THE EARLY IMPACT OF MEDICAID EXPANSION ON HEALTH CARE ACCESS AND UTILIZATION AMONG INDIVIDUALS WITH AMBULATORY CARE SENSITIVE CONDITIONS

By

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To my parents, who inspired my interest in issues pertaining to healthcare access through their personal struggles as patients in the healthcare system. Thank you for your countless sacrifices; none of this would be possible without your invaluable support. This dissertation is dedicated not only to them, but to individuals and families who are faced with difficulties in accessing healthcare. Lastly, this dissertation is dedicated to my Aunt Lorna who faced tremendous difficulties in accessing needed healthcare. Your untimely death continues to be my motivation in combating healthcare access issues.

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LIST OF ABBREVIATIONS

ACA	Affordable Care Act
ACSC	Ambulatory Care Sensitive Conditions
AECB	Acute Exacerbation of Chronic Bronchitis
AHCA	American Health Care Act
AHRQ	Agency for Healthcare Research and Quality
BCRA	Better Care Reconciliation Act
BRFSS	Behavioral Risk Factor Surveillance System
CBO	Congressional Budget Office
CDC	Centers for Disease Control and Prevention
CHF	Congestive Heart Failure
CMS	Centers for Medicare and Medicaid Services
COPD	Chronic Obstructive Pulmonary Disease
CPI	Consumer Price Index
DC	District of Columbia
DID	Difference-in-Differences
ED	Emergency Department
EHBs	Essential Health Benefits
ER	Emergency Room
EMTALA	Emergency Medical Treatment and Labor Act
FIPS	Federal Information Processing Standards
FPL	Federal Poverty Level
GLM	Generalized Linear Model
HCUP	Healthcare Cost and Utilization Project
HMO	Health Maintenance Organization

IMG	International Medical Graduate
IOM	Institute of Medicine
IRB	Institutional Review Board
KFF	Kaiser Family Foundation
LOS	Length of Stay
MEPS	Medical Expenditure Panel Survey
MSE	Medical Screening Examination
NHIS	National Health Interview Survey
OR	Odds Ratio
PCP	Primary Care Provider
PQI	Prevention Quality Indicator
SID	State Inpatient Database
UF	University of Florida
US	United States
UTI	Urinary Tract Infection
WHO	World Health Organization

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Since 1965, Medicaid has been a safety net for low-income adults and families, pregnant women, and individuals with disabilities in the United States. However, until 2014, a coverage gap existed for some 2.6 million low-income adults whose income was above Medicaid's eligibility criteria but below eligibility for Marketplace premium tax credits. Consequently, Medicaid's coverage gap generated concern regarding the healthcare and outcomes for poor adults within the coverage gap.

In January 2014 under the Affordable Care Act (ACA), states were given the option to expand Medicaid to non-elderly individuals with incomes at or below 138% of the federal poverty level in an effort to improve access to care for low-income adults. As a result, approximately 15.1 million people were enrolled under this Medicaid expansion. Ostensibly, the expansion would provide new enrollees with improved access to primary medical care, and therefore reduce the frequency of emergency department (ED) use for medical circumstances that might better be managed in an ambulatory care setting. Throughout the literature, ambulatory care sensitive conditions (ACSC) have been used as a proxy measure for access to ambulatory care. However,

few studies have examined the effects of the state Medicaid expansion on access to care and utilization outcomes among individuals with ACSC.

Using a difference-in-differences approach, this study examines the impact of Medicaid expansion on access to care and utilization among low-income individuals with ACSC. In states with Medicaid expansion, Aim 1 determined whether individuals with ACSC had an increased likelihood of insurance coverage, provider access, and routine check-ups, while Aim 2 determined whether changes occurred in ED visits, hospitalizations and length of stay.

Results of Aim 1 indicate a 4.19 percentage points increase in the rate of insurance among individuals with ACSC living in expansion states. The documented increase in coverage, however, does not appear to have resulted in changes to the use of the ED. However, when examining ACSC-associated utilization measures among low-income adults, results showed a 23.08 percentage points significant reduction in CHF-associated ED hospitalizations in expansion states. On the contrary, expansion states saw a 15.80 percentage points significant increase in COPD-associated ED hospitalizations.

CHAPTER 1
INTRODUCTION

Background

Access to quality healthcare is often at the forefront of many programs, policies and initiatives within the health care sector. However, access to healthcare is a complex concept with several definitions and ways of measurements. In fact, According to the Agency for Healthcare Research and Quality (AHRQ), healthcare access measures may be focused on health insurance coverage, usual source of care, unmet need, or mental health/substance abuse.[1]

Since 1965, Medicaid has served as a safety net for low-income adults and families, as well as for pregnant women, and individuals with disabilities in the United States (US). However, despite its reputation as a long-standing safety net program, a coverage gap existed for some 2.6 million low-income adults whose income was above Medicaid's eligibility criteria but below the eligibility for Marketplace premium tax credits as established by the Affordable Care Act (ACA).[2] Over the first decade of the 20th century, Medicaid's coverage gap generated concerns regarding the healthcare and outcomes of poor adults within the coverage gap.[2] As such, in January 2014 under the ACA, states were given the option to expand Medicaid to non-elderly individuals with incomes at or below 138% of the federal poverty level or $16,394 for an individual in 2016.[3] As of July 2016, 32 states, including the District of Columbia (DC), have chosen to adopt Medicaid expansion,[4] enrolling approximately 15.1 million people under Medicaid expansion. Of these, 11.9 million were newly eligible.[5]

Throughout the literature, health insurance has been shown to increase access, utilization, and to improve health outcomes. As far back as 1974, Aday and Andersen

developed a conceptual model to explain how health care is accessed and utilized. Within the model, insurance coverage is seen as an enabling component and mutable factor in the access and utilization of health care.[6] Since then, studies have shown that access to health insurance leads to an increase in health care utilization and improved health outcomes. In fact, a systematic review of studies estimating the causal effects of insurance coverage on utilization and/or health outcomes of the nonelderly found that access to health insurance increased the likelihood of having a regular source of care, using preventive and diagnostic services, and having more ambulatory visits. Furthermore, the study found that the insured were less likely to delay care, less likely to require avoidable hospitalizations, had lower mortality rates, and reported better health status.[7]

Improving access to care, by way of health reform, has been a long-standing objective and topic of debate throughout US history, especially during times of economic downturn. During 1933 and 1934, the worst years of The Great Depression, unemployment was at its peak of 25%. With a shrinking middle class, a widening gap in healthcare access disparities, and rising uncompensated hospital care, welfare agencies began assisting in the payment of medical costs for the poor. At that time, the idea of including some form of health insurance was put forward, but was left out of the final Social Security bill.[8] In 1937, the Technical Committee on Medical Care assembled, with the hopes of advancing comprehensive health reform.[8] During this period, health reforms included a state-run system with states being given the option to participate. Through the Social Security Act, the federal government provided matching

funds to states with public health expansion, and maternal and child health services. In some ways, this served as a precursor to the modern Medicaid program.[8]

Despite Medicaid's status as a long-standing program within the US health care system, the 2014 Medicaid expansion has been a topic of great polarity among political parties, and decision-makers. As a consequence, states were given the option to expand Medicaid by way of a Supreme Court ruling. Although public health insurance expansion continues to be a topic of controversy, decision-makers are often tasked with enacting mechanisms by which healthcare access may be improved. For example, in 1986, the Emergency Medical Treatment and Labor Act (EMTALA) was enacted as a means of ensuring public access to emergency services regardless of one's ability to pay. The law required hospitals participating in Medicare to offer emergency services such as a medical screening examination (MSE) upon request or treatment for an emergency medical condition.[9] In more recent times, health reform efforts have been focused on repealing and replacing the ACA.

Attempts to Repeal and Replace the ACA

Recent health reform efforts are presented in the subsequent paragraphs to provide a context for the changing scheme of healthcare that surrounds the focus of this dissertation, particularly as it relates to Medicaid. The House of Representatives' American Health Care Act of 2017 H.R.1628 (AHCA) and the Senate's Better Care Reconciliation Act of 2017 H.R. 1628 (BCRA) are major acts that have been proposed in an effort to repeal and replace the ACA. AHCA was introduced in the House of Representatives on March 7, 2017 without review by the Congressional Budget Office (CBO) and was approved in both committees on March 8, 2017.[10] AHCA proposed the reversal of Medicaid expansion by way of ceasing federal funding for new Medicaid

enrollees who would not be eligible under pre-ACA eligibility criteria. Additionally, the AHCA proposed a change in the way Medicaid is funded by moving away from the traditional Federal Medical Assistance Percentages (FMAP) to a per-capita cap method of funding. Under the proposed funding mechanism, the federal government would no longer match Medicaid state funding; alternatively, federal spending would be capped at a certain amount per state Medicaid enrollee which would not consider the state's real costs.[11]

Several amendments were made to the bill in an attempt to garner support. Such amendments included the March 20th Manager's Amendment that included the state option for states to choose block grants rather than a per-capita cap, as well as the work requirement for Medicaid benefits; the April 24th MacArthur Amendment that would allow states to apply for a waiver of the ACA's essential health benefits (EHBs) requirements; and the May 3rd Upton Amendment that included the creation of an $8 billion fund to lower out-of-pocket costs for consumers with pre-existing conditions living in states that allow insurers to charge higher premiums for individuals with pre-existing conditions.[10] On May 4, 2017, AHCA passed Congress in a 217 to 213 vote. Within hours, and in an effort to garner the necessary 50 votes, the Senate announced a plan to write its own bill for ACA repeal and place. On June 22, 2017, the Senate's BCRA was released to the public, and on June 26th, the CBO estimated that, compared to the ACA, 15 million additional people would be left uninsured by 2018, a number which would increase to 22 million by 2026.[10]

Under BCRA, the current ACA-enhanced Medicaid expansion funding of 90% would continue until 2021 and gradually decrease over 3 years. In 2021, states would

receive 85% in federal matching for Medicaid costs, followed by 80% in 2022, and 75% in 2023. Finally, in 2024, the federal matching rate would fall anywhere from 50% to 75% depending on the state. In terms of funding, BCRA also proposed a change in Medicaid's funding mechanism by no longer matching state Medicaid spending. Instead a per-capita cap would be utilized beginning in 2021, with states given the option of choosing block grants.

In the beginning, the federal government's inputs would increase based on the medical care component of the consumer price index (CPI), as well as the share of Medicaid enrollees in the various beneficiary categories. However, in 2025, increases would simply be based on the standard inflation rate.[12] Amendments were made to the BCRA through the July 13th Amendment and the Cruz Amendment, which would allow states to use block grant funding for the Medicaid expansion population. Furthermore, the amendment offered the ability for states to exceed the block grant caps during public health emergencies. However, this option would last from 2020 through 2024.[12] The Cruz Amendment would also add $45 billion to address the opioid epidemic. However, overall, the BCRA proposed to eliminate the requirement of EHB coverage for the Medicaid expansion population beginning in 2020. Similar to AHCA, the BCRA also proposed a work requirement for Medicaid coverage.[12]

Finally under retroactive eligibility, individuals who apply for Medicaid are able to receive benefits for up to three months before, if they were eligible during their application period.[12] The BCRA proposed a reduction in the retroactive eligibility from 3 months to one month, as well as elimination of the extension of presumptive eligibility to the Medicaid expansion population. On July 25th, the BCRA failed to pass as 60 votes

were needed but the proposal received a Senate vote of 57-43 against a procedural motion.[12]

After the BCRA's failure, Republican Senators Lindsey Graham and Bill Cassidy proposed the Graham-Cassidy plan in a final attempt to repeal and replace the ACA. Similar to the BCRA, the Graham-Cassidy plan also included block grant funding. Under the Graham-Cassidy plan, states may use no more than 20% of the block grant funding to expand their Medicaid program.[13] By 2026, under the Health Care Grant Program, federal funding for low-income individuals would be equal across states, instead of the customary adjustments for each state's base amount of spending which would reflect the number of individuals with low income in the state versus the number of low-income individuals nationwide, clinical risk factors, and the actuarial value of coverage.[13] In addition to block grant funding, the Graham-Cassidy plan also proposed per-capita caps in Medicaid, which would be based on previous spending patterns for the non-expansion Medicaid population in each state. Additionally, separate caps would be established for the elderly, blind and disabled, children, and non-expansion adults.[13]

Unlike the BCRA, which proposed the adjustment of per-capita caps based solely on general inflation in 2025, the Graham-Cassidy plan also proposed the use of medical inflation to be used for the aged, blind and disabled in 2025. Furthermore, the plan proposed the provision of an additional $8 billion bonus pool to reward states that are able to spend below the per-capita limits while keeping satisfactory quality measures.[13] However, the Graham-Cassidy bill did not make it to the Senate floor for a vote.

Common to the BCRA, AHCA, and the Graham-Cassidy plan is the proposition to change Medicaid's current financing structure to block grants or per-capita caps.

However, there are concerns regarding the ability of block grants and per-capita caps to keep up with costs. In a previously published work by a colleague, A. Hall, and myself (2012), block grants were discussed with predicted adverse outcomes of reduced funding for states, and an increased number of uninsured.[14] These predictions were in line with current estimates by the CBO, which predicted an increase in the number of uninsured based on all the aforementioned proposed plans.

Significance

Despite the impending changes to Medicaid, the question of whether or not the expansion of health insurance results in the right care at the right time and at the right place remains, particularly for vulnerable populations such as low-income adults with ambulatory care sensitive conditions (ACSC) who, with proper access to ambulatory care, would presumably forgo unnecessary ER visits and preventable ER hospitalizations. As such, the 2014 enactment of Medicaid expansion offers an opportunity to determine the effects of a change in health insurance policy on healthcare access and other healthcare outcomes of interest. The analysis described here is intended to examine one element of that question – the impact of Medicaid expansion on the use of hospital services to meet the needs for health conditions that are best managed in an ambulatory care setting.

CHAPTER 2
LITERATURE REVIEW

Healthcare Access and Utilization Measures

Healthcare access may be defined and measured in various ways according to the measures used. Conceptually, access refers to an individual's ability to obtain medical care under the circumstances in which he or she believes medical care is needed; that is, one's potential to obtain medical care. On the other hand, access is sometimes conceived as the realization of potential access through the actual use of medical care as depicted within the Andersen and Aday behavioral model of health care utilization (1974). In that framework, access is viewed as being multidimensional; that is, potential and realized.

Within this model, potential access is defined as the presence of enabling resources, such as health insurance, which may increase the likelihood of healthcare utilization. Realized access is the act of using health services or simply, healthcare utilization.[15] Health insurance coverage is associated with both access and utilization. It may include measures such as the proportion of persons with health insurance, with any private health insurance coverage, with only public health insurance coverage, or uninsured all year. Other elements of access include having a usual source of care as indicated by the proportion of persons who have one or more specific sources of ongoing care, with a usual primary care provider, or with very little or no choice in source of care. Measures of healthcare access may also include difficulties or delays in obtaining health care, and the primary reason for difficulty or delay in obtaining health care; whereas mental health/substance abuse measures may include the proportion of

adults with the various types of mental illness/substance abuse who received treatment.[1]

Like healthcare access, healthcare utilization may be operationalized in various ways depending on the measure used. AHRQ classifies healthcare utilization under eleven categories: doctors' offices/hospital outpatient departments, specialty care, mental health/substance abuse, HIV care, hospital emergency departments, hospitalizations, dental services, home health services, hospice services, nursing home services, and prescription medications.[16]

Given the multidimensional nature of healthcare access, potential access, such as the availability of health insurance, plays an integral role in achieving realized access or health care utilization.[6,7] As such, interventions targeting improvements in healthcare access often include the expansion of health insurance coverage to uninsured populations.

