08)	0.92	(0.76 - 1.12)
Low Income	0.87	(0.69 - 1.09)	0.94	(0.64 - 1.38)	1.00	(0.84 - 1.18)	1.08	(0.89 - 1.30)
Concordance (Ref: Discordance)								
Only Gender Concordance	0.94	(0.79 - 1.11)	1.15	(0.90 - 1.48)	0.90	(0.78 - 1.04)	0.99	(0.86 - 1.14)
Only Race Concordance	1.07	(0.87 - 1.31)	1.21	(0.78 - 1.88)	1.15	(0.97 - 1.36)	1.04	(0.85 - 1.28)
Race and Gender Concordance	1.14	(0.92 - 1.40)	1.63**	(1.05 - 2.51)	1.15	(0.97 - 1.35)	1.11	(0.92 - 1.35)
Gender Concordance*middle income	1.11	(0.89 - 1.40)	0.69	(0.44 - 1.09)	1.14	(0.96 - 1.35)	1.02	(0.84 - 1.23)
Gender Concordance*low income	1.05	(0.82 - 1.33)	0.89	(0.59 - 1.32)	1.05	(0.87 - 1.26)	0.82**	(0.68 - 0.99)
Race Concordance* high income	1.00	(1.00 - 1.00)	1.00	(1.00 - 1.00)	1.00	(1.00 - 1.00)	1.00	(1.00 - 1.00)
Race Concordance* middle income	1.26*	(0.96 - 1.65)	0.94	(0.55 - 1.59)	0.95	(0.76 - 1.18)	1.15	(0.91 - 1.43)
Race Concordance* low income	0.91	(0.70 - 1.17)	1.00	(0.62 - 1.61)	0.87	(0.73 - 1.05)	0.99	(0.79 - 1.23)
Both Concordance* high income	1.00	(1.00 - 1.00)	1.00	(1.00 - 1.00)	1.00	(1.00 - 1.00)	1.00	(1.00 - 1.00)
Both Concordance* middle income	1.12	(0.85 - 1.46)	0.59**	(0.35 - 0.99)	0.98	(0.78 - 1.21)	1.00	(0.80 - 1.24)
Both Concordance* low income	0.91	(0.71 - 1.15)	0.96	(0.60 - 1.54)	0.82**	(0.67 - 1.00)	0.82*	(0.66 - 1.01)
Age (Ref: 18-24 yrs)								
25-44yrs	0.88	(0.75 - 1.04)	0.77	(0.56 - 1.05)	1.05	(0.91 - 1.20)	1.02	(0.89 - 1.18)
45-64yrs	0.88	(0.74 - 1.03)	0.87	(0.64 - 1.18)	1.11*	(0.98 - 1.26)	0.97	(0.85 - 1.11)
65yrs and older	0.73***	(0.61 - 0.88)	1.19	(0.85 - 1.68)	1.08	(0.93 - 1.26)	1.07	(0.91 - 1.26)
Gender (Ref: Male)								
Female	1.02	(0.95 - 1.10)	1.04	(0.90 - 1.20)	1.03	(0.96 - 1.09)	0.99	(0.92 - 1.05)
Race/Ethnicity (Ref: NH white)								
Non-Hispanic black	1.16**	(1.01 - 1.33)	1.34**	(1.05 - 1.70)	0.96	(0.85 - 1.07)	1.11	(0.98 - 1.26)
Hispanics	1.12*	(0.99 - 1.28)	1.09	(0.83 - 1.43)	0.84***	(0.73 - 0.96)	0.96	(0.84 - 1.09)

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 7: Full Regression Results Race and Gender Concordance by Income (continued)

Education (Ref: Less than high school)								
GED/high school	1.05	(0.94 - 1.18)	0.98	(0.81 - 1.18)	1.07	(0.98 - 1.17)	1.14**	(1.02 - 1.27)
Some College	1.18***	(1.07 - 1.29)	0.94	(0.78 - 1.13)	1.04	(0.94 - 1.15)	1.09*	(0.98 - 1.21)
College Graduate	1.35***	(1.20 - 1.53)	0.86	(0.68 - 1.10)	0.95	(0.85 - 1.05)	0.87**	(0.77 - 0.99)
Insurance coverage (Ref: Uninsured)								
Public Only	1.10	(0.93 - 1.31)	0.88	(0.65 - 1.20)	0.92	(0.79 - 1.06)	1.14	(0.97 - 1.33)
Any private Insurance	1.11	(0.93 - 1.31)	1.06	(0.80 - 1.42)	0.97	(0.84 - 1.11)	1.15*	(1.00 - 1.33)
Perceived physical health status (Ref: Fair)								
Good	0.99	(0.85 - 1.15)	1.11	(0.86 - 1.44)	0.96	(0.85 - 1.09)	1.00	(0.86 - 1.16)
Very good to Excellent	0.92	(0.80 - 1.06)	1.17	(0.89 - 1.53)	1.13**	(1.00 - 1.26)	1.16*	(1.00 - 1.34)
Perceived mental health status (Ref: Fair)								
Good	0.99	(0.80 - 1.23)	1.01	(0.71 - 1.44)	1.01	(0.85 - 1.20)	1.06	(0.87 - 1.29)
Very good to Excellent	1.07	(0.87 - 1.33)	1.41*	(0.97 - 2.05)	1.22**	(1.03 - 1.45)	1.27**	(1.04 - 1.54)
Comorbidities (Ref: No comorbidity)								
1comorbidity	1.08	(0.98 - 1.20)	0.82*	(0.65 - 1.02)	1.07	(0.97 - 1.18)	1.03	(0.93 - 1.13)
2comorbidities	1.08	(0.97 - 1.21)	0.84	(0.65 - 1.08)	1.09*	(0.99 - 1.20)	1.04	(0.94 - 1.15)
3+comorbidities	1.15**	(1.02 - 1.29)	0.73***	(0.58 - 0.93)	1.00	(0.89 - 1.12)	1.04	(0.92 - 1.17)
Region (Ref: West)								
Northeast	1.24**	(1.05 - 1.48)	1.14	(0.88 - 1.49)	0.97	(0.83 - 1.14)	1.18**	(1.00 - 1.38)
Midwest	1.12	(0.94 - 1.33)	1.21	(0.91 - 1.60)	1.09	(0.95 - 1.24)	1.34***	(1.16 - 1.56)
South	1.50***	(1.27 - 1.77)	1.07	(0.84 - 1.36)	1.09	(0.96 - 1.23)	1.27***	(1.10 - 1.47)
Provider Location (Ref: Office)								
Office in Hospital	1.04	(0.91 - 1.19)	1.24	(0.95 - 1.63)	0.93	(0.83 - 1.04)	0.94	(0.82 - 1.08)
Provider type (Ref: MD Family Medicine)								
MD Specialty	1.08	(0.90 - 1.30)	1.87***	(1.34 - 2.62)	1.13*	(0.99 - 1.30)	1.21**	(1.03 - 1.42)
Non-MD	1.13	(0.91 - 1.40)	1.09	(0.75 - 1.58)	1.39***	(1.14 - 1.69)	1.61***	(1.33 - 1.93)
Provide race/ethnicity (Ref: NH white)								
NH black	0.85	(0.69 - 1.03)	0.77	(0.53 - 1.11)	1.00	(0.86 - 1.16)	1.12	(0.97 - 1.29)

Hispanic	1.13	(0.94 - 1.36)	0.83	(0.59 - 1.17)	0.90	(0.79 - 1.03)	0.85*	(0.72 - 1.00)
Asian	0.89	(0.76 - 1.05)	0.74**	(0.55 - 0.99)	0.81***	(0.70 - 0.94)	0.84**	(0.74 - 0.97)
Native American	1.05	(0.76 - 1.46)	0.89	(0.56 - 1.42)	0.93	(0.75 - 1.16)	0.88	(0.69 - 1.13)
Pacific Islander	1.20	(0.70 - 2.03)	0.87	(0.41 - 1.86)	1.02	(0.69 - 1.52)	1.07	(0.69 - 1.68)
Provider Gender (Ref: Male)								
Female	1.17***	(1.05 - 1.31)	1.33***	(1.10 - 1.61)	1.01	(0.93 - 1.10)	1.07	(0.97 - 1.17)
*** p<0.01, ** p<0.05, * p<0.1								

Chapter 5: Conclusion

Patient experience of care is a multi-dimensional construct where differences in healthcare system level factors such as health care coverage and the health care providers may contribute to disparate experiences. Disparities have continued to pose a challenge; where patients with low income and of racial and ethnic minorities may continue to be dissatisfied with the care received or may receive inequitable care. In this study, role of health coverage and health care workforce in disparities is measured across three domains that constitute a patient's health care experience – whether care is affordable, whether it is utilized in a timely way and whether it is satisfactory.