Effect of Health Insurance on Access and Utilization of Care

Prior to the implementation of the ACA, 48 million nonelderly Americans were without health insurance.[17,18] In an effort to reduce the number of individuals without health insurance, the ACA aimed to increase access to health insurance by expanding Medicaid, providing subsidies toward the purchase of private coverage for individuals with incomes up to 400% of the federal poverty level (FPL), as well as reforming the health insurance marketplace. Since then, the number of individuals without health insurance has decreased to 29 million or 9.1% of the U.S. population.[18] It is well documented that health insurance is an important factor in accessing health care. Data from the National Health Interview Survey (NHIS) showed that more than half of nonelderly adults without health insurance did not have a usual source of care,

compared to 10% for insured individuals. Other barriers to health care among nonelderly adults without insurance included delaying care due to cost, going without needed care due to cost, and not being able to afford a prescription drug.[18]

A longitudinal study examining the consequences of losing and gaining health insurance coverage on access to care showed that for Medicaid beneficiaries who became uninsured, the proportion of individuals without a usual source of care increased from 12 % to 35% when individuals lost their Medicaid coverage. Alternatively, when individuals gained health insurance, the proportion of individuals without a usual source of care was reduced from 33% to 20%.[19] This finding indicates the important role that health insurance plays in access to medical care, specifically as it relates to having a usual source of care. Furthermore, having a usual source of care plays an integral role in the convoluted process of getting the right care at the right time and at the right place. It has been confirmed that by having a usual source of care, patients will be better able to get preventive care, and are less likely to delay or forgo needed care. A study by Ayanian et al. (2000) found that uninsured adults were less likely to receive preventive services such as breast cancer screening (64% versus 89%) when compared to individuals with health insurance. Results of the study showed that even in terms of basic preventive services such as hypertension screening, the uninsured were less likely to have had their blood pressure screened (80% versus 94%) and were more likely to go without a routine checkup within the past 2 years (40% versus 18%).[20] Throughout the literature, studies have shown that a lack of health insurance not only decreases the likelihood of having a usual source of care, but also

increases the likelihood of delaying needed and preventive care with some reports of cost-barriers.[20-24]

The right care at the right time and right place scenario becomes especially critical for patients with chronic conditions. Chronic conditions, such as heart disease, and Type 2 diabetes, are some of the most common, most costly, and often preventable conditions among health issues.[25] As a result, ensuring the right care at the right time and place involves proper management in which patients have a usual source of care by which they may undergo routine checkups to delay or prevent the progression of disease, therefore, decreasing the likelihood of preventable hospitalizations. For uninsured patients with chronic conditions, the goal of preventing avoidable hospitalizations proves to be difficult, as more than half of uninsured adults with chronic conditions delay or postpone care when compared to 27% of insured adults with chronic conditions.[20,26] Furthermore, for uninsured patients who are hospitalized, studies have shown that a lack of insurance increases mortality risk, as well as increases average length of stay (LOS).[27,28] Some studies have cited a lack of insurance as a reason for increases in length of stay, while other studies have found that a lack of insurance reduces length of stay.[29,30] In fact, a recent study found that the expansion of Medicaid eligibility was associated with shorter hospital length of stay after injury and even lower length of stay for patients who remained uninsured.[31]

Ambulatory Care Sensitive Conditions

Hospitalizations for ambulatory care sensitive conditions (ACSC) are commonly referred to as preventable hospitalizations. The frequency of such events can be used as a proxy for access to ambulatory care, since as many as 75% occur through the ED.[32-34] Billings alongside an advisory panel of primary care access experts developed

the ACSC category and in 1993, the Institute of Medicine (IOM) recommended that ACSC hospitalization be used as an outcome indicator of primary care access.[35,36] ACSC includes both acute, and chronic conditions that may be prevented, delayed, controlled or managed with access to appropriate primary care. As such, ACSC are defined as prevention quality indicators (PQIs) by the Agency for Healthcare Research and Quality (AHRQ), and are a set of measures often used to identify ambulatory care sensitive conditions. Acute ACSC include bacterial pneumonia, dehydration, and urinary tract infections (UTI). Chronic ACSC include angina without procedure, perforated appendix, congestive heart failure (CHF), hypertension, adult asthma, chronic obstructive pulmonary disease (COPD), diabetes short-term and long-term diabetes complications, as well as uncontrolled diabetes.[37] Angina pectoris was excluded due to recent evidence regarding concerns of its validity as a PQI.[38]

Many ACSC ED visits result in hospitalizations that might be avoided given better access to ambulatory care. In fact, a study found that 34% of ACSC ED visits resulted in hospitalizations when compared to non-ACSC ED visits (14%).[39] Furthermore, the association between ACSC hospitalization and access to ambulatory care is supported by studies showing that communities with higher access to care have fewer ACSC hospitalizations.[40,41] Using data from the Healthcare Cost and Utilization Project, a study examining predictors of ACSC admissions in small geographic areas found that ACSC admissions were inversely associated with access to local primary care physicians.[42] Similar results were found in a study of emergency department (ED) visits for ACSC among the South Carolina population aged 18 years old and over. Results of the study

found that counties with high ED visits were associated with less access to primary health care, as well as no access to community health centers.[43]

Effect of Health Insurance on Access and Utilization of Care among Individuals with Ambulatory Care Sensitive Conditions

Similar to results in the general population, studies have shown negative outcomes from the absence of health insurance among individuals with ambulatory care sensitive conditions (ACSC). Throughout the literature, the absence of health insurance has been cited as a principal contributing factor in the use of emergency departments as alternative sources of care.[44-46] Results of a study examining the impact of health insurance on non-urgent and ACSC emergency department use found that lack of health insurance was associated with a higher probability of non-urgent or ACSC emergency department use when compared to individuals with private insurance.

The article further states that results of their model predict that, should the uninsured become insured under the ACA through Medicaid expansion or insurance exchanges, the result would be a change in ED use for non-urgent conditions or ACSC.[47] Another study examining patients with ACSC found adverse utilization outcomes in terms of hospital length of stay. Results of the study by Mainous et al. found that lack of insurance was associated with reduced length of stay for both ACSC and non-ACSC patients when compared to insured patients. The suggestion was therefore that lack of insurance may be a stronger determinant of hospital length of stay than the type of condition with which the patient presents.[48]

Public Insurance Expansion and Ambulatory Care Sensitive Conditions

In 2008, the state of Oregon launched a Medicaid lottery. Since then, studies have investigated the effect of expanding public health insurance on health care use,

health outcomes, financial strain, as well as the well-being of low-income adults. Through this lottery, investigators found that Medicaid coverage resulted in more outpatient visits, hospitalizations, prescription medications and emergency department visits for conditions that were non-emergent and treatable by primary care, as well as conditions that were emergent and preventable through timely ambulatory care. However, the study found that Medicaid improved self-reported health, increased the diagnosis and treatment of diabetes and decreased the rates of depression.[49-51] Another study examining the impact of the Oregon Medicaid lottery on cancer screening rates found that Medicaid coverage led to better health care access and higher recommended cancer screenings, especially among women.[52]

A study using a difference-in differences model assessed the change in access to care, utilization and self-reported health among low-income non-elderly adults living in an expansion state (Kentucky), a private option state (Arkansas) and a non-expansion state (Texas). The researchers found that expansion was associated with increased access to primary care, fewer skipped medications due to cost, reduced emergency department visits, and increased outpatient visits.[53] Similar to the Oregon study, this study also found that diabetes screening increased. Furthermore, glucose testing among patients with diabetes and regular care for chronic conditions also increased after expansion; therefore, showing the potential impact that expansion may have on the management of chronic conditions among low-income adults.[53]

There are important implications to be learned from this study as the study shows that with expansion, newly insured individuals with chronic conditions may be better able to access and utilize the health services that they need in order to manage their

condition and ultimately, avoid preventable hospitalizations. In 2006, there were 4.4 million preventable hospitalizations costing $30.8 billion in hospital costs, costs which could have otherwise been avoided with timely and effective ambulatory care or proper self-management.[54] A study examining Wisconsin's BadgerCare Plus Core Plan, a plan that expanded health insurance to childless adults with incomes up to 200% of the federal poverty line (FPL), showed that following enrollment into the program, there was a 47.5% decline in ten of the eleven measures of preventable hospitalizations.[55] Contrary to results from Wisconsin's BadgerCare Plus Core Plan, a study using the State Inpatient Databases (SID) from the Healthcare Cost and Utilization Project (HCUP) examined trends in hospital inpatient admissions following California's early Medicaid expansion and found no change in preventable admissions, but instead found an increase in the overall number of inpatient admissions.[56]

The implementation of the Affordable Care Act's state Medicaid expansion in 2014 presents a unique opportunity for more generalizable studies examining the impact of Medicaid expansion on health care access and utilization. However, to date, very few studies have examined the impact of state Medicaid expansion. A recent study using data from the 2010 to 2014 National Health Interview Survey (NHIS) assessed the early effects of the Affordable Care Act Medicaid Expansion on coverage, access, utilization, and health effects and found an increase in Medicaid coverage, as well as a decrease in lack of coverage. Furthermore, the study found improvements in respondents' satisfaction with their health insurance coverage, an increase in general physician utilization and overnight hospital stays. In terms of health effects, the study found an increase in the diagnosis of high cholesterol and diabetes.[57] The increase in

diabetes and high cholesterol diagnoses in this study provides some insight regarding the potential impact of Medicaid expansion on ambulatory care sensitive conditions (ACSC) as individuals who gained health care coverage were better able to access care and receive a diagnosis. Consequently, these individuals should be better equipped to delay the progress of disease through the identification of and management of their respective conditions.

Despite the potential benefits noted in studies such as those previously discussed, some policy makers have voiced concern regarding the expected increase in demand for healthcare with Medicaid expansion and the supply of primary care physicians. A study examining emergency department (ED) visits for ACSC based on primary care provider (PCP) density and payer status found that among the insured, ED visits for ACSC had a negative correlation with PCP density; that is, the higher the PCP density the lower the number of ED visits for ACSC.[58] Furthermore, another study projecting primary care use in the Medicaid expansion population estimated that 2113 additional primary care providers would be needed if all states were to expand Medicaid.[59] However, results of a study examining Medicaid expansion in Michigan showed that during the first year following Medicaid expansion, appointment availability for new enrollees increased and wait times stayed within 2 weeks.[60] Furthermore, results of a study published in March 2017 showed a 5.4 percentage points increase in primary care appointment availability for patients with Medicaid.[61]

Medicaid Expansion and Ambulatory Care Sensitive Conditions

Despite the controversy that often surrounds Medicaid, studies have shown that having Medicaid coverage yields more benefits in terms of having a usual source of care, more health care visits overall, results in timely care, and is less likely to result in

delay or loss of needed care when compared to the uninsured.[62-64] As such, Medicaid expansion may prove to be beneficial in terms of improving access to care, as well as in reducing preventable ED visits and hospitalizations. However, while ambulatory care sensitive conditions (ACSC) is a commonly used proxy measure for adequate access to primary care, few studies have used ACSC in their evaluation of the ACA Medicaid expansion in terms of improving access outcomes among individuals with ACSC and ultimately, reducing the likelihood of potentially avoidable ED visits and hospitalizations.

A study by Torres et al. assessing the impact of the 2014 Medicaid expansion on access to care measures for individuals with chronic disease found that insurance coverage, not having to forgo a physician visit, and having a check-up all increased under Medicaid expansion.[65] Given the nature of chronic conditions, some of the conditions examined within the aforementioned study are classified as ACSC. They include asthma and COPD. Despite the study's inclusion of diabetes, diabetes short-term and long-term complications are more appropriate ACSC or PQI measures.

While results of this study offer significant insight pertaining to the impact of Medicaid expansion, the study's population was not limited to low-income adults, a population for which Medicaid expansion was intended. Additionally, the authors were only able to examine data up to 2014, the year in which Medicaid expansion was implemented. The aforementioned limitations of the study by Torres et al. brings into question the true impact of Medicaid expansion on the population for which it is intended, that is, for low-income adults. In terms of utilization, an analysis examining the changes in discharges by payer for expansion states and non-expansion states showed that, overall, regardless of medical condition (all medical conditions, asthma, congestive

heart failure, diabetes and surgical), Medicaid expansion states saw a decrease in inpatient hospital stays for all payers, as well as for the uninsured. However, an increase in inpatient hospital stays were seen for Medicaid.[66] While results of this study offers insight pertaining to the impact of Medicaid expansion on ACSC, this study did not examine hospitalizations through the ED. More than 75% of preventable hospitalizations occur through the ED; therefore, ACSC hospitalizations through the ED may offer a better understanding of the impact of Medicaid expansion on access outcomes and potentially avoidable utilization measures.

Another study examining the impact of Medicaid expansion on ED utilization for ACSC by high ED utilizers in an urban safety-net hospital found that high utilizers were more likely to have ACSC ED visits both before and after Medicaid expansion. Furthermore, the study found that, overall, ACSC ED visits decreased slightly following Medicaid expansion.[35] However, results of the aforementioned study are limited in its generalizability as the findings were regional and may not be applicable to states outside of Maryland.

Lastly, a more recent study by Garthwaite et al. examined the impact of Medicaid expansion on the types of ED visits, as well as location, and insurance status. The study found that Medicaid expansion states had fewer ED visits when compared to non-expansion states. Furthermore, Medicaid expansion states saw a 47.1% decrease in uninsured visits, a 125.7% increase In Medicaid visits following Medicaid expansion, and a decrease in travel time for nondiscretionary conditions, [67] indicating that hospitals began attracting Medicaid patients following the implementation of Medicaid expansion. Furthermore, Medicaid expansion states saw a decrease in uninsured ED visits for

emergent and primary care preventable conditions but saw a substantial increase in Medicaid ED visits for emergent and primary care preventable conditions.[67] Authors of this study only examined data up to 2014; therefore, it is uncertain whether or not this increase in Medicaid ED visits for emergent and primary care preventable conditions was short-term. Results of this study are not generalizable as the authors only examined investor-owned hospitals, which are inherently different from other hospital types across the nation.

Studies examining the impact of Medicaid expansion on access and utilizations measures for individuals with ACSC are limited and results are inconclusive. Given the previously discussed limitations of formerly published research, this study will add to the literature by using nationally-representative data to examine the impact of state Medicaid expansion on access to care and utilization for individuals with ACSC, thereby contributing more generalizable findings. Furthermore, results of this study will build on previous literature by examining ACSC hospitalizations through the ED rather than simply examining all hospitalizations. Since 75% of ACSC hospitalizations occur through the ED, by doing so, results of this study will provide a better understanding of the impact of Medicaid expansion on utilization outcomes for conditions that, with proper access to ambulatory care, would be preventable or avoidable.

Theoretical Foundation and Conceptual Framework

The Andersen behavioral model of health services utilization (behavioral model) will serve as the foundation of this study. Developed in the 1960s, the behavioral model has served as a cornerstone model in the field of health services research. The initial model illustrated the way in which predisposing characteristics, enabling resources and need influence the use of health services.[15] As illustrated in Figure 2-1, the behavioral

model of health services utilization was later modified to include components such as the environment, and health behavior. Within the environment component, there are elements such as the health care system and the external environment that may influence population characteristics such as predisposing characteristics, enabling resources, and need. The pathway continues with health behavior, inclusive of personal health practices, and health care utilization, which may ultimately feed into the outcomes of perceived health status, evaluated health status, and consumer satisfaction.[15] Within this model, feedback loops are present to show that the outcomes may affect one's health behavior and population characteristics. Furthermore, feedback loops display the ability of one's health behavior to influence population characteristics. Finally, the model (Figure 2-1) shows that outcomes may be influenced through direct pathways from the environment and population characteristics.[15]

The behavioral model captures the convoluted process by which access and utilization are achieved. The behavioral model represents the mechanism by which Medicaid expansion can impact insurance coverage, access to a health care provider, and routine check-ups following implementation of Medicaid expansion. Based on the literature, changes in health insurance policy may lead to improvements in access outcomes such as the ones specified in Aim 1 (below) which are expected when controlling for predisposing characteristics such as age, race/ethnicity, marital status, sex, education, employment and income.[53,57] With access outcomes of Aim 1 serving as a mediator and should improvements in the access measures be observed, a decrease in ACSC ED visits, ACSC hospitalizations through the ED, and ACSC LOS are

expected, while controlling for race/ethnicity, age, sex, education, employment, insurance status and marital status (Figure 2-2).[34,47,53,57]

Specific Aims

To date, few studies have examined the effects of the state Medicaid expansion on access to care and utilization outcomes among individuals with ambulatory care sensitive conditions (ACSC). The recent implementation of state Medicaid expansions under the Affordable Care Act presents a unique opportunity not only to evaluate Medicaid expansion in terms of its intended goal of increasing access to care, but also to examine its effect on ACSC utilization, a well-established proxy measure for access to outpatient care and otherwise preventable hospitalizations. As such, the aims of the study were:

Aim 1: To determine, among individuals with one or more ambulatory care sensitive conditions (ACSC), whether state Medicaid expansions are associated with an increased likelihood of:

1. Insurance coverage
2. Healthcare provider access
3. Routine check-ups

Aim 2: To determine whether state Medicaid expansions were associated with changes in:

1. ED visits for ACSC
2. ACSC hospitalizations through the ED
3. ACSC-associated length of stay (LOS)

Hypotheses

Based on the conceptual framework presented in this study (Figure 2-2), it was hypothesized that, following implementation of Medicaid expansion, there would be an increased likelihood of insurance coverage; access to a health care provider; as well as

an increased likelihood of timely routine check-ups among individuals with ACSC living in expansion states. Furthermore, with improvements in the aforementioned access outcomes and with access outcomes serving as a mediator for Aim 2 outcome measures, it was hypothesized that there would be a decrease in ED visits for ACSC, a decrease in ACSC hospitalizations through the ED, as well as a decrease in ACSC-associated LOS. As such, the following was hypothesized:

Aim 1: Medicaid eligible individuals up to 138% of the Federal Poverty Level (FPL) with one or more ACSC living in expansion states will be more likely to be insured, have access to a healthcare provider, and more likely to have timely routine check-ups when compared to individuals living in non-expansion states.

Aim 2: When compared to non-expansion states, there will be a decrease in the yearly count of ED visits for ACSC, the yearly count of ACSC hospitalizations through the ED, as well as a decrease in ACSC-associated LOS for Medicaid expansion states following the implementation of Medicaid expansion.

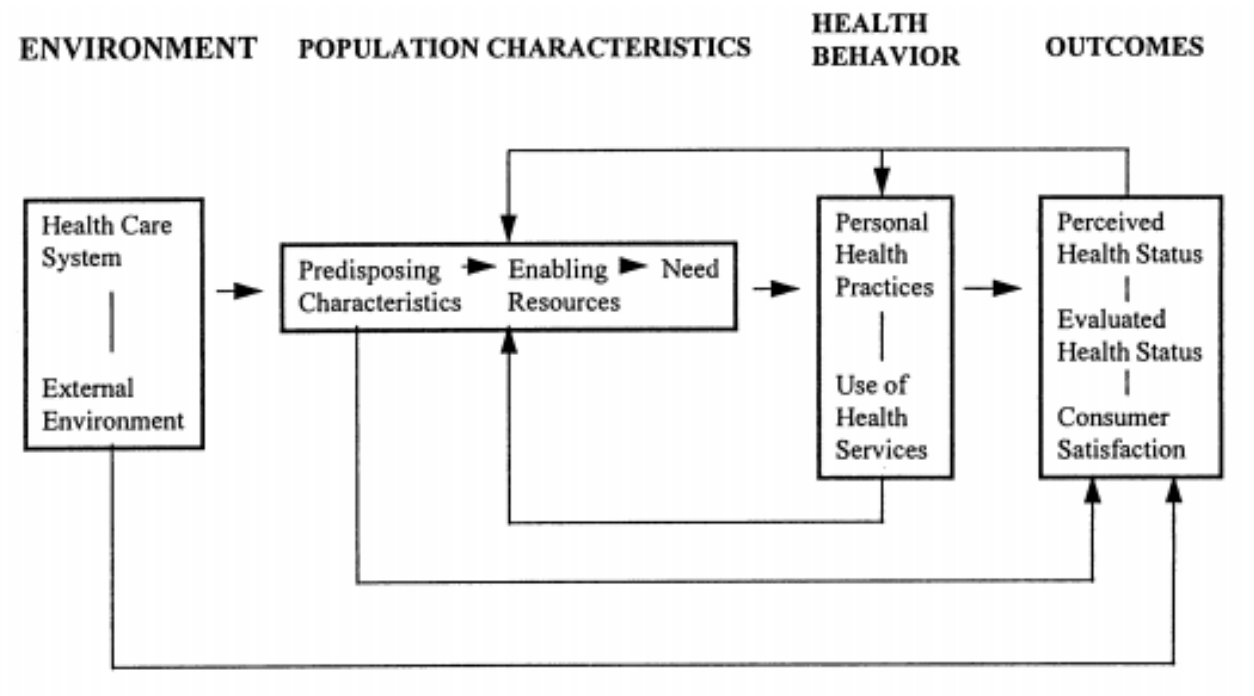

Figure 2-1 . The Andersen Behavioral Model of Health Services Utilization, Phase 4

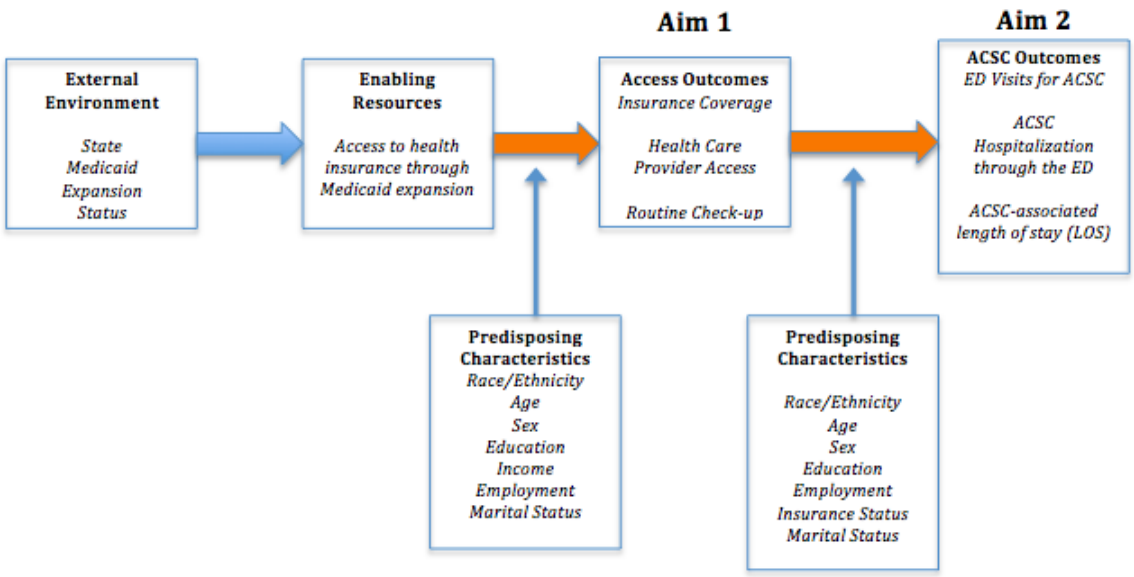

Figure 2-2. Conceptual Framework

CHAPTER 3
DATA AND METHODS

The present study was approved by the University of Florida (UF) Institutional Review Board (IRB). Expansion and non-expansion states were identified through the Henry J. Kaiser Family Foundation (KFF) “Status of State Action on the Medicaid Expansion Decision” report. As of October 14, 2016, 19 states chose not to adopt Medicaid Expansion including Alabama, Florida, Georgia, Idaho, Kansas, Maine, Mississippi, Missouri, Nebraska, North Carolina, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Wisconsin, and Wyoming.

Pennsylvania, Indiana, Alaska, Montana and Louisiana were excluded from the analysis due to implementation dates in or after 2015, therefore, providing an insufficient window for post-period analysis. Furthermore, since this study focuses on Federal expansions only, Arizona, Arkansas, Iowa, Michigan, and New Hampshire were excluded from this study as they have approved Section 1115 waivers. As such, a total of 10 states were excluded from the analysis for Aim 1. Additionally, a total of 5 states were excluded from the analysis for Aim 2 because they had Section 1115 waivers and/or expanded Medicaid expansion after January 2014 (AZ, IN, LA, MI, and PA).

According to state Medicaid expansion eligibility guidelines, participants of Aim 1 and Aim 2 of this study included nonelderly adults, aged 18 to 64 years, with incomes at or below 138% of the federal poverty level. Aim 1 included individuals with one or more ambulatory care sensitive conditions (ACSC) in addition to the aforementioned criteria.

Data

Aim 1 Data

The Behavioral Risk Factor Surveillance System (BRFSS) was used to assess insurance coverage, health care provider access, and timely routine check-ups. The BRFSS, established in 1984, is a telephone survey that collects state data regarding health-related risk behaviors, chronic health conditions, and preventive services utilization of U.S. individuals.[68] For purposes of this analysis, 2012-2013 BRFSS data was used to assess the outcomes for the pre-Medicaid expansion period and 2015 BRFSS data was used to assess the outcomes for the post-Medicaid expansion period. To assess insurance coverage during the pre-post periods, the following question was analyzed: “Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare, or Indian Health Service?” To assess healthcare provider access, the question, “Do you have one person you think of as your personal doctor or health care provider?” was analyzed. Finally, timely routine check-ups were determined as respondents who responded to the question: “About how long has it been since you last visited a doctor for a routine checkup?” with the answer, “within past year (anytime less than 12 months).”

Aim 2 Data

The Medical Expenditure Panel Survey (MEPS) was used to determine if there was a change in the yearly count of ED visits for ACSC, ACSC hospitalizations through the ED, and ACSC-associated length of stay. To assess the aforementioned Aim 2 outcomes, panels 17, 18, and 19 (that is, years 2013-2014) of MEPS were used for analysis. MEPS data for 2013 consisted of interview rounds 3-5 of panel 17, as well as interview rounds 1-3 of panel 18 and were used as the pre-Medicaid expansion period.

MEPS data for 2014 consisted of interview rounds 3-5 of panel 18, as well as interview rounds 1-3 of panel 19 and were used as the post-Medicaid expansion period. MEPS is a nationally representative survey of non-institutionalized civilians in the United States which began in 1996.[69] MEPS is composed of two main components, the household component and the insurance component. The household component provides data from individual households that participated in the previous year's National Health Interview Survey (NHIS). The household component also contains supplemental data from medical providers while the separate insurance component provides data on employer-based health insurance.[70] Other components of MEPS include the Medical Provider Component, which aims to supplement and/or replace information provided by respondents of the household component and includes health care providers identified by respondents.[70] A key advantage of MEPS is the oversampling of blacks, Hispanics and Asians, as well as policy-relevant sub-groups such as low-income households, which will be the main focus of this analysis.[71]

To determine the impact of state Medicaid expansion on ACSC-associated ED visits and ED hospitalizations, this study used a person-level analysis of individuals living in expansion and non-expansion states. To examine the change in ED visits, and ED hospitalizations, the data was transposed in order to examine the outcomes at the person-level rather than at the event-level. State FIPS codes, as well as fully specified ICD-9 codes from MEPS-restricted data files were used to identify ACSC utilization within expansion and non-expansion states. Analysis of the change in ACSC-associated length of stay (LOS) was performed at the event level; therefore, data was not transposed for this analysis.

Variables

Aim 1 Variables

Data from the 2012-2015 Behavioral Risk Factor Surveillance System (BRFSS) was used to measure access outcomes outlined in Aim 1 (Table A-1). Respondents with an ACSC were identified based on their self-report of having been diagnosed with any of the 14 Prevention Quality Indicators (PQI) previously discussed. To identify expansion and non-expansion states, the BRFSS state ID variable was used. Currently, 19 states have chosen not to adopt Medicaid Expansion including Alabama (AL), Florida (FL), Georgia (GA), Idaho (ID), Kansas (KS), Maine (ME), Mississippi (MS), Missouri (MO), Nebraska (NE), North Carolina (NC), Oklahoma (OK), South Carolina (SC), South Dakota (SD), Tennessee (TN), Texas (TX), Utah (UT), Virginia (VA), Wisconsin (WI), and Wyoming (WY); the remaining states are in the Medicaid expansion group.

Self-reported data were used to classify individuals with ACSC. To identify individuals with asthma, the respondents' response to the question, "(ever told) you had asthma" was used. To identify individuals with Chronic Obstructive Pulmonary Disease, respondents' response to the question, "(ever told) you have Chronic Obstructive Pulmonary Disease or COPD, emphysema or chronic bronchitis" was used. Lastly, individuals were classified as having diabetes complications if they responded yes to the question, "(ever told) you have diabetes," as well as yes to either of the following questions: "Has a doctor ever told you that diabetes has affected your eyes or that you had retinopathy," "(ever told) you have kidney disease," "(ever told) you had a stroke," or "(ever told) you had a heart attack, also called a myocardial infarction."

Dependent Variables

Aim 1.1: HLTHPLN1 is a binary variable that was used to determine access to health insurance.

Aim 1.2: PERSDOC2 is a dummy-coded variable that was used to determine whether an individual has a person that they think of as their personal doctor or health care provider.

Aim 1.3: CHECKUP1 is a dummy-coded variable that was used to determine whether an individual has had their recommended routine checkup (i.e., a general physical exam, not an exam for a specific injury, illness or condition within the past year or anytime less than 12 months ago).

Independent Variable

This study used a difference-in-differences (DID) approach. As such, an interaction term, POST*EXP, was created to test the effect of state Medicaid expansion on the dependent variables of interest.

The interaction term included a dummy-coded variable, EXP, indicating Medicaid expansion states (EXP=1). In addition to the EXP variable, the interaction term included a time variable denoting observations occurring in 2015, post-Medicaid expansion (POST=1).

Aim 2 Variables

Data from the 2012-2014 Medical Expenditure Panel Survey (MEPS) was used to measure the outcomes outlined in Aim 2. Since this project involved analysis of non-Medicaid expansion states versus Medicaid expansion states, state IDs were used to determine expansion and non-expansion states. MEPS provided unencrypted state IDs for the top 29 states that could yield accurate estimates. The top 29 states included

Alabama (AL), Arizona (AZ), California (CA), Colorado (CO), Connecticut (CT), Florida (FL), Georgia (GA), Illinois (IL), Indiana (IN), Kentucky (KY), Louisiana (LA), Massachusetts (MA), Maryland (MD), Michigan (MI), Minnesota (MN), Missouri (MO), North Carolina (NC), New Jersey (NJ), New York (NY), Ohio (OH), Oklahoma (OK), Oregon (OR), Pennsylvania (PA), South Carolina (SC), Tennessee (TN), Texas (TX), Virginia (VA), Washington (WA), and Wisconsin (WI). Of the top 29 states, 13 expanded Medicaid (CA, CO, CT, IL, KY, MA, MD, MN, NJ, NY, OH, OR, and WA); 5 states were excluded from the analysis because they had Section 1115 waivers and/or expanded Medicaid expansion after January 2014 (AZ, IN, LA, MI, and PA). The remaining11 states were non-expansion states (AL, FL, GA, MD, NC, OK, SC, TN, TX, VA, and WI).

ED visits for ACSC, ACSC hospitalizations through the ED, and ACSC-associated length of stay were identified using the fully specified ICD-9 codes for 6 of the 14 PQI; low birth weight (PQI 09) and perforated appendix (PQI 12) were excluded because they do not pertain to adult populations.[72] Furthermore, angina pectoris was excluded due to recent evidence regarding the validity of its use as a PQI.[38] Lastly, diabetes complications, and hypertension complications were removed from the analysis due to insufficient sample sizes; leaving 4 of the 14 PQI to be examined (See Table A-1).

Dependent Variables

Dependent variables included emergency room visits from the MEPS household component events emergency room visits file, as well as hospitalizations through the emergency room measured using the variable, EMERROOM in the MEPS household component events hospital inpatient stays file. Lastly, ACSC-associated length of stay was measured using the number of nights in the hospital variable in the MEPS hospital

inpatient stays file. To determine whether these events were for ambulatory care sensitive conditions, fully specified ICD-9-CM codes from MEPS restricted data files were used.

Independent Variables

This study used a difference-in-differences (DID) approach. As such, an interaction term, POST*EXP, was created to test the effect of state Medicaid expansion on the dependent variables of interest. The interaction term included a dummy-coded variable, EXP, indicating Medicaid expansion states (EXP=1). In addition to the EXP variable, the interaction term included a time variable consisting of event year to denote observations occurring in 2014, post-Medicaid expansion (POST=1).

Methodology

Consistent with policy evaluations, this study used a difference-in-differences model. Difference-in-differences models are commonly used in place of randomized control trials, the gold standard of examining causal relationships, as a more pragmatic approach to evaluating the impact of health care policies in observational studies.[73] Due to its credibility, ease of implementation and estimation, DiD has become increasingly popular in health policy and medicine.[74]

Aim 1 Methodology

Fifteen separate logit regressions were used to test the probability of having insurance coverage, health care provider access, and timely routine check-ups in Medicaid expansion states after the Medicaid expansion period among low-income individuals with ACSC, low-income individuals with multiple ACSC, as well as among low-income individuals with diabetes complications, COPD or asthma. Models were adjusted for sex, age, employment, race/ethnicity, marital status, education and income.

Low-income adults were defined as individuals in a household size up to 4 with incomes less than $35,000 according to Federal guidelines used to classify individuals at or below 138% Federal Poverty Level (FPL).[75] To account for the complex survey design, the svy command in STATA was used.