This study explored three research questions: 1) what is the impact of cost-sharing on affording and utilizing health care, 2) to what extent do disparities in timely utilization of cancer screening continue to persist in the presence of coverage expansions and provisions to eliminate financial barriers to preventive care, 3) what is the role of healthcare providers in improving satisfaction among low-income patients. The study used two datasets – a hospital administrative claims from a unique safety-net coverage program and the 2008-2014 Medical Expenditure Panel Survey. It used various econometric methods, including mixed effects linear probability and negative binomial models, Oaxaca-Blinder and Fairlie decomposition and multivariate logistic regression models.

The study findings suggested that cost-sharing continue to pose a financial barrier to low-income patients and is associated with reduction of primary care and emergency department use. The findings also suggest that while racial-ethnic disparities in cancer screening have declined over time as insurance rates have improved, insurance coverage and having a usual source of care continue to remain as the most significant factors for improving timely cancer screening, especially among Hispanic patients. Further, low-income individuals continue to face dissatisfaction with their provider's communication, even when provider and patients have concordant demographic characteristics.

The study has important policy and practical implications in addressing health care disparities. The findings are important for states that are considering increased cost-sharing in coverage programs for the low-income, including state Medicaid waivers to ensure that such policies do not widen disparities leading to adverse health outcomes. In addition, while coverage expansions can potentially reduce racial and ethnic disparities in preventive care uptake, these effects may not be distributed equally across all races and ethnicities. Finally, health care providers play a crucial role in improving satisfaction among low-income patients. While increasing diversity of the health care workforce is important, there is a larger need to train providers especially those in safety-net settings to improve communication and elicit patient preferences for communication. The dissertation findings have several new opportunities for future research including an evaluation of state-level re-structuring of Medicaid policies related to cost-sharing and its effect on health care use and overall healthcare costs. A continued examination of racial-ethnic disparities for other cancer screening modalities in the light of the health care reform. Finally, an assessment of patient-provider communication in specific clinical areas such as cancer care and treatment and its effect on health care utilization and outcomes.

List of References

Andersen RM. Revisiting the behavioral model and access to medical care: Does it matter. Journal of Health and Social Behavior 1995; 36:1-8

Andersen, R. M. (1995). Revisiting the behavioral model and access to medical care: does it matter?. Journal of health and social behavior, 1-10.

Anderson N, Skopec L, Kenny G. (Urban Institute, Washington DC). Profile of Virginia's Uninsured, 2013 [Internet]. Richmond (VA): Virginia Health Care Foundation; 2014 Aug. Available from: http://www.vhcf.org/data/profile-of-the-uninsured/

Ahmed, A. T., Welch, B. T., Brinjikji, W., Farah, W. H., Henrichsen, T. L., Murad, M. H., & Knudsen, J. M. (2017). Racial Disparities in Screening Mammography in the United States: A Systematic Review and Meta-analysis. Journal of the American College of Radiology, 14(2), 157-165.

Aldridge, M. L., Daniels, J. L., & Jukic, A. M. (2006). Mammograms and Healthcare Access Among US Hispanic and Non-Hispanic Women 40 Years and Older. Family & Community Health, 29(2), 80-88.

Ayanian, J. Z., Weissman, J. S., Schneider, E. C., Ginsburg, J. A., & Zaslavsky, A. M. (2000). Unmet health needs of uninsured adults in the United States. Jama, 284(16), 2061-2069.

Ackerson, L. K., & Viswanath, K. (2009). The social context of interpersonal communication and health. Journal of Health Communication, 14(S1), 5-17.

Adler, N. E., & Newman, K. (2002). Socioeconomic disparities in health: pathways and policies. Health affairs, 21(2), 60-76.

Arrow, K. J. (1963). Uncertainty and the welfare economics of medical care.The American economic review, 941-973.

Ashton, C. M., Haidet, P., Paterniti, D. A., Collins, T. C., Gordon, H. S., O'Malley, K., ... & Street, R. L. (2003). Racial and ethnic disparities in the use of health services. Journal of general internal medicine, 18(2), 146-152.

Bloom, B. S. (2002). Crossing the quality chasm: a new health system for the 21st century (committee on quality of health care in America, institute of medicine). *JAMA-Journal of the American Medical Association-International Edition*, *287*(5), 645.

Baicker, K., & Goldman, D. (2011). Patient cost-sharing and healthcare spending growth. The Journal of Economic Perspectives, 47-68.

Baker, D. W., Shapiro, M. F., & Schur, C. L. (2000). Health insurance and access to care for symptomatic conditions. Archives of Internal Medicine, 160(9), 1269-1274.

Ballard, D. W., Price, M., Fung, V., Brand, R., Reed, M. E., Fireman, B., & Hsu, J. (2010). Validation of an algorithm for categorizing the severity of hospital emergency department visits. Medical care, 48(1).

Billings, J., Parikh, N., & Mijanovich, T. (2000). Emergency department use in New York City: a substitute for primary care?. Issue brief (Commonwealth Fund), (433), 1-5.

Bradley, C. J., Gandhi, S. O., Neumark, D., Garland, S., & Retchin, S. M. (2012). Lessons for coverage expansion: a Virginia primary care program for the uninsured reduced utilization and cut costs. Health Affairs, 31(2), 350-359.

Broyles, R. W., Narine, L., & Brandt Jr, E. N. (2002). The temporarily and chronically uninsured: does their use of primary care differ?. Journal of health care for the poor and underserved, 13(1), 95-111.

Burns, M. E., Dague, L., DeLeire, T., Dorsch, M., Friedsam, D., Leininger, L. J., ... & Voskuil, K. (2014). The Effects of Expanding Public Insurance to Rural Low-Income Childless Adults. Health services research, 49(S2), 2173-2187.

Balsa, A. I., & McGuire, T. G. (2001). Statistical discrimination in health care.Journal of health economics, 20(6), 881-907.

Balsa, A. I., & McGuire, T. G. (2003). Prejudice, clinical uncertainty and stereotyping as sources of health disparities. Journal of health economics, 22(1), 89-116.

Beck, R. S., Daughtridge, R., & Sloane, P. D. (2002). Physician-patient communication in the primary care office: a systematic review. The Journal of the American Board of Family Practice, 15(1), 25-38.

Becker, H. S. (Ed.). (2002). Boys in white: Student culture in medical school. Transaction publishers.

Buhlman, N., & Matthes, N. (2011). The time to prepare for value-based purchasing is now. White Papers for Hospitals.

Burgess, D. J., Fu, S. S., & Van Ryn, M. (2004). Why do providers contribute to disparities and what can be done about it?. Journal of General Internal Medicine, 19(11), 1154-1159.

Chan, K. S., Bird, C. E., Weiss, R., Duan, N., Meredith, L. S., & Sherbourne, C. D. (2006). Does patient–provider gender concordance affect mental health care received by primary care patients with major depression?. Women's Health Issues, 16(3), 122-132.

Charles, C., Gafni, A., & Whelan, T. (1997). Shared decision-making in the medical encounter: what does it mean?(or it takes at least two to tango). Social science & medicine, 44(5), 681-692.

Cheraghi-Sohi, S., Bower, P., Mead, N., McDonald, R., Whalley, D., & Roland, M. (2006). What are the key attributes of primary care for patients? Building a conceptual 'map' of patient preferences. Health Expectations, 9(3), 275-284.

Cohen, S. B., & Buchmueller, T. (2006). Trends in medical care costs, coverage, use, and access: research findings from the medical expenditure panel survey. Medical care, 44(5), I-1.

Cooper, L. A., Beach, M. C., Johnson, R. L., & Inui, T. S. (2006). Delving below the surface. Journal of General Internal Medicine, 21(S1), S21-S27.

Cooper, L. A., Roter, D. L., Johnson, R. L., Ford, D. E., Steinwachs, D. M., & Powe, N. R. (2003). Patient-centered communication, ratings of care, and concordance of patient and physician race. Annals of internal medicine,139(11), 907-915.

Cooper-Patrick, L., Gallo, J. J., Gonzales, J. J., Vu, H. T., Powe, N. R., Nelson, C., & Ford, D. E. (1999). Race, gender, and partnership in the patient-physician relationship. Jama, 282(6), 583-589.

Chandra, A., Gruber, J., & McKnight, R. (2010). Patient cost-sharing in low-income populations. The American Economic Review, 303-308.

Chandra, A., Gruber, J., & McKnight, R. (2014). The impact of patient cost-sharing on low-income populations: Evidence from Massachusetts. Journal of health economics, 33, 57-66.

Cutler, D. M., & Zeckhauser, R. J. (2000). The anatomy of health insurance. Handbook of health economics, 1, 563-643.