Aim 1 Econometric Models

The econometric models for the total sample of low-income individuals with ACSC, as well as for the sub-population of low-income individuals with multiple ACSC, diabetes complications, COPD or asthma are presented below.

$$\text{Pr (Health Coverage)} = \beta_0 + \beta_1\text{Post} + \beta_2\text{Exp} + \beta_3\text{Post*Exp} + \beta_4\text{Sex} + \beta_5\text{Age} + \beta_6\text{Employment} + \beta_7\text{Race} + \beta_8\text{Marital} + \beta_9\text{Education} + \beta_{10}\text{Income} \quad (3\text{-}1)$$

$$\text{Pr (Access)} = \beta_0 + \beta_1\text{Post} + \beta_2\text{Exp} + \beta_3\text{Post*Exp} + \beta_4\text{Sex} + \beta_5\text{Age} + \beta_6\text{Employment} + \beta_7\text{Race} + \beta_8\text{Marital} + \beta_9\text{Education} + \beta_{10}\text{Income} \quad (3\text{-}2)$$

$$\text{Pr (Check Up)} = \beta_0 + \beta_1\text{Post} + \beta_2\text{Exp} + \beta_3\text{Post*Exp} + \beta_4\text{Sex} + \beta_5\text{Age} + \beta_6\text{Employment} + \beta_7\text{Race} + \beta_8\text{Marital} + \beta_9\text{Education} + \beta_{10}\text{Income} \quad (3\text{-}3)$$

Aim 2 Methodology

Five separate negative binomial regressions, controlling for sex, race/ethnicity, insurance status, and age, were used to determine the change in the yearly count of ED visits for ACSC, COPD, asthma, CHF, and UTI. To determine the probability of having a hospitalization through the ED, five separate logit models were run controlling for sex, race/ethnicity, age, insurance status, education and employment status. Lastly, to determine the change in ACSC-associated length of stay post-Medicaid expansion, five separate generalized linear models (GLM), using a mixed model approach, were proposed with random effects to account for the clustered nature of the data, specifically, repeated measures of participants. However, it was determined that the

data was unable to sustain the original analyses based on errors stating that the models' initial values were not feasible even after multiple attempts at specifying the models' starting values using STATA's matrix command.[76] As such, panel 18, which consisted of individuals with two consecutive years of data, were dropped from the dataset, leaving only asthma-associated LOS to be analyzed. As such, GLM with gamma distribution and log-link was used to determine the change in asthma-associated length of stay among low-income individuals controlling for sex, race/ethnicity, age, insurance status, and education. A variable denoting family income as a percentage of the poverty level was used to subset the population to low-income adults with incomes at or below 138% FPL. To account for the complex survey design, svy command in STATA was used for all analyses.

Aim 2 Econometric Models

The econometric models to examine each ACSC-associated utilization measure among low-income individuals is presented below.

$$\text{ED visits for ACSC} = \beta_0 + \beta_1\text{Post} + \beta_2\text{Exp} + \beta_3\text{Post*Exp} + \beta_4\text{Sex} + \beta_5\text{Age} + \beta_6\text{Insurance} + \beta_7\text{Race} \quad (3\text{-}4)$$

$$\text{ACSC ED Hospitalization} = \beta_0 + \beta_1\text{Post} + \beta_2\text{Exp} + \beta_3\text{Post*Exp} + \beta_4\text{Sex} + \beta_5\text{Age} + \beta_6\text{Employment} + \beta_7\text{Race} + \beta_8\text{Education} + \beta_9\text{Insurance} \quad (3\text{-}5)$$

$$\text{Asthma Length of Stay} = \beta_0 + \beta_1 Post + \beta_2 Exp + \beta_3 Post*Exp + \beta_4 Sex + \beta_5 Age + \beta_6 Race + + \beta_7 Education + \beta_8 Insurance \quad (3\text{-}6)$$

CHAPTER 4
RESULTS

The aims of this dissertation were to assess the early impact of the 2014 Medicaid expansion on health care access and utilization among individuals with ambulatory care sensitive conditions. Results pertaining to the study's aims are presented in this chapter. All results presented are based on weighted estimates. For Aim 1, the final sample was 37,989 (unweighted) and 12,807,975 (weighted) from the Behavioral Risk Factor Surveillance System. For Aim 2, the final sample size for the analysis of ED visits and hospitalizations through the ED was 44,954 (unweighted) and 163,752,148 (weighted) from the Medical Expenditure Panel Survey (MEPS). The final sample size for the analysis of length of stay was 5,889 (unweighted) and 20,313,665 (weighted) from the Medical Expenditure Panel Survey (MEPS). A statistical significance level at or below 0.05 was used for all results within this study.

Aim 1: Medicaid Expansion's Impact on Health Care Access Among Individuals with Ambulatory Care Sensitive Conditions

Descriptive Statistics

The total population of individuals living in expansion states was 5,316,635 for years 2012-2015. In non-expansion states, the total population was 7,491,340 for years 2012-2015. Table 4-1 presents descriptive statistics, which were used to examine the distribution of demographic characteristics between non-expansion and expansion states. Low-income adults in expansion states were more likely to be in the youngest age category of 18-29 years old (13.0% versus 8.8%). Furthermore, low-income adults in expansion states were more likely to be classified as non-White (39.6% versus 37.6%). Low-income adults were also more likely to be a college graduate or higher (7.6% versus 6.5%) and less likely to be married (26.0% versus 32.1%). However, in

terms of employment, low-income adults in expansion states were more likely to be unemployed (15.2% versus 12.5%), but less likely to report being unable to work (43.2% versus 48.1%).

Table 4-2 presents the proportion of diabetes complications, COPD, and asthma among low-income adults with ACSC in expansion and non-expansion states. In expansion states, low-income adults with ACSC were significantly less likely to have COPD (45.5% versus 50.0%). However, low-income adults with ACSC were significantly more likely to have asthma (73.5% versus 65.9%). Furthermore, non-expansion states had a higher proportion of low-incomes adults with 2 or more ACSC when compared to expansion states (28.6% versus 25.5%).

Access to Care Measures

Results of the logit regression models are presented in Appendix C, and margins plots are presented in Appendix D. Tables 4-3 to 4-5 present the adjusted mean differences in insurance rates before and after the implementation of Medicaid expansion, as well as the DID results. Significant increases in insurance rates, usual source of care, and timely check-ups were observed among individuals with ACSC. Among individuals with ACSC, non-expansion states saw a 7.00 percentage points increase in insurance rates and a 2.61 percentage points increase in timely check-ups. Expansion states showed a significantly greater increase in insurance rates (a 11.19 percentage points increase), while usual source of care increased by 3.04 percentage points.

Tables 4-6 to 4-8 present the adjusted mean differences and DID results for access outcome measures among individuals with asthma. Significant increases in insurance rates, and usual source of care were observed among individuals with

asthma. Similar to the general ACSC population, among individuals with asthma, non-expansion states saw a 7.43 percentage points increase in insurance while expansion states saw an 11.49 percentage points increase in in insurance rates. Furthermore, expansion states saw a 4.92 percentage points increase in usual source of care. No significant changes in timely check-ups were observed for individuals with asthma.

Among individuals with COPD, non-expansion states saw a 6.15 percentage points increase in insurance rates while expansion states saw a 9.10 percentage points increase in insurance rates. Furthermore, expansion states saw a 0.28 percentage points increase in usual source of care and a 5.70 percentage points increase in timely check-ups (Tables 4-9 and 4-11).

Non-expansion states saw a 9.45 percentage points increase in insurance rates among individuals with diabetes complications (Table 4-12). However, a change in insurance rates was not observed among individuals with diabetes complications living in expansion states nor was a change in rates of usual source of care and timely check-ups observed in expansion and non-expansion states.

Results in Tables 4-15 to 4-17 show significant increases in insurance rates, and timely check-ups among individuals with two or more ACSC. Among individuals with ACSC comorbidity, non-expansion states saw an 8.40 percentage points increase in insurance rates, while expansion states saw a 7.11 percentage points increase in in insurance rates. In regards to timely check-ups, expansion states saw a 7.07 percentage points increase.

Lastly, the DID model measured the changes in each access outcome measure of expansion states from before to after the implementation of Medicaid expansion

relative to non-expansion states. Results of the DID model showed that, following Medicaid expansion, the change in insurance rates was 4.19 percentage points significantly higher in expansion states than non-expansion states (Table 4-3), while there were no significant differences in the changes for usual source of care (Table 4-4).

Aim 2: Medicaid Expansion's Impact on Ambulatory Care Sensitive Conditions Associated Utilization Among Low-Income Individuals

Descriptive Statistics

The total population of individuals living in expansion states was 66,718,626 for the years 2013-2014. In non-expansion states, the total population was 97,033,522 for years 2013-2014. Table 4-18 presents descriptive statistics, which were used to examine the distribution of demographic characteristics between non-expansion and expansion states. Overall, non-expansion states were more likely to have low-income adults with incomes at or below 138% FPL (24.4% versus 22.3%). For purposes of this study, the population was limited to low-income adults. Low-income adults in non-expansion states were more likely to be Non-Hispanic White (57.1% versus 54.9%). In terms of employment, non-expansion states were more likely to have individuals who were unemployed (79.1% versus 75.7%). Lastly, individuals living in non-expansion were more likely to be uninsured (11.7% versus 7.6%).

Table 4-19 presents the proportion of individuals with any ambulatory care sensitive condition, chronic obstructive pulmonary disease, asthma, congestive heart failure, and urinary tract infection. In expansion states, low-income adults were significantly more likely to have asthma (49.7% versus 42.7%). However, low-income adults living in expansion states were significantly less likely to have congestive heart failure (7.3% versus 2.8%).

ACSC-Associated Utilization Measures

Results of the regression models are presented in Appendix D, and margins plots are presented in Appendix E. Tables 4-20 to 4-24 present the adjusted mean differences in hospitalizations through the ED before and after the implementation of Medicaid expansion, as well as results of the DID results. Significant increases of 17.25 percentage points and 17.97 percentage points were observed for ACSC-associated ED hospitalizations in expansion states and non-expansion states, respectively (Table 4-20). Expansion states also saw an 11.29 percentage points significant increase in asthma-associated ED hospitalizations (Table 4-22) and a 12.37 percentage points decrease in CHF-associated ED hospitalizations (Table 4-23). Further, the change in CHF-associated ED hospitalizations following Medicaid expansion was 23.08 percentage points lower for expansion states than non-expansion states (Table 4-23). However, the change in COPD-associated ED hospitalizations was 15.80 percentage points higher for expansion states than non-expansion states (Table 4-21). Results indicate no significant changes in UTI-associated ED hospitalizations.

In terms of ED visits, results showed an 85.44 percentage points significant reduction in ACSC-associated ED visits in non-expansion states (Table 4-25). However, no other significant changes in ED visits were observed for any ACSC or subsets of ACSC (Tables 4-25 to 4-29). Lastly, results of the LOS models showed no significant changes in asthma-associated length of stay (LOS) (Table 4-30).

Table 4-1. Demographic Characteristics by Medicaid Expansion Status

Characteristics	Medicaid Expansion Status Non Expansion States (n=7,491,340)	Expansion States (n=5,316,635)
Age (years)***		
18-29	656,815 (8.8%)	691,477 (13.0%)
30-39	996,837 (13.3%)	837,406 (15.8%)
40-49	1,411,327 (18.8%)	1,019,834 (19.2%)
50-59	2,878,245 (38.4%)	1,776,612 (33.4%)
60-64	1,548,116 (20.7%)	991,306 (18.6%)
Gender		
Male	2,598,405 (34.7%)	1,887,644 (35.5%)
Female	4,892,935 (65.3%)	3,428,991 (64.5%)
Race/ethnicity***		
Non-Hispanic White	3,159,120 (62.3%)	2,122,557 (60.4%)
Non-Hispanic Black	1,107,423 (21.8%)	614,347 (17.5%)
Hispanic	524,103 (10.3%)	560,206 (15.9%)
Other	281,121 (5.5%)	216,659 (6.2%)
Income		
Less than $10,000	1,892,130 (25.3%)	1,458,086 (27.4%)
Less than $15,000	1,755,060 (23.4%)	1,211,399 (22.8%)
Less than $20,000	1,856,626 (24.8%)	1,294,804 (24.4%)
Less than $25,000	1,552,110 (20.7%)	1,033,926 (19.4%)
Less than $35,000	435,414 (5.8%)	318,421 (6.0%)

Table 4-1. Continued

Education**		
Less than high school	2,189,030	1,537,673
	(29.2%)	(28.9%)
High school graduate	2,731,138	1,772,160
	(36.5%)	(33.4%)
Some College	2,080,686	1,600,150
	(27.8%)	(30.1%)
College graduate or higher	483,538	401,549
	(6.5%)	(7.6%)
Employment**		
Employed	1,247,530	863,636
	(24.4%)	(24.4%)
Unemployed	636,748	538,193
	(12.5%)	(15.2%)
Retired/homemaker/student	770,129	614,202
	(15.1%)	(17.3%)
Unable to Work	2,457,566	1,530,630
	(48.1%)	(43.2%)
Marital Status***		
Married	2,397,111	1,373,859
	(32.1%)	(26.0%)
Not Married	5,076,990	3,913,569
	(67.9%)	(74.0%)
Family Composition		
Mean number of adults (95% CI)	1.7	1.6
	(1.7, 1.7)	(1.6, 1.7)
Mean number of children	56.9	55.5
(95% CI)	(55.8, 58.0)	(54.0, 56.9)

Note: All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table 4-2. Proportion of Individuals with ACSC by Medicaid Expansion Status

ACSC	Medicaid Expansion Status		
	Non Expansion States	Expansion States	Total
Diabetes Complications			
Yes	1,110,345 (73.0%)	433,285 (70.5%)	1,543,630 (72.3%)
No	409,754 (27.0%)	181,222 (29.5%)	590,976 (27.7%)
COPD***			
Yes	3,668,131 (50.0%)	2,357,003 (45.4%)	6,025,134 (52.0%)
No	3,674,882 (50.0%)	2,839,832 (54.6%)	6,514,715 (48.1%)
Asthma***			
Yes	4,884,913 (65.9%)	3,868,777 (73.5%)	8,753,690 (69.1%)
No	2,522,336 (34.1%)	1,392,511 (26.5%)	3,914,847 (30.9%)
≥ 2 ACSC**			
Multi-ACSC	2,139,464 (28.6%)	1,352,258 (25.5%)	3,491,723 (27.3%)
All Others	5,340,807 (71.4%)	3,958,264 (74.5%)	9,299,072 (72.7%)

Note: All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table 4-3. Difference-in-Difference estimates among individuals with ACSC, Insurance %

Insurance %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	78.96	90.15	11.19 (8.32, 14.06)***
Non-Expansion States	72.20	79.20	7.00 (4.57, 9.43)***
Difference-in-Differences (95% CI)[a,b]			4.19 (0.42, 7.96)*

[a] Estimates based on adjusted regression models controlling for gender, race/ethnicity, age, marital status, education, occupation, and income
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table 4-4. Difference-in-Difference estimates among individuals with ACSC, Usual Source of Care %

Usual Source of Care %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	83.66	86.70	3.04 (0.26, 5.83)*
Non-Expansion States	81.61	83.61	2.00 (-0.28, 4.29)
Difference-in-Differences (95% CI)[a,b]			1.04 (-2.56, 4.64)

[a] Estimates based on adjusted regression models controlling for gender, race/ethnicity, age, marital status, education, occupation, and income
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table 4-5. Difference-in-Difference estimates among individuals with ACSC, Timely Check-Up %

Timely Check-Up %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	72.36	75.66	3.30 (-0.13, 6.73)
Non-Expansion States	70.29	72.91	2.61 (0.00, 5.19)*
Difference-in-Differences (95% CI)[a,b]			0.69 (-3.60, 4.98)

[a] Estimates based on adjusted regression models controlling for gender, race/ethnicity, age, marital status, education, occupation, and income
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table 4-6. Difference-in-Difference estimates among individuals with asthma, Insurance %

Insurance %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	79.14	90.64	11.49 (8.19, 14.79)***
Non-Expansion States	71.64	79.06	7.43 (4.34, 10.51)***
Difference-in-Differences (95% CI)[a,b]			4.07 (-0.48, 8.61)

[a] Estimates based on adjusted regression models controlling for gender, race/ethnicity, age, marital status, education, occupation, and income
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table 4-7. Difference-in-Difference estimates among individuals with asthma, Usual Source of Care %

Usual Source of Care %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	81.67	86.59	4.92 (1.40, 8.44)**
Non-Expansion States	80.50	82.15	1.65 (-1.34, 4.63)
Difference-in-Differences (95% CI)[a,b]			3.28 (-1.35, 7.90)

[a] Estimates based on adjusted regression models controlling for gender, race/ethnicity, age, marital status, education, occupation, and income
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table 4-8. Difference-in-Difference estimates among individuals with asthma, Timely Check-Up %