DeLeire, T., Dague, L., Leininger, L., Voskuil, K., & Friedsam, D. (2013). Wisconsin experience indicates that expanding public insurance to low-income childless adults has health care impacts. Health Affairs, 32(6), 1037-1045.

Dearborn, J. L., Panzer, V. P., Burleson, J. A., Hornung, F. E., Waite, H., & Into, F. H. (2006). Effect of gender on communication of health information to older adults. Journal of the American Geriatrics Society, 54(4), 637-641.

DeVoe, J. E., Wallace, L. S., & Fryer Jr, G. E. (2009). Patient age influences perceptions about health care communication. Fam Med, 41(2), 126-33.

DeVoe, J. E., Wallace, L. S., Pandhi, N., Solotaroff, R., & Fryer, G. E. (2008). Comprehending care in a medical home: a usual source of care and patient perceptions about healthcare communication. The Journal of the American Board of Family Medicine, 21(5), 441-450.

Dovidio, J. F., & Gaertner, S. L. (2004). Aversive racism. Advances in experimental social psychology, 36, 1-52.

Droomers, M., & Westert, G. P. (2004). Do lower socioeconomic groups use more health services, because they suffer from more illnesses?. The European Journal of Public Health, 14(3), 311-313.

Dow, A. W., Bohannon, A., Garland, S., Mazmanian, P. E., & Retchin, S. M. (2013). The effects of expanding primary care access for the uninsured: Implications for the health care workforce under health reform. Academic Medicine, 88(12), 1855-1861.

Eisert, S., & Gabow, P. (2002). Effect of Child Health Insurance Plan enrollment on the utilization of health care services by children using a public safety net system. Pediatrics, 110(5), 940-945.

Fairlie, R. W. (2005). An extension of the Blinder-Oaxaca decomposition technique to logit and probit models. Journal of economic and social measurement, 30(4), 305-316.

Fenton, J. J., Jerant, A. F., Bertakis, K. D., & Franks, P. (2012). The cost of satisfaction: a national study of patient satisfaction, health care utilization, expenditures, and mortality. Archives of internal medicine, 172(5), 405-411.

Ferguson, W. J., & Candib, L. M. (2002). Culture, language, and the doctor-patient relationship. FMCH Publications and Presentations, 61.

Finney Rutten, L. J., Augustson, E., & Wanke, K. (2006). Factors associated with patients' perceptions of health care providers' communication behavior. Journal of Health Communication, 11(S1), 135-146.

Flocke, S. A., & Gilchrist, V. (2005). Physician and patient gender concordance and the delivery of comprehensive clinical preventive services. Medical care, 43(5), 486-492.

Francis, V., Korsch, B. M., & Morris, M. J. (1969). Gaps in doctor-patient communication: patients' response to medical advice. The New England Journal of Medicine.

Franks, P., & Bertakis, K. D. (2003). Physician gender, patient gender, and primary care. Journal

Goldman, D. P., Joyce, G. F., Escarce, J. J., Pace, J. E., Solomon, M. D., Laouri, M., & Teutsch, S. M. (2004). Pharmacy benefits and the use of drugs by the chronically ill. Jama, 291(19), 2344-2350.

Garcıa, J. A., Paterniti, D. A., Romano, P. S., & Kravitz, R. L. (2003). Patient preferences for physician characteristics in university-based primary care clinics. Ethnicity & disease, 13.

Haas-Wilson, D. (2001). Arrow and the information market failure in health care: the changing content and sources of health care information. Journal of Health Politics, Policy and Law, 26(5), 1031-1044.

Hadley, J., & Holahan, J. (2003). Is health care spending higher under Medicaid or private insurance?. INQUIRY: The Journal of Health Care Organization, Provision, and Financing, 40(4), 323-342.

Institute of Medicine. Coverage Matters: Insurance and Health Care. Washington, D.C.: National Academies Press; 2001.

Jensen, J. D., King, A. J., Guntzviller, L. M., & Davis, L. A. (2010). Patient–provider communication and low-income adults: Age, race, literacy, and optimism predict communication satisfaction. Patient education and counseling, 79(1), 30-35.

Jerant, A., Bertakis, K. D., Fenton, J. J., Tancredi, D. J., & Franks, P. (2011). Patient-provider sex and race/ethnicity concordance: a national study of healthcare and outcomes. Medical care, 49(11), 1012-1020.