Timely Check-Up %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	71.82	74.67	2.85 (-1.38, 7.08)
Non-Expansion States	68.62	71.64	3.02 (-0.23, 6.26)
Difference-in-Differences (95% CI)[a,b]			-0.17 (-5.51, 5.18)

[a] Estimates based on adjusted regression models controlling for gender, race/ethnicity, age, marital status, education, occupation, and income
[b] All estimates were calculated using survey weights
*******Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
***** Indicates significant differences at P < 0.05

Table 4-9. Difference-in-Difference estimates among individuals with COPD, Insurance %

Insurance %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	82.13	91.23	9.10 (5.36,12.81)***
Non-Expansion States	75.38	81.53	6.15 (3.01, 9.29)***
Difference-in-Differences (95% CI)[a,b]			2.95 (-1.93, 7.83)

[a] Estimates based on adjusted regression models controlling for gender, race/ethnicity, age, marital status, education, occupation, and income
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table 4-10. Difference-in-Difference estimates among individuals with COPD, Usual Source of Care %

Usual Source of Care %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	89.56	89.84	0.28 (-2.62, 3.17)
Non-Expansion States	85.27	87.94	2.68 (-0.07, 5.42)
Difference-in-Differences (95% CI)[a,b]			-2.40 (-6.38, 1.59)

[a] Estimates based on adjusted regression models controlling for gender, race/ethnicity, age, marital status, education, occupation, and income
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table 4-11. Difference-in-Difference estimates among individuals with COPD, Timely Check-Up %

Timely Check-Up %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	74.36	80.06	5.70 (1.46, 9.95)**
Non-Expansion States	72.23	76.28	4.05 (0.53, 7.57)*
Difference-in-Differences (95% CI)[a,b]			1.65 (-3.87, 7.17)

[a] Estimates based on adjusted regression models controlling for gender, race/ethnicity, age, marital status, education, occupation, and income
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table 4-12. Difference-in-Difference estimates among individuals with diabetes complications, Insurance %

Insurance %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	84.57	89.95	5.39 (-1.68, 12.45)
Non-Expansion States	80.06	89.51	9.45 (4.48, 14.42)***
Difference-in-Differences (95% CI)[a,b]			-4.07 (-12.65, 4.52)

[a] Estimates based on adjusted regression models controlling for gender, race/ethnicity, age, marital status, education, occupation, and income
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table 4-13. Difference-in-Difference estimates among individuals with diabetes complications, Usual Source of Care %

Usual Source of Care %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	92.42	91.60	-0.81 (-0.57.5.84)
Non-Expansion States	91.55	94.19	2.64 (-0.57, 5.84)
Difference-in-Differences (95% CI)[a,b]			-3.45 (-10.05, 3.15)

[a] Estimates based on adjusted regression models controlling for gender, race/ethnicity, age, marital status, education, occupation, and income
[b] All estimates were calculated using survey weights
*******Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
***** Indicates significant differences at P < 0.05

Table 4-14. Difference-in-Difference estimates among individuals with diabetes complications, Timely Check-Up %

Timely Check-Up %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	83.45	88.52	5.07 (-1.69, 11.82)
Non-Expansion States	84.26	87.36	3.10 (-2.07,8.26)
Difference-in-Differences (95% CI)[a,b]			1.97 (-6.45, 10.39)

[a] Estimates based on adjusted regression models controlling for gender, race/ethnicity, age, marital status, education, occupation, and income
[b] All estimates were calculated using survey weights
*******Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
***** Indicates significant differences at P < 0.05

Table 4-15. Difference-in-Difference estimates among individuals with 2 or more ACSC, Insurance %

Insurance %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	86.06	93.16	7.11 (3.20, 11.02)***
Non-Expansion States	77.25	85.65	8.40 (4.41, 12.38)***
Difference-in-Differences (95% CI)[a,b]			-1.29 (-6.86, 4.27)

[a] Estimates based on adjusted regression models controlling for gender, race/ethnicity, age, marital status, education, occupation, and income
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table 4-16. Difference-in-Difference estimates among individuals with 2 or more ACSC, Usual Source of Care %

Usual Source of Care %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	91.71	93.02	1.32 (-1.82, 4.45)
Non-Expansion States	88.66	90.83	2.17 (-0.89, 5.22)
Difference-in-Differences (95% CI)[a,b]			-0.85 (-5.20, 3.50)

[a] Estimates based on adjusted regression models controlling for gender, race/ethnicity, age, marital status, education, occupation, and income
[b] All estimates were calculated using survey weights
*******Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
***** Indicates significant differences at P < 0.05

Table 4-17. Difference-in-Difference estimates among individuals with 2 or more ACSC, Timely Check-Up %

Timely Check-Up %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	77.00	84.07	7.07 (1.62, 12.52)*
Non-Expansion States	74.23	80.35	6.12 (1.61, 10.63)**
Difference-in-Differences (95% CI)[a,b]			0.65 (-.6.07, 7.96)

[a] Estimates based on adjusted regression models controlling for gender, race/ethnicity, age, marital status, education, occupation, and income
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table 4-18. Demographic Characteristics by Medicaid Expansion Status

Characteristics	Medicaid Expansion Status Non Expansion States (n=97,033,522)	 Expansion States (n=66,718,626)
Income**		
Low-Income	97,033,522 (24.4%)	66,718,626 (22.3%)
All Others	300,836,848 (75.6%)	233,107,280 (77.7%)
Age (years)		
18-29	10,461,745 (19.1%)	7,795,887 (20.0%)
30-39	8,202,813 (15.0%)	7,065,585 (18.1%)
40-49	9,449,622 (17.3%)	7,212,095 (18.5%)
50-59	18,833,352 (34.4%)	11,571,221 (29.7%)
60-64	7,808,473 (14.3%)	5,317,076 (13.6%)
Gender**		
Male	34,629,638 (35.7%)	26,653,840 (39.9%)
Female	62,403,885 (64.3%)	40,064,786 (60.1%)
Race/ethnicity***		
Non-Hispanic White	55,431,859 (57.1%)	36,637,715 (54.9%)
Non-Hispanic Black	17,687,573 (18.2%)	9,971,647 (14.9%)
Hispanic	16,679,433 (17.2%)	14,320,457 (21.5%)
Other	7,234,658 (7.5%)	5,788,807 (8.7%)
Education		
Less than high school	35,331,937 (39.2%)	23,220,829 (37.1%)
High school graduate or GED	23,217,542 (25.7%)	16,080,593 (25.7%)
Some College or Associate degree	24,822,771 (27.5%)	17,388,730 (27.8%)
College graduate or higher	6,818,991 (7.6%)	5,901,687 (9.4%)

Table 4-18. Continued

Employment*		
Employed	17,233,772	13,954,277
	(20.9%)	(24.3%)
Unemployed	65,060,742	43,355,801
	(79.1%)	(75.7%)
Marital Status		
Married	23,876,401	16,292,776
	(28.6%)	(28.0%)
Not Married	59,464,130	41,814,165
	(71.4%)	(72.0%)
Insurance Status***		
Insured	85,696,943	61,654,531
	(88.3%)	(92.4%)
Uninsured	11,336,580	5,064,095
	(11.7%)	(7.6%)

Note: All estimates were calculated using survey weights
***Indicates significant differences at $P < 0.001$
** Indicates significant differences at $P < 0.01$
* Indicates significant differences at $P < 0.05$

Table 4-19. Proportion of Individuals with ACSC by Medicaid Expansion

ACSC	Medicaid Expansion Status Non Expansion States	Expansion States	Total
Any ACSC			
Yes	32,111,890 (99.9%)	23,512,574 (99.9%)	55,624,465 (99.9%)
No	23,357 (0.1%)	16,637 (0.1%)	39,994 (0.1%)
COPD			
Yes	6,430,335 (20.0%)	5,417,916 (23.0%)	11,848,252 (21.3%)
No	25,704,912 (80.0%)	18,111,295 (77.0%)	43,816,207 (78.7%)
Asthma*			
Yes	13,721,034 (42.7%)	11,697,221 (49.7%)	25,418,255 (45.7%)
No	18,414,213 (57.3%)	11,831,991 (50.3%)	30,246,204 (54.3%)
CHF**			
Yes	2,349,858 (7.3%)	652,465 (2.8%)	3,002,323 (5.4%)
No	29,785,389 (92.7%)	22,876,746 (97.2%)	52,662,136 (94.6%)
UTI			
Yes	9,610,664 (29.9%)	5,744,972 (24.4%)	15,355,635 (27.6%)
No	22,524,583 (70.1%)	17,784,240 (75.6%)	40,308,824 (72.4%)

Note: All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table 4-20. Difference-in-Difference estimates, ACSC-associated ED hospitalizations

ACSC-associated ED hospitalizations %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	40.64	57.89	17.25 (2.15, 32.35)*
Non-Expansion States	53.14	71.10	17.97 (5.67, 30.26)**
Difference-in-Differences (95% CI)[a,b]			-0.72 (-18.70, 17.27)

[a] Adjusted for gender, race/ethnicity, age, insurance status, education, and employment status
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table 4-21. Difference-in-Difference estimates, COPD-associated ED hospitalizations

COPD-associated ED hospitalizations %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	10.51	18.57	8.06 (-1.71, 17.84)
Non-Expansion States	22.60	14.86	-7.74 (-19.81, 4.33)
Difference-in-Differences (95% CI)[a,b]			15.80 (1.21, 30.39)*

[a] Adjusted for gender, race/ethnicity, age, insurance status, education, and employment status
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table 4-22. Difference-in-Difference estimates, asthma-associated ED hospitalizations

Asthma-associated ED hospitalizations %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	14.57	25.86	11.29 (1.68, 20.90)*
Non-Expansion States	20.16	26.27	6.11 (-4.40, 16.63)
Difference-in-Differences (95% CI)[a,b]			5.17 (-7.98, 18.33)

[a] Adjusted for gender, race/ethnicity, age, insurance status, education, and employment status
[b] All estimates were calculated using survey weights
*******Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
***** Indicates significant differences at P < 0.05

Table 4-23. Difference-in-Difference estimates, CHF-associated ED hospitalizations

CHF-associated ED hospitalizations %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	12.93	0.55	-12.37 (-22.94, -1.81)*
Non-Expansion States	4.68	15.38	10.70 (-3.64, 25.05)
Difference-in-Differences (95% CI)[a,b]			-23.08 (-39.77, -6.38)**

[a] Adjusted for gender, race/ethnicity, age, insurance status, education, and employment status
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table 4-24. Difference-in-Difference estimates, UTI-associated ED hospitalizations

UTI-associated ED hospitalizations %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	9.54	12.47	2.93 (-7.53, 13.39)
Non-Expansion States	8.49	15.26	6.77 (-1.59, 15.14)
Difference-in-Differences (95% CI)[a,b]			-3.84 (-14.75, 7.07)

[a] Adjusted for gender, race/ethnicity, age, insurance status, education, and employment status
[b] All estimates were calculated using survey weights
*******Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
***** Indicates significant differences at P < 0.05

Table 4-25. Difference-in-Difference estimates, ACSC-associated ED visits

ACSC-associated ED visits %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	201.54	86.34	-115.20 (-251.51, 21.11)
Non-Expansion States	146.90	61.47	-85.44 (-160.82, -10.05)*
Difference-in-Differences (95% CI)[a,b]			-29.76 (-179.31, 119.79)

[a] Adjusted for gender, race/ethnicity, age, insurance status, education, and employment status
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table 4-26. Difference-in-Difference estimates, COPD-associated ED visits

COPD-associated ED visits %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	26.67	94.77	68.10 (-945.70, 387.81)
Non-Expansion States	387.83	108.89	-278.95 (-11.32, 147.53)
Difference-in-Differences (95% CI)[a,b]			347.05 (-344.67, 1038.77)

[a] Adjusted for gender, race/ethnicity, age, insurance status, education, and employment status
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table 4-27. Difference-in-Difference estimates, asthma-associated ED visits

Asthma-associated ED visits %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	360.44	92.66	-267.78 (-565.37, 298.13)
Non-Expansion States	72.74	51.87	-20.87 (-87.86, 46.12)
Difference-in-Differences (95% CI)[a,b]			-246.90 (-554.74, 60.93)

[a] Adjusted for gender, race/ethnicity, age, insurance status, education, and employment status
[b] All estimates were calculated using survey weights
*******Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
***** Indicates significant differences at P < 0.05

Table 4-28. Difference-in-Difference estimates, UTI-associated ED visits

UTI-associated ED visits %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	362.33	87.59	-274.74 (-681.54, 132.06)
Non-Expansion States	904.17	78.78	-825.40 (-1944.78, 294.99)
Difference-in-Differences (95% CI)[a,b]			550.66 (-360.90, 1462.21)

[a] Adjusted for gender, race/ethnicity, age, insurance status, education, and employment status
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table 4-29. Difference-in-Difference estimates, CHF-associated ED visits

CHF-associated ED visits %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	35.76	565.80	530.04 (-619.05, 1679.13)
Non-Expansion States	550.72	69.04	-481.69 (-1199.86, 236.48)
Difference-in-Differences (95% CI)[a,b]			1011.73 (-550.72, 2574.17)

[a] Adjusted for gender, race/ethnicity, age, insurance status, education, and employment status
[b] All estimates were calculated using survey weights
*******Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
***** Indicates significant differences at P < 0.05

Table 4-30. Difference-in-Difference estimates, asthma-associated length of stay (LOS)

Asthma-associated LOS %	Pre-Medicaid Expansion	Post-Medicaid Expansion	Difference (95% CI)[a,b]
Expansion States	306.69	327.10	20.41 (-143.79, 184.61)
Non-Expansion States	378.36	331.97	-46.39 (-199.53, 106.75)
Difference-in-Differences (95% CI)[a,b]			66.80 (-157.19, 290.78)

[a] Adjusted for gender, race/ethnicity, age, insurance status, education, and employment status
[b] All estimates were calculated using survey weights
*******Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
***** Indicates significant differences at P < 0.05

CHAPTER 5
DISCUSSION

Descriptive Findings Discussion

Overall, descriptive findings showed that there were more individuals living in non-expansion states when compared to expansion states. Results of Aim 1 descriptive findings showed that low-income adults in expansion states fared favorably in some instances, as they were less likely to be unemployed, and more likely to have a college degree or higher. Based on the Andersen model, predisposing characteristics influences one's enabling resources. This becomes especially true within the US health care system where the primary mechanism of health insurance coverage is through employer-sponsored health insurance. As such, employed individuals, as well as individuals with a college degree or higher, are more likely to be insured as they are able to attain health insurance through their employers.

Aim 1 descriptive findings also showed that expansion states were more likely to have low-income individuals between the age of 18 and 29 years old. Prior to the ACA, young adults were more likely to be uninsured, and less likely to receive needed medical care.[77] However, provisions within the ACA have enabled young adults to have better access to health care. Within the ACA, young adults are allowed to stay on their parent's insurance plan until the age of twenty-six which has drastically reduced the rate of uninsurance among moderate- and high-income young adults. For example, one study found that the rate of uninsurance among young adults decreased from above 30% in 2009 to 19% in the second quarter of 2014. Results further illustrated no significant change in health insurance coverage among low-income young adults

between 2010 and 2013. However, following the 2014 Medicaid expansion, there was a decline in uninsurance from 39.6% to 30.7% among low-income young adults.[78]

Results of that study indicate that despite the implementation of the ACA provision designed to improve access among young adults, low-income young adults did not experience a reduction in uninsurance rates until the implementation of Medicaid expansion in expansion states. These results indicate that for low-income young adults, living in an expansion state may enable them to better access the enabling resource of health insurance when compared to low-income young adults in non-expansion states. Low-income individuals in expansion states were more likely to classify themselves as non-White, and more likely to be unmarried. Results of a previous study found that non-Whites and individuals who were unmarried experienced larger gains in coverage under the ACA, and Medicaid expansion.[79] Therefore, non-White and unmarried individuals living in expansion states may also benefit in terms of improved access to care measures.

Using Aim 2 data, for low-income individuals, regardless of whether they had an ACSC or not, the results demonstrated similar descriptive findings as the descriptive findings of Aim 1. Aim 2 descriptive findings showed that low-income individuals living in expansion states were more likely to be employed, and more likely to be non-White. Lastly, descriptive findings of Aim 2 indicate that individuals in non-expansion states were more likely to be uninsured and more likely to be of low-income. These findings highlight the coverage gap that often exists in non-expansion states where individuals have incomes above Medicaid eligibility but below the criteria for Marketplace premium tax credits[2], therefore, leaving them uninsured.

Aim 1 Discussion

Aim 1 examined the early impact of Medicaid expansion on health care access among low-income individuals with ACSC. Results of this aim indicate that Medicaid expansion was associated with a significant increase in insurance rates among low-income individuals with ACSC living in expansion states. However, no other significant changes for usual source of care and timely check-ups were observed among individuals with ACSC and its subsets. These results are similar to a recent study by Torres et al., which reported a 4.9 percentage points increase in insurance coverage and no changes in having a personal physician among nonelderly patients with chronic disease following Medicaid expansion.[65] Results pertaining to timely check-ups were also similar to a study which found no significant increase in timely check-ups among low-income adults in Medicaid expansion states.[80] Therefore, while Medicaid expansion achieved its goal of improving access to health insurance, it did not impact usual source of care, nor did it impact realized access through improvements in timely check-ups.

Specific to this study's data, the ceiling effect may explain the results of Aim 1. The ceiling effect often occurs when the independent variable no longer has an effect on the outcome measure. For instance, prior to the implementation of Medicaid expansion, data from this study showed that about 83% of low-income respondents with ACSC in both expansion and non-expansion states had a usual source of care (Table F-1). With such high proportions of individuals with a usual source of care prior to Medicaid expansion, we are less likely to see a statistically significant increase in these proportions. This study's data also indicates that prior to Medicaid expansion, about 70% of low-income respondents with ACSC living in both expansion and non-expansion

states had timely check-ups (Table F-1), which falls above the national median of 67.7%.[81]

Results of Aim 1 show evidence to support the multi-faceted nature of the Andersen model and are consistent with previous research that has found that access to health insurance does not equate to health care access. Results suggest that simply changing one aspect of the model, the enabling resource of health insurance, may not be sufficient to impact realized access. For example, a 2016 study by Baker, et al. proposed adequate provider capacity as a mechanism by which access to care and effective healthcare delivery are impacted. [82] This suggests the need to consider the environmental factor of the number of full-time equivalent primary care providers per 1000 population, or simply, the supply of providers available to meet the demands of newly insured Medicaid enrollees. In fact, studies have suggested that Medicaid expansion may have played a role in provider capacity issues, such as longer wait times for appointments, and may result in the need for 2113 additional primary care providers if all states were to expand Medicaid.[59,83]

Furthermore, a mixed methods study found that healthcare access issues were more often expressed among low-income families with public insurance.[84] Evidence suggests that the access to care issues faced by Medicaid beneficiaries are more pronounced when seeking specialist care.[85] In addition to insufficient supply of providers to meet increased demand for healthcare, low provider participation may also play a significant role in creating inadequate provider capacity for Medicaid beneficiaries. In fact, a study showed that approximately 29.9% of office-based physicians, and 33% of primary care physicians did not accept new Medicaid patients in 2011 to 2012.[53,86]

Furthermore, the CDC estimates that, in 2013, only 68.9% of physicians were accepting new Medicaid patients, compared to 83.7% who were accepting new Medicare patients, and 84.7% who were accepting new privately insured patients.[87] Low provider participation may be due to a myriad of factors such as low reimbursement rates, payment delays, and concerns about the time it takes to manage patients with complex needs, especially given the low reimbursement rates. With past provisions of the ACA focused on increasing Medicaid payments for some primary care services to 100% of Medicare rates in 2013 and 2014 [86], much of the literature has focused on how changes in reimbursement rates have affected providers' willingness to accept Medicaid patients. While the literature shows that increased Medicaid provider payments may be associated with an in increase in providers' willingness to accept new Medicaid patients, particularly, after the ACA Medicaid reimbursement increase where one study observed an increase in Medicaid appointment availability from 58.7% to 66.4%.[88] Further factors must be taken into consideration, such as administrative burdens, as such factors may make some providers more or less responsive to changes in reimbursement.[89] Literature suggests that salaried providers, providers who regularly participate in Medicaid, providers in Health Maintenance Organizations (HMOs) or hospital based practices, as well as providers perceived to be less desirable such as international medical graduates (IMGs) may be less responsive to reimbursement increases.[90] Therefore, future initiatives need to not only consider the expansion of health insurance accessibility, but also to consider the inclusion of incentives designed to encourage different provider groups to accept newly insured patients such as Medicaid patients.

Aim 2 Discussion

Aim 2 examined the early impact of Medicaid expansion on ACSC-associated utilization among low-income individuals. Results of this aim indicated that, following Medicaid expansion, there was a 23.08 percentage points differential reduction in CHF-association ED hospitalizations. However, there was a 15.80 percentage points differential increase in COPD-associated ED hospitalizations following Medicaid expansion.

According to a report by the Engelberg Center for Health Care Reform at Brookings, the treatment of chronic conditions, such as CHF, benefit from a three-pronged approach that focuses on patient behavior, physician or practice-level interventions, and public policy or population health strategies.[91] Elements of physician interventions and public policy strategies have been frequently studied in studies of nonelderly and/or low-income adults. For example, one such study examined the impact of Medicaid expansion on access to care, and utilization among low-income adults living in an expansion state, a private option state and a non-expansion state. Results of that study coincided with previous studies which showed that insurance expansion was associated with increased primary care access, increased outpatient visits, and increased prescription medications.[19,49,53,92] Although physician intervention (usual source of care, and timely check-ups), and Medicaid expansion as a public policy strategy are the focus of this study, the plausible role of patient behavior in the observed impact of Medicaid expansion will be discussed as a factor in the opposing results of COPD-associated and CHF-associated ED hospitalizations. In particular, the subsequent paragraphs focus on medication adherence to explain results pertaining to COPD-associated and CHF-associated ED hospitalizations. Furthermore, the role of

provider-level factors such as the ED referrals by PCPs will be discussed. Additionally, the subsequent paragraphs address similar yet distinct characteristics between COPD and asthma and their role in the opposing results of significant increases in ED hospitalizations for COPD with no significant changes found for asthma-associated ED hospitalizations.

The World Health Organization (WHO), medication adherence is “the degree to which the person’s behavior corresponds with the agreed recommendations from a health care provider.” [93] Medication adherence is a critical factor in chronic disease management as it greatly affects the success of treatment, and ultimately, the likelihood of adverse health outcomes such as hospitalization, worsened morbidity, and death. For example, a study showed that risk of hospitalization among patients with CHF was more than twice that of the general population.[94,95] Furthermore, studies have also shown that poor medication and disease management adherence among patients with COPD leads to emergency hospitalization.[96,97]

Results of Aim 2 showed a 15.80 percentage points differential increase in COPD-associated ED hospitalizations, while a 23.08 percentage points differential reduction in CHF-association ED hospitalizations was found following Medicaid expansion. Despite evidence in the literature which points to an increase in primary care access, and increased prescription medication, it is important to note the differences in the rate of medication adherence between patients with CHF and patients with COPD. COPD patients are particularly vulnerable to medication non-adherence as their treatment regimen includes the use of multiple medications, often including aerosolized medications that require daily use ranging from 2 to 6 times in a day, and requires the

use of different devices such as wearing oxygen in addition to implementing behavioral and lifestyle changes.[95] As such, medication adherence rates for COPD patients are about 40% to 60% on average as compared to medication adherence rates for CHF patients with adherence rates as high as 98%.[95,98] Furthermore, it is estimated that as many as 85% of COPD patients use their inhaler incorrectly.[99] Therefore, while some evidence suggests that gaining insurance may lead to improved access to care among low-income adults[19], patient behavior such as medication non-adherence may hinder the full potential of public policy strategies such as Medicaid expansion.

Multiple studies have shown that medication adherence facilitates lowering health care use and costs.[95,100] In addition to greater issues of medication adherence, COPD patients also experience acute exacerbations of chronic bronchitis (AECB) or COPD exacerbations which often leads to frequent ED visits [101], particularly, among low-income COPD patients, as well as those who are younger than 65 years old.[102] Therefore, high medication non-adherence and the risk of AECB may serve as plausible factors for the observed increase in COPD ED hospitalizations.

On the other hand, the high rates of medication adherence among patients with CHF (upward of 98% versus upward of 60% for COPD) may have facilitated the observed reduction in CHF ED hospitalizations. In fact, medication adherence has been shown to reduce health care use and costs among individuals with chronic vascular diseases such as CHF. [95]

In addition to the role of patient behavior, provider-level behaviors must be considered. Studies have shown that most patients who visit the ED for non-emergent causes were sent by their usual source of care, sometimes without the consultation of a

physician or by an automated message.[103,104] Furthermore, research suggests that EDs have become an increasingly vital source of hospital admissions due to office-based physicians' use of EDs to perform complex examinations and to bypass administrative barriers such as the difficulty of receiving non-elective admissions.[104] Results of this study and findings from previous research highlight the need to include provider-level interventions in efforts to reduce preventable hospitalizations.

In addition to patient behavior and provider-level factors, it is important to note the role that disease pathology plays a role in the results of this study. This is particularly important when observing the opposing results of asthma and COPD, respiratory conditions with similar disease characteristics. Asthma and COPD are both respiratory conditions with reduced rate of pulmonary airflow. Despite this similarity, there are distinct differences that influence the management and progression of disease.[105] Asthma differs in its age of onset, which typically occurs during childhood. COPD occurs primarily among older adults with a history of smoking. History of smoking differs among COPD and asthma patients, with COPD patients reporting greater pack-years, therefore, putting them at risk for poorer lung function[105] In fact, smoking cessation has been shown to reduce the risk of COPD exacerbations which are often associated with increased ED visits.[106]

A notable key difference that influences disease management and progression of asthma and COPD is the reversibility of airway obstruction. In asthma, airway obstruction is generally fully reversible or nearly fully reversible, whereas COPD is characterized by airway obstruction that is not fully reversible even with adequate access and disease management. As such, COPD is progressive in nature and is

marked by declining lung function.[105] Consequently, although asthma is more prevalent, the progressive nature of COPD, which is marked by COPD exacerbations over the natural course of the disease[107], as well as the irreversibility of COPD airway obstruction, contributes to a larger number of hospitalizations, and poorer disease prognosis.[105] The observed increase in ED hospitalization for COPD and the irreversibility of COPD airflow obstruction may suggest the need to revisit the inclusion of COPD as a condition that is sensitive to access to adequate ambulatory care.

Finally, in recent times, the Centers for Medicare and Medicaid Services (CMS) have placed significant focus on reducing hospital readmissions due to the cost burden on the health care system. Since 2009, CMS has publicly reported risk-standardized readmission rates in an effort to reduce hospital readmission rates. Acute heart failure is among the conditions that are publicly reported by CMS.[108] Since these initiatives were implemented under the assumption that readmission rates serve as an indicator of quality of care, it is possible that the observed reduction in CHF is a reflection of such initiatives rather than the 2014 Medicaid expansion.

Strengths and Limitations

To the best of my knowledge, this is the first study to examine the early impact of Medicaid expansion on access and utilization among low-income nonelderly adults with ambulatory care sensitive conditions, inclusive of individuals with diabetic complications. Furthermore, this study uses nationally-representative data and the study's results add to a growing body of literature evaluating the 2014 Medicaid expansion, and in general, the effect of health insurance on access to care among a vulnerable population of low-income adults with ACSC, as well as its impact on utilization measures that are often avoidable with proper access to ambulatory care. Despite the study's strengths, several

limitations should be noted. First, the observational nature of this study cannot provide evidence of a causal relationship. Second, the study included self-reported data that may introduce recall bias. However, despite the use of self-reported data, this study includes some self-reported data that is supplemented by data provided by the providers and hospitals that served respondents of the household component of MEPS. Third, this study used the first ICD-9-CM code to classify ACSC-associated events. However, the first ICD-9-CM code may not accurately reflect the primary diagnosis of some patients.[72] Lastly, these findings may not present the full extent of changes under the 2014 Medicaid expansion because at the time of this study, the latest available data was 2015 and 2014 for BRFSS and MEPS, respectively. As such, more time may be needed to examine the true impact of Medicaid expansion on the outcome measures of interest. Furthermore, the changes reflected might include external initiatives that were not controlled for in the study's regression models, such as CMS' public reporting of hospital readmission rates that were implemented prior to January 2014.

Future Research and Policy Implications

Future research should examine providers' willingness to accept Medicaid patients, the appropriateness of ED referrals by office-based physicians, as well as medication adherence in the context of Medicaid expansion. This is especially critical as research suggests that providers may be unwilling to accept Medicaid; therefore, creating a barrier to healthcare access despite the availability of healthcare coverage. This is particularly true for providers faced with the decision of accepting patients with ACSC in light of low reimbursement rates, high administrative workload, in addition to the complexity of treating patients with ACSC or comorbidities. Furthermore, research has shown that physicians may play a critical role in ED visits for non-emergent cases

and ED hospitalizations as most ED visits for non-emergent cases were initiated by the physician- partially due to administrative barriers for non-elective admissions or simply their inability to see patients. Lastly, medication adherence in the context of health reform should be examined as adherence plays a critical role in alleviating healthcare utilization and costs; particularly among patients with ACSC, such as those with chronic conditions, whose treatment success relies on adherence to often-complex treatment regimens. Furthermore, this study suggests that the observed increase in ED hospitalizations for COPD may be partially due to the progressive nature of COPD and the irreversibility of COPD airflow obstruction which may suggest the need to revisit the inclusion of COPD as a condition that is sensitive to access to adequate ambulatory care.

This study attempted to evaluate the early impact of Medicaid expansion on ACSC-associated LOS; however, the data could not sustain the entirety of the analysis. Future research should examine the impact of Medicaid expansion on ACSC-associated LOS as research has shown that insurance status affects LOS; however, the direction of the effect remains inconclusive.

Results of this study add to a growing body of literature that indicates that the expansion of health coverage may not be enough in improving access to care. Future policy initiatives for low-income adults, including those with ACSC, should not only focus on the expansion of health insurance coverage. Rather, future policies should include incentives to increase providers' willingness to accept vulnerable and complex populations while accounting for provider-mix in each state as different provider types such as salaried providers may be less responsive to such incentives. Furthermore,

medication non-adherence should be considered as an important factor in the improvement of healthcare outcomes. This may be achieved through a greater focus on simplified drug regimens, patient education, case management, and pharmaceutical counseling.[100] These considerations are especially critical as recent evidence suggests that low access to primary care may not be the primary drive of ACSC hospitalizations.[109] Therefore, future policy initiatives should think outside the realms of simply increase healthcare coverage and primary care access.

CHAPTER 6
CONCLUSION

This study examined the early impact of Medicaid expansion on access to care among individuals with ACSC, as well as its impact on ACSC-associated utilization measures. Results of this study indicate that following Medicaid expansion, there was a 4.19 percentage points differential increase in insurance coverage among individuals with ACSC living in expansion states. Furthermore, results of the study indicate a 15.08 percentage points differential increase in COPD ED hospitalizations, whereas a 23.08 percentage points differential reduction in CHF ED hospitalizations was observed.

While Medicaid expansion achieved its goal of increasing insurance coverage, results of this study indicate that other considerations, such as providers' willingness to accept Medicaid patients, as well as medication adherence, are especially important among low-income individuals with ACSC, as well as to achieve improvements in ACSC-associated utilization measures. These considerations align with recommendations for a three-pronged approach that focuses on patient behavior, physician or practice-level interventions, and public policy or population health strategies when addressing chronic disease treatment.

Given the changing scheme of health care, results of this study provide evidence pertaining to the effect of health insurance expansion and offers insight into current and future health reform initiatives. Most importantly, results suggest the need for decision makers to consider other factors that may play integral roles in addressing access to care issues, particularly, among low-income individuals and individuals with ACSC. Future research should explore providers' willingness to accept Medicaid patients, as

well as medication adherence in the context of health reform, such as Medicaid expansion.