Jacobs, E. A., Karavolos, K., Rathouz, P. J., Ferris, T. G., & Powell, L. H. (2005). Limited English proficiency and breast and cervical cancer screening in a multiethnic population. American journal of public health, 95(8), 1410-1416.

Joseph P. Newhouse, & Rand Corporation. Insurance Experiment Group. (1993). Free for all?: lessons from the RAND health insurance experiment. Harvard University Press.

Kasper, J. D., Giovannini, T. A., & Hoffman, C. (2000). Gaining and losing health insurance: strengthening the evidence for effects on access to care and health outcomes. Medical Care Research and Review, 57(3), 298-318.

Kraus, M. W., Piff, P. K., & Keltner, D. (2009). Social class, sense of control, and social explanation. Journal of personality and social psychology, 97(6), 992.

Ku, L., Deschamps, E., & Hilman, J. (2004). The effects of copayments on the use of medical services and prescription drugs in Utah's Medicaid program. Center on Budget and Policy Priorities.

Ku, L., & Broaddus, M. (2005). Out-of-pocket Medical Expenses for Medicaid Beneficiaries are Substantial and Growing. Washington, DC: Center on Budget and Policy Priorities.

Ku, L. C., MacTaggart, P., Pervez, F., & Rosenbaum, S. J. (2009). Improving Medicaid's Continuity of Coverage and Quality of Care.

Ku, L. C., Steinmetz, E. (2013). The Continuity of Medicaid Coverage: An Update (http://www.communityplans.net/portals/0/coverageyoucancounton/Continuity_of_Medicaid_Coverage_Update_4-2013.pdf)

Long, S. K., Coughlin, T., & King, J. (2005). How well does Medicaid work in improving access to care?. Health services research, 40(1), 39-58.

LaVeist, T. A., & Nuru-Jeter, A. (2002). Is doctor-patient race concordance associated with greater satisfaction with care?. Journal of health and social behavior, 296-306.

Lazare, A. (1995). The interview as a clinical negotiation. In The medical interview (pp. 50-62). Springer New York.

Link, B. G., & Phelan, J. (1995). Social conditions as fundamental causes of disease. Journal of health and social behavior, 80-94.

MACPAC, 2016:https://www.macpac.gov/wp-content/uploads/2016/11/Arizona-Medicaid-Expansion-Waiver.pdf. Accessed 04-27-17

MACPAC, 2017: https://www.macpac.gov/subtopic/cost-sharing-and-premiums/. Accessed 04-27-17.

Manning, W. G., Newhouse, J. P., Duan, N., Keeler, E. B., & Leibowitz, A. (1987). Health insurance and the demand for medical care: evidence from a randomized experiment. The American economic review, 251-277.

Miranda, P. Y., Tarraf, W., & González, H. M. (2011). Breast cancer screening and ethnicity in the United States: implications for health disparities research. Breast cancer research and treatment, 128(2), 535-542.

Miranda, P. Y., Tarraf, W., González, P., Johnson-Jennings, M., & González, H. M. (2012). Breast cancer screening trends in the United States and ethnicity. Cancer Epidemiology and Prevention Biomarkers, 21(2), 351-357.

Miller, J. W., King, J. B., Joseph, D. A., Richardson, L. C., & Centers for Disease Control and Prevention (CDC). (2012). Breast cancer screening among adult women—behavioral risk factor surveillance system, United States, 2010. MMWR Morb Mortal Wkly Rep, 61(Suppl), 46-50.

McMorrow, S., & Polsky, D. (2016). Insurance Coverage and Access to Care Under the Affordable Care Act.

Makoul, G. (2001). Essential elements of communication in medical encounters: the Kalamazoo consensus statement. Academic Medicine, 76(4), 390-393.

Mead, N., & Bower, P. (2000). Patient-centredness: a conceptual framework and review of the empirical literature. Social science & medicine, 51(7), 1087-1110.

Mechanic, D., & Schlesinger, M. (1996). The impact of managed care on patients' trust in medical care and their physicians. Jama, 275(21), 1693-1697.

Meer, J., & Rosen, H. S. (2004). Insurance and the utilization of medical services. Social Science & Medicine, 58(9), 1623-1632.

Meghani, S. H., Brooks, J. M., Gipson-Jones, T., Waite, R., Whitfield-Harris, L., & Deatrick, J. A. (2009). Patient–provider race-concordance: does it matter in improving minority patients' health outcomes?. Ethnicity & health, 14(1), 107-130.