APPENDIX A
STUDY METHODS: PREVENTION QUALITY INDICATORS

Table A-1. Technical Specifications for Prevention Quality Indicators (PQI), Source: 2013-2014 Medical Expenditure Panel Survey

Medical Conditions	Corresponding ICD 9 Codes
Chronic Obstructive Pulmonary Disease (COPD)	4910 4911 49120 49121 4918 4920 4928 494 4940 4941 496
Asthma	49300 49301 49302 49310 49311 49312 49320 49321 49322 49381 49382 49390 49391 49392
Congestive heart failure; nonhypertensive	39891 4280 4281 42820 42821 42822 42823 42830 42831 42832 42833 42840 42841 42842 42843 4289
Urinary Tract Infections	59010 59011 5902 5903 59080 59081 5909 5950 5959 5990

APPENDIX B
STUDY METHODS: VARIABLES

Table B-1. Aim 1 Variables, 2012-2015 Behavioral Risk Factor Surveillance System (BRFSS)

Variable	Definition	Data Source
Dependent (Outcomes)		
Health Care Coverage (HLTHPLN1)	Dummy coded variable that was used to determine access to health insurance.	2012-2015 BRFSS
Health Care Access (PERSDOC2)	Dummy coded variable that was used to determine whether an individual has a person they think of as their personal doctor or health care provider.	2012-2015 BRFSS
Routine Check Up (CHECKUP1)	Dummy coded variable that was used to determine whether an individual has had their recommended routine checkup (i.e., a general physical exam, not an exam for a specific injury, illness or condition within the past year or anytime less than 12 months ago).	2012-2015 BRFSS
Independent Variable		
Post-Medicaid Expansion (POST*EXP)	Interaction term developed based on the state variable, _STATE and interview year variable, IYEAR	2012-2015 BRFSS
Explanatory Variables		
Sex (SEX)	Dummy coded variable indicating Male or Female	2012-2015 BRFSS

Table B-1. Continued

Age (_AGEG5YR)	Fourteen level categorical age variable	2012-2015 BRFSS
Employment Status (EMPLOY1)	Categorical variable indicating employment status	2012-2015 BRFSS
Race/Ethnicity (_RACEGR3)	5-Level Race/ethnicity variable	2012-2015 BRFSS
Marital Status (MARITAL)	Categorical marital status variable	2012-2015 BRFSS
Education (EDUCA)	Categorical education level variable	2012-2015 BRFSS
Income (INCOME2)	Categorical household income from all sources	2012-2015 BRFSS

Table B-2. Aim 2 Variables, 2013-2014 Medical Expenditure Panel Survey (MEPS)

Variable	Definition	Data Source
Dependent (Outcomes)		
Emergency Department Visits (ERTOTAL)	Total number of emergency room visits	2013-2014 MEPS HC Event Files, Emergency Room Visits File
Hospitalizations through the Emergency Department (EMERROOM)	Binary variable that Identifies hospital stays originating from the Emergency Department	2013-2014 MEPS HC Hospital Inpatient Stays File
ICD-9-CM Code for Conditions and/or Procedure (ICD9CODX)	Fully specified ICD-9 codes. Used to identify Ambulatory Care Sensitive Conditions	2013-2014 MEPS HC Medical Conditions File or the encrypted Fully Specified ICD-9 codes (if approved by MEPS)
Person ID (DUPERSID)	Used to append person-level information such as the Emergency room visit events to the Medical Conditions File	2013-2014 MEPS Household Component Files
Independent Variable		
Post-Medicaid Expansion (POST*EXP)	Interaction term developed based on the confidential and non-public use state variable, STATE COUNTY FIPS CODES, the event date month and year (ERDATEMM, ERDATEYR) in the Emergency Room Visits File and the event start date month and year (IPBEGMM, IPBEGYR) in the hospital inpatient stays file	2013-2014 State/County FIPS codes, MEPS HC Event Files, Emergency Room Visits Files, Hospital Inpatient Stays File

Table B-2. Continued

Explanatory Variables		
Sex (SEX)	Categorical variable indicating Male or Female	2013-2014 MEPS HC Full Year Consolidated Files
Age (AGELAST)	Continuous age variable	2013-2014 MEPS HC Full Year Consolidated Files
Race/Ethnicity (RACETHX)	5-Level Race/ethnicity variable	2013-2014 MEPS HC Full Year Consolidated Files
Education (EDUYRDG)	Categorical education level variable	2013-2014 MEPS HC Full Year Consolidated Files
Insurance Status (INSCOV13/INSCOV14)	Categorical insurance status variable	2013-2014 MEPS HC Full Year Consolidated Files
Employment (EMPST31/EMPST41/EMPST53)	Categorical employment status variable	2013-2014 MEPS HC Full Year Consolidated Files
Poverty Level (POVLEV13/POVLEV14)	Family Income as a percentage of poverty line	2013-2014 MEPS HC Full Year Consolidated Files

APPENDIX C
STUDY METHODS: REGRESSION MODELS

Aim 1 Regression Models

Table C-1. Logit Regression: Probability of being insured, having a usual source of care and having timely checkup for individuals with ambulatory care sensitive conditions living in expansion states post-Medicaid expansion

Individuals with ACSC	Difference-in-Differences	
	Unadjusted (95% CI) [a]	Adjusted (95% CI) [a,b]
Insurance Status		
Uninsured	Ref	Ref
Insured	0.57 (0.32, 0.82)***	0.54 (0.24, 0.83)***
Usual Source of Care		
No Usual Source of Care	Ref	Ref
Usual Source of Care	0.07 (-0.19, 0.32)	0.11 (-0.19, 0.41)
Timely Check-Up		
Untimely Check-up	Ref	Ref
Timely Check-up	0.02 (-0.18, 0.22)	0.05 (-0.19, 0.28)

[a] Adjusted for gender, race/ethnicity, age, marital status, education, occupation, and income
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table C-2. Logit Regression: Probability of being insured, having a usual source of care and having timely checkup for individuals with 2 or more ambulatory care sensitive conditions living in expansion states post-Medicaid expansion

Individuals with ≥ 2 ACSC	Difference-in-Differences	
	Unadjusted (95% CI) [a]	Adjusted (95% CI) [a,b]
Insurance Status		
Uninsured	Ref	Ref
Insured	0.44 (-0.06, 0.94)	0.22 (-0.35, 0.79)
Usual Source of Care		
No Usual Source of Care	Ref	Ref
Usual Source of Care	0.18 (-0.34, 0.70)	-0.06 (-0.66, 0.54)
Timely Check-Up		
Untimely Check-up	Ref	Ref
Timely Check-up	0.07 (-0.31, 0.44)	0.11 (-0.35, 0.57)

[a] Adjusted for gender, race/ethnicity, age, marital status, education, occupation, and income
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table C-3. Logit Regression: Probability of being insured, having a usual source of care and having timely checkup for individuals with asthma living in expansion states post-Medicaid expansion

Individuals with Asthma	Difference-in-Differences	
	Unadjusted (95% CI) [a]	Adjusted (95% CI) [a,b]
Insurance Status		
Uninsured	Ref	Ref
Insured	0.64 (0.34, 0.94)***	0.56 (0.21, 0.91)**
Usual Source of Care		
No Usual Source of Care	Ref	Ref
Usual Source of Care	0.19 (-0.11, 0.50)	0.29 (-0.08, 0.66)
Timely Check-Up		
Untimely Check-up	Ref	Ref
Timely Check-up	0.04 (-0.20, 0.29)	0.00 (-0.29, 0.29)

[a] Adjusted for gender, race/ethnicity, age, marital status, education, occupation, and income
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table C-4 Logit Regression: Probability of being insured, having a usual source of care and having timely checkup for individuals with COPD living in expansion states post-Medicaid expansion

Individuals with COPD	Difference-in-Differences	
	Unadjusted (95% CI) [a]	Adjusted (95% CI) [a,b]
Insurance Status		
Uninsured	Ref	Ref
Insured	0.44 (0.05, 0.83)*	0.48 (0.03, 0.93)*
Usual Source of Care		
No Usual Source of Care	Ref	Ref
Usual Source of Care	-0.12 (-0.48, 0.25)	-0.23 (-0.66, 0.21)
Timely Check-Up		
Untimely Check-up	Ref	Ref
Timely Check-up	-0.03 (-0.31, 0.24)	0.12 (-0.20, 0.44)

[a] Adjusted for gender, race/ethnicity, age, marital status, education, occupation, and income
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table C-5. Logistic Regression: Probability of being insured, having a usual source of care and having timely checkup for individuals with diabetes complications living in expansion states post-Medicaid expansion

Individuals with Diabetes Complications	Difference-in-Differences	
	Unadjusted (95% CI) [a]	Adjusted (95% CI) [a,b]
Insurance Status		
Uninsured	Ref	Ref
Insured	0.14 (-0.49, 0.77)	-0.29 (-1.08, 0.50)
Usual Source of Care		
No Usual Source of Care	Ref	Ref
Usual Source of Care	-0.32 (-1.05, 0.41)	-0.55 (-1.53, 0.44)
Timely Check-Up		
Untimely Check-up	Ref	Ref
Timely Check-up	0.14 (-0.44, 0.72)	0.18 (-0.53, 0.89)

[a] Adjusted for gender, race/ethnicity, age, marital status, education, occupation, and income
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Aim 2 Regression Models

Table D-1. Logit Regression: Probability of having had an ACSC-associated hospitalization through the ED for low-income individuals living in expansion states post-Medicaid expansion

ED Hospitalizations	Difference-in-Differences	
	Unadjusted (95% CI) [a]	Adjusted (95% CI) [a,b]
ACSC-associated		
No	Ref	Ref
Yes	0.58 (0.11, 1.06)*	0.84 (0.26, 1.41)**
COPD-associated		
No	Ref	Ref
Yes	0.72 (-0.06, 1.51)	-0.63 (-1.52, 0.26)
Asthma-associated		
No	Ref	Ref
Yes	-0.37 (-0.90, 0.16)	0.42 (-0.34, 1.19)
CHF-associated		
No	Ref	Ref
Yes	0.84 (-0.28, 1.96)	2.11 (-1.97, 6.19)
UTI-associated		
No	Ref	Ref
Yes	0.35 (-0.33, 1.04)	0.72 (-0.27, 1.70)

[a] Adjusted for gender, race/ethnicity, age, insurance status, education, and employment status
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table D-2. Negative Binomial Regression: DID estimators for change in ACSC-associated ED visits for low-income individuals living in expansion states post-Medicaid expansion

ED Visits	Difference-in-Differences	
	Unadjusted (95% CI) [a]	Adjusted (95% CI) [a,b]
ACSC-associated		
No	Ref	Ref
Yes	-0.83 (-1.32, -0.35)**	-0.87 (-1.42, -0.32)**
COPD-associated		
No	Ref	Ref
Yes	-0.84 (-2.05, 0.03)	-1.27 (-2.90, 0.36)
Asthma-associated		
No	Ref	Ref
Yes	-0.27 (-0.87, 0.33)	-0.34 (-1.30, 0.63)
CHF-associated		
No	Ref	Ref
Yes	-1.04 (-2.23, 0.15)	-2.08 (-3.95, -0.20)*
UTI-associated		
No	Ref	Ref
Yes	-1.56 (-2.40, -0.72)***	-2.44 (-3.54, -1.34)***

[a] Adjusted for gender, race/ethnicity, insurance status, and age
[b] All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table D-3. Generalized Linear Model: DID estimators for change in asthma-associated length of stay (LOS) for low-income individuals living in expansion states post-Medicaid expansion

Length of Stay	Difference-in-Differences	
	Unadjusted (95% CI) [a]	Adjusted (95% CI) [a,b]
Asthma-associated		
No	Ref	Ref
Yes	-0.11 (-1.13, 0.91)	0.20 (-0.49, 0.88)

[a] Adjusted for gender, race/ethnicity, insurance status, age, and education
[b] All estimates were calculated using survey weights
*******Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
***** Indicates significant differences at P < 0.05

APPENDIX D
AIM 1 MARGINS PLOTS

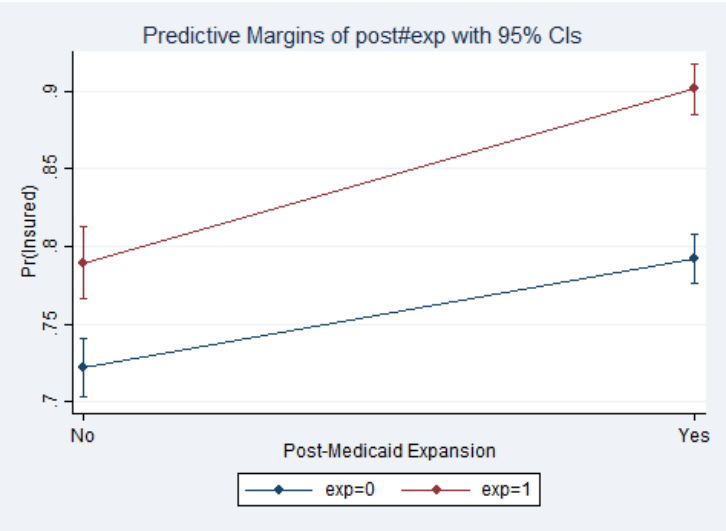

Figure D-1. Margins plot indicating the change in insurance among low-income nonelderly adults with ACSC by Medicaid Expansion Status, Pre-Post Medicaid Expansion

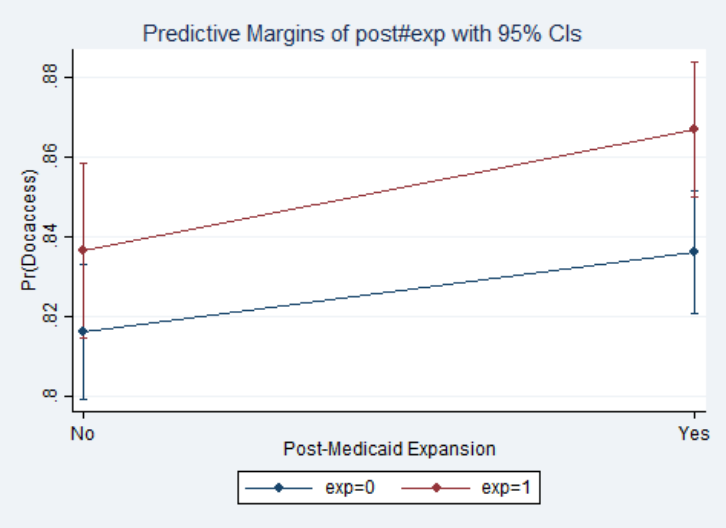

Figure D-2. Margins plot indicating the change in usual source of care among low-income nonelderly adults with ACSC by Medicaid Expansion Status, Pre-Post Medicaid Expansion

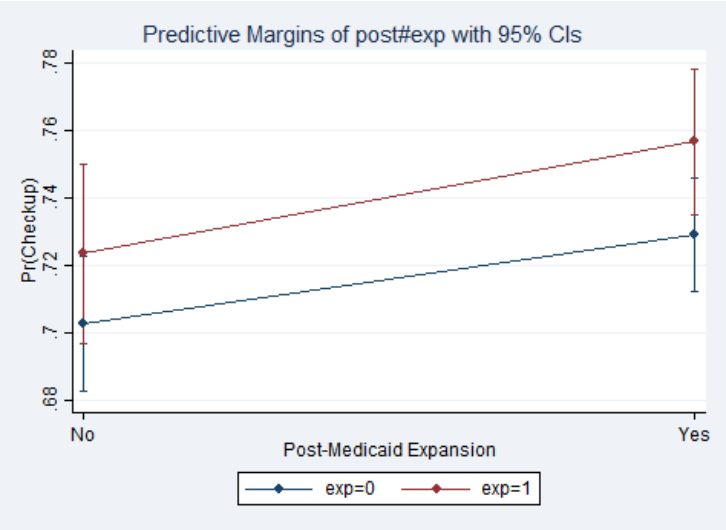

Figure D-3. Margins plot indicating the change in timely checkups among low-income nonelderly adults with ACSC by Medicaid Expansion Status, Pre-Post Medicaid Expansion

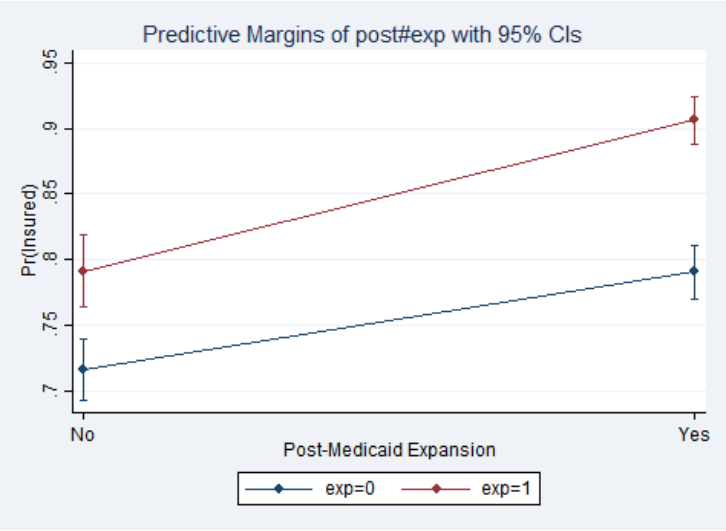

Figure D-4. Margins plot indicating the change in insurance among low-income nonelderly adults with asthma by Medicaid Expansion Status, Pre-Post Medicaid Expansion