Nelson, A. R., Stith, A. Y., & Smedley, B. D. (Eds.). (2002). *Unequal treatment: confronting racial and ethnic disparities in health care (full printed version)*. National Academies Press.

Pauly, M. V. (1968). The economics of moral hazard: comment. The American Economic Review, 531-537.

Paradise, J. (2015). Medicaid moving forward. Menlo Park, CA: Henry J. Kaiser Family Foundation. http://kff. org/health-reform/issue-brief/medicaid-moving-forward.

Parker, R. M., & Gazmararian, J. A. (2003). Health literacy: essential for health communication. Journal of health communication, 8(S1), 116-118.

Retchin, S. M., Garland, S. L., & Anum, E. A. (2009). The transfer of uninsured patients from academic to community primary care settings. The American journal of managed care, 15(4), 245-252.

Sabatino, S. A., Coates, R. J., Uhler, R. J., Breen, N., Tangka, F., & Shaw, K. M. (2008). Disparities in mammography use among US women aged 40–64 years, by race, ethnicity, income, and health insurance status, 1993 and 2005. Medical care, 46(7), 692-700

Sabik, L. M., & Dahman, B. A. (2012). Trends in care for uninsured adults and disparities in care by insurance status. Medical Care Research and Review, 69(2), 215-230.

Saloner, B., Sabik, L., & Sommers, B. D. (2014). Pinching the poor? Medicaid cost-sharing under the ACA. New England Journal of Medicine, 370(13), 1177-1180.

S. Rosenbaum, S. Schmucker, S. Rothenberg et al., How Will Section 1115 Medicaid Expansion Demonstrations Inform Federal Policy? (The Commonwealth Fund, May 2016).

Section 1115 waivers, are intended to allow for “experimental, pilot, or demonstration projects” that, in the view of the HHS Secretary, “promote the objectives” of the Medicaid program. 42 U.S.C. § 1315(a).).

Selvin, E., & Brett, K. M. (2003). Breast and cervical cancer screening: sociodemographic predictors among White, Black, and Hispanic women. American journal of public health, 93(4), 618-623.

Singh, G. K., & Siahpush, M. (2006). Widening socioeconomic inequalities in US life expectancy, 1980–2000. *International journal of epidemiology*, *35*(4), 969-979.

Shi, L. (2012). The impact of primary care: a focused review. Scientifica, 2012.

StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP

Stroebel, R. J., Gloor, B., Freytag, S., Riegert-Johnson, D., Smith, S. A., Huschka, T., ... & Kottke, T. E. (2005). Adapting the chronic care model to treat chronic illness at a free medical clinic. Journal of Health Care for the Poor and Underserved, 16(2), 286-296.

Ratanawongsa, N., Haywood, C., Bediako, S. M., Lattimer, L., Lanzkron, S., Hill, P. M., & Beach, M. C. (2009). Health care provider attitudes toward patients with acute vaso-occlusive crisis due to sickle cell disease: Development of a scale. Patient education and counseling, 76(2), 272-278.

Reineck, L. A., & Kahn, J. M. (2013). Quality measurement in the affordable care Act. A reaffirmed commitment to value in health care. American journal of respiratory and critical care medicine, 187(10), 1038-1039.

Saha, S., Komaromy, M., Koepsell, T. D., & Bindman, A. B. (1999). Patient-physician racial concordance and the perceived quality and use of health care. Archives of internal medicine, 159(9), 997-1004.

Sandhu, H., Adams, A., Singleton, L., Clark-Carter, D., & Kidd, J. (2009). The impact of gender dyads on doctor–patient communication: a systematic review. Patient education and counseling, 76(3), 348-355.

Schneider, E. C., Zaslavsky, A. M., Landon, B. E., Lied, T. R., Sheingold, S., & Cleary, P. D. (2001). National quality monitoring of Medicare health plans: the relationship between enrollees' reports and the quality of clinical care. Medical care, 1313-1325.

Schnittker, J., & Liang, K. (2006). The promise and limits of racial/ethnic concordance in physician-patient interaction. Journal of Health Politics, Policy and Law, 31(4), 811-838.

Schrop, S. M. L. (2011). The relationship between patient socioeconomic status and patient satisfaction: Does patient-physician communication matter? (Doctoral dissertation, Kent State University).

Sequist, T. D., Schneider, E. C., Anastario, M., Odigie, E. G., Marshall, R., Rogers, W. H., & Safran, D. G. (2008). Quality monitoring of physicians: linking patients' experiences of care to clinical quality and outcomes. Journal of general internal medicine, 23(11), 1784-1790.

Shim, J. K. (2010). Cultural health capital a theoretical approach to understanding health care interactions and the dynamics of unequal treatment. Journal of Health and Social Behavior, 51(1), 1-15.

Smith, D. L. (2012). Health care disparities for persons with limited English proficiency: relationships from the 2006 Medical Expenditure Panel Survey (MEPS). Journal of Health Disparities Research and Practice, 3(3), 4.

Starr, P. (1982). The social transformation of American medicine. Basic Books.

Street Jr, R. L., Gordon, H. S., Ward, M. M., Krupat, E., & Kravitz, R. L. (2005). Patient participation in medical consultations: why some patients are more involved than others. Medical care, 43(10), 960-969.

Street, R. L., O'Malley, K. J., Cooper, L. A., & Haidet, P. (2008). Understanding concordance in patient-physician relationships: personal and ethnic dimensions of shared identity. The Annals of Family Medicine, 6(3), 198-205.

Sudano, J. J., & Baker, D. W. (2006). Explaining US racial/ethnic disparities in health declines and mortality in late middle age: the roles of socioeconomic status, health behaviors, and health insurance. Social science & medicine, 62(4), 909-922.

Traylor, A. H., Schmittdiel, J. A., Uratsu, C. S., Mangione, C. M., & Subramanian, U. (2010). Adherence to cardiovascular disease medications: does patient-provider race/ethnicity and language concordance matter?. Journal of general internal medicine, 25(11), 1172-1177.

US Department of Health and Human Services. (2015). Agency for Healthcare Research and Quality. 2014 national healthcare quality & disparities report.

U.S General Accounting Office, “Medicaid and SCHIP: States Premium and Cost-Sharing Requirements for Beneficiaries,” March 2004. http://www.gao.gov/new.items/d04491.pdf/ Accessed: 04-27-17

Ubri, P., & Artiga, S. (2016). Disparities in health and health care: Five key questions and answers. *Kaiser Family Foundation. Retrieved December*, *15*, 2016.

Van Ryn, M., & Burke, J. (2000). The effect of patient race and socio-economic status on physicians' perceptions of patients. Social science & medicine, 50(6), 813-828.

Van Wieringen, J. C., Harmsen, J. A., & Bruijnzeels, M. A. (2002). Intercultural communication in general practice. European Journal of Public Health, 12(1), 63-68.

Verlinde, E., De Laender, N., De Maesschalck, S., Deveugele, M., & Willems, S. (2012). The social gradient in doctor-patient communication. Int J Equity Health, 11(1).

Villani, J. (2012). Perception of Patient-provider Communication and Its Association with Health Services Utilization

Wallace, L. S., DeVoe, J. E., Bennett, I. M., Roskos, S. E., & Fryer, G. E. (2008). Perceptions of healthcare providers’ communication skills: Do they differ between urban and non-urban residents?. Health & place, 14(4), 653-660.

Wiggers, J. H., & Sanson-Fisher, R. (1997). Duration of general practice consultations: association with patient occupational and educational status. Social science & medicine, 44(7), 925-934.

Zandbelt, L. C., Smets, E. M., Oort, F. J., Godfried, M. H., & de Haes, H. C. (2006). Determinants of physicians’ patient-centred behaviour in the medical specialist encounter. Social science & medicine, 63(4), 899-910.

Vita

Anushree Vichare was born on January 18, 1981 in Mumbai, India. In 2004, she graduated from MGM Medical College, Maharashtra University of Health Sciences in Mumbai, India with a Bachelor in Medicine and Bachelor in Surgery (MBBS) degree. She has practiced as a primary care physician and worked at the National Institute for Research in Reproductive Health in Mumbai, India. She received a Master in Public Health degree in 2007 from Virginia Commonwealth University in Richmond, Virginia. Prior to joining the doctoral program, Anushree has gained significant work experience. She has worked as an epidemiologist to lead research efforts at the Virginia Department of Health in Richmond, Virginia. She has also worked at two professional associations and steered the development of clinical practice guidelines and quality improvement tools. In the Fall of 2013, she enrolled in the Department of Health Behavior and Policy's doctoral program at Virginia Commonwealth University. She completed the requirements for the Ph.D. degree in healthcare policy and research in August 2017. Anushree will be joining as an Assistant Professor in the Department of Health Policy and Management at the Milken School of Public Health, George Washington University in Washington DC.