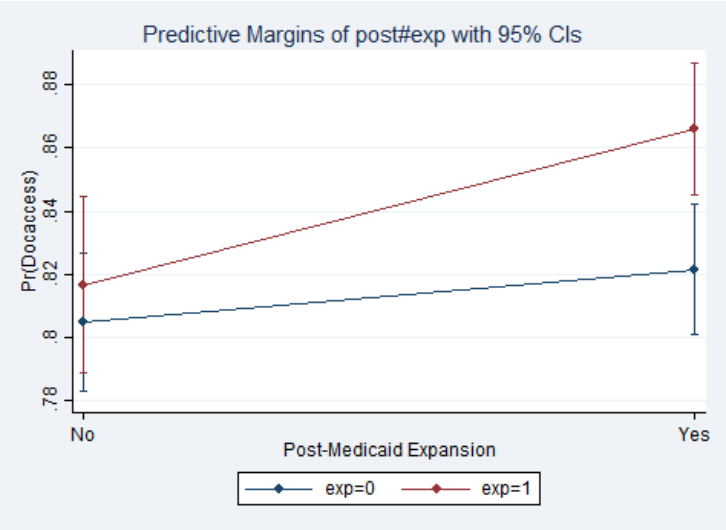

Figure D-5. Margins plot indicating the change in usual source of care among low-income nonelderly adults with asthma by Medicaid Expansion Status, Pre-Post Medicaid Expansion

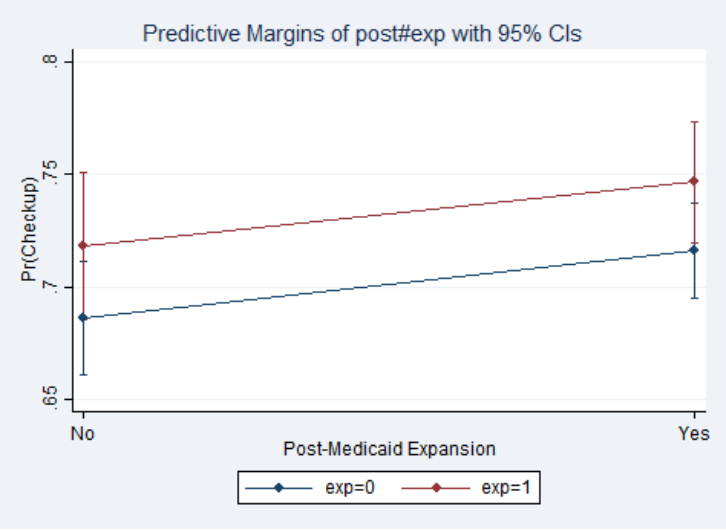

Figure D-6. Margins plot indicating the change in timely checkups among low-income nonelderly adults with asthma by Medicaid Expansion Status, Pre-Post Medicaid Expansion

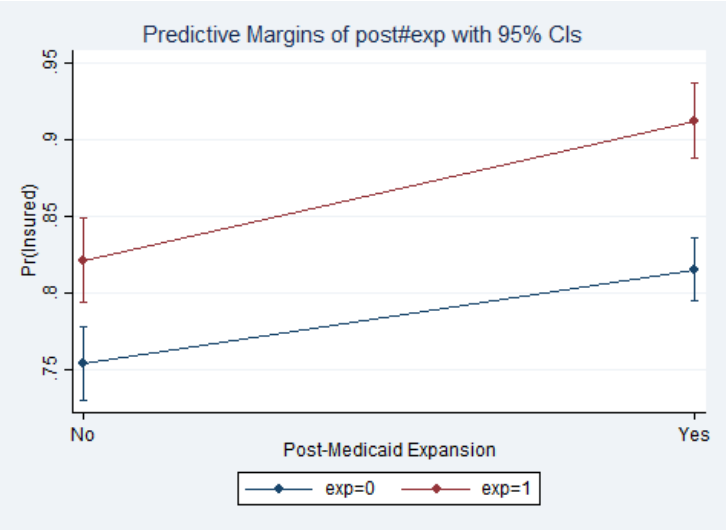

Figure D-7. Margins plot indicating the change in insurance among low-income nonelderly adults with COPD by Medicaid Expansion Status, Pre-Post Medicaid Expansion

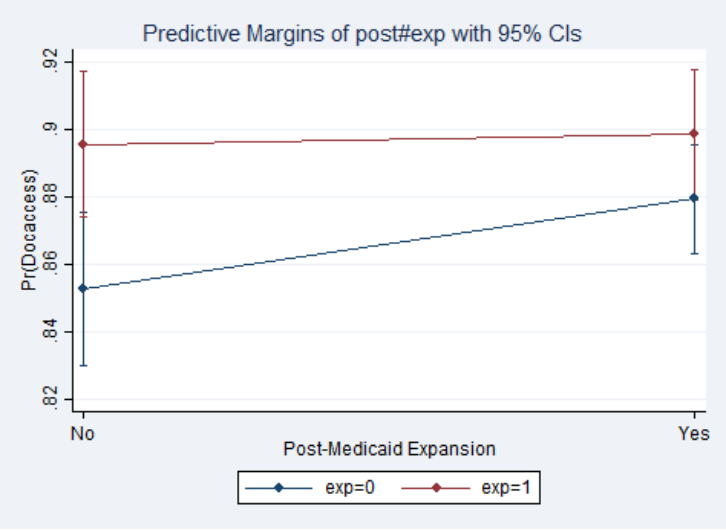

Figure D-8. Margins plot indicating the change in usual source of care among low-income nonelderly adults with COPD by Medicaid Expansion Status, Pre-Post Medicaid Expansion

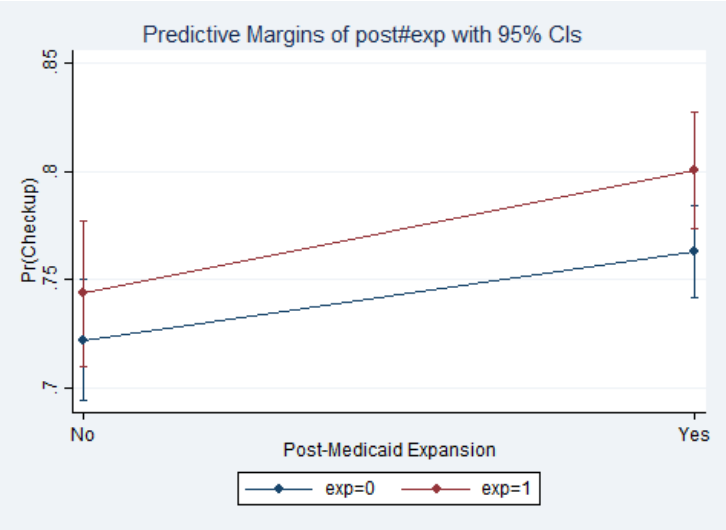

Figure D-9. Margins plot indicating the change in timely checkups among low-income nonelderly adults with COPD by Medicaid Expansion Status, Pre-Post Medicaid Expansion

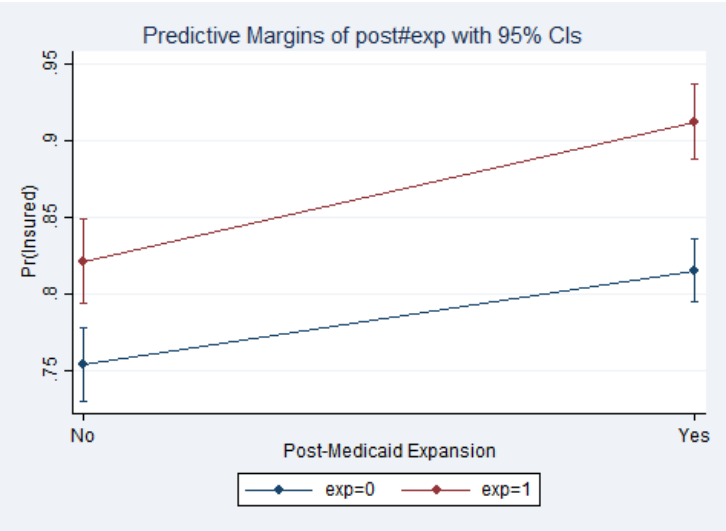

Figure D-10. Margins plot indicating the change in insurance among low-income nonelderly adults with diabetes complications by Medicaid Expansion Status, Pre-Post Medicaid Expansion

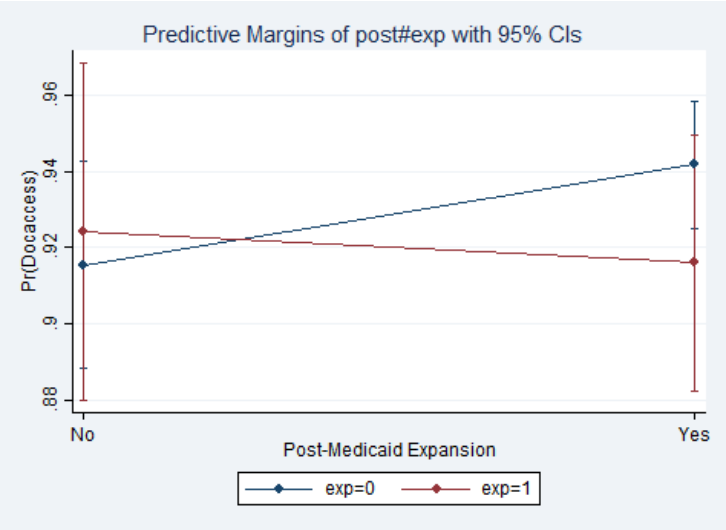

Figure D-11. Margins plot indicating the change in usual source of care among low-income nonelderly adults with diabetes complications by Medicaid Expansion Status, Pre-Post Medicaid Expansion

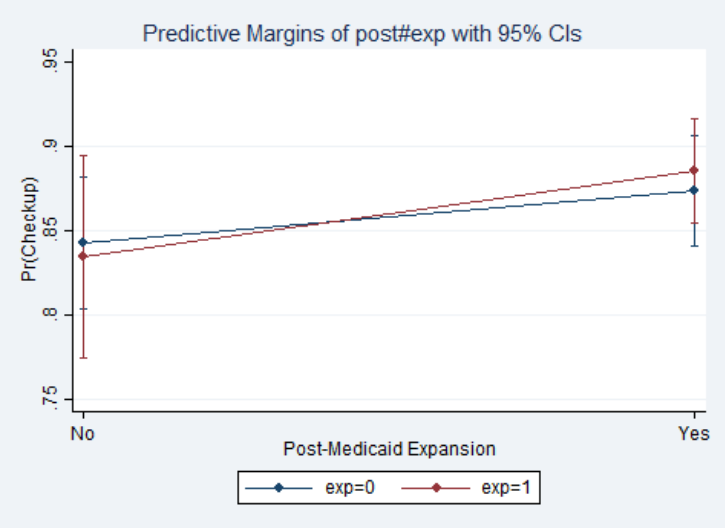

Figure D-12. Margins plot indicating the change in timely checkups among low-income nonelderly adults with diabetes complications by Medicaid Expansion Status, Pre-Post Medicaid Expansion

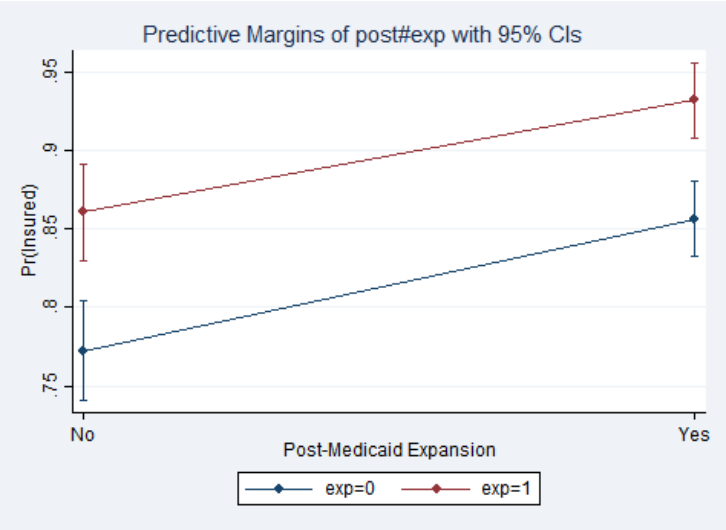

Figure D-13. Margins plot indicating the change in insurance among low-income nonelderly adults with multi-ACSC by Medicaid Expansion Status, Pre-Post Medicaid Expansion

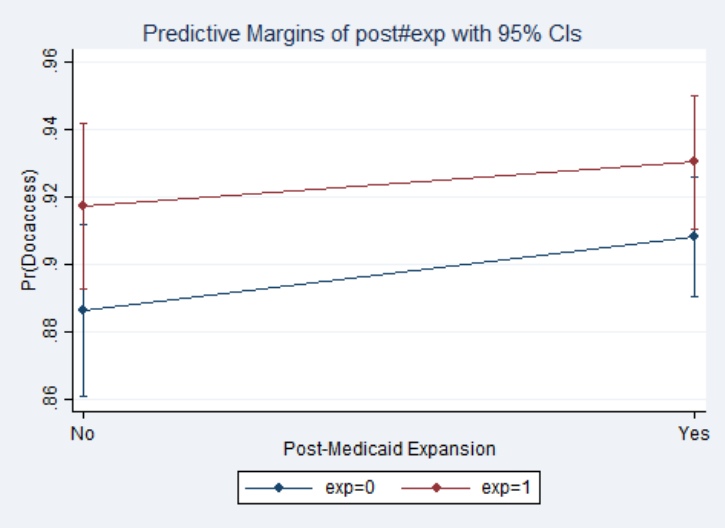

Figure D-14. Margins plot indicating the change in usual source of care among low-income nonelderly adults with multi-ACSC by Medicaid Expansion Status, Pre-Post Medicaid Expansion

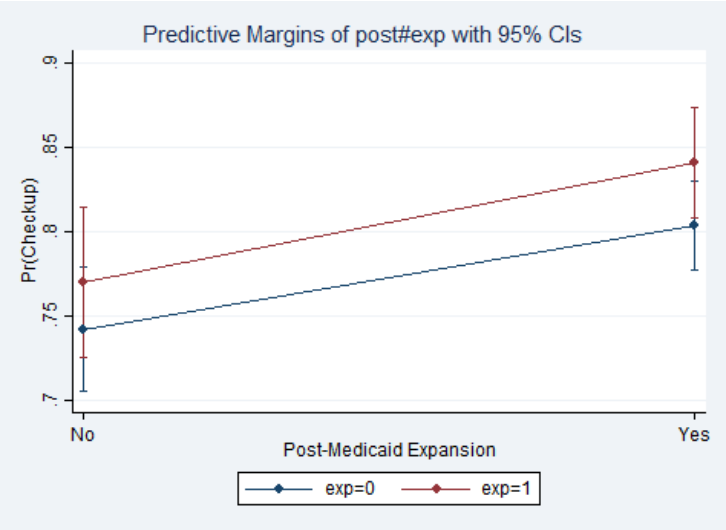

Figure D-15. Margins plot indicating the change in timely checkups among low-income nonelderly adults with multi-ACSC by Medicaid Expansion Status, Pre-Post Medicaid Expansion

APPENDIX E
AIM 2 MARGINS PLOTS

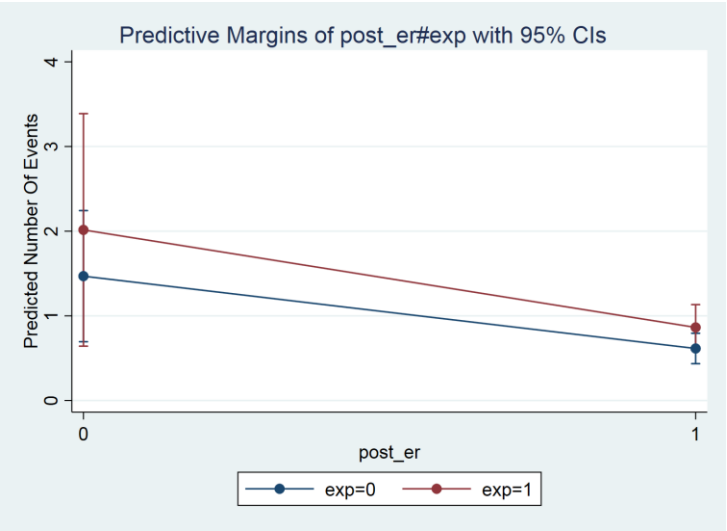

Figure E-1. Margins plot indicating the change in the yearly count of ACSC-associated ED visits among low-income nonelderly adults by Medicaid Expansion Status, Pre-Post Medicaid Expansion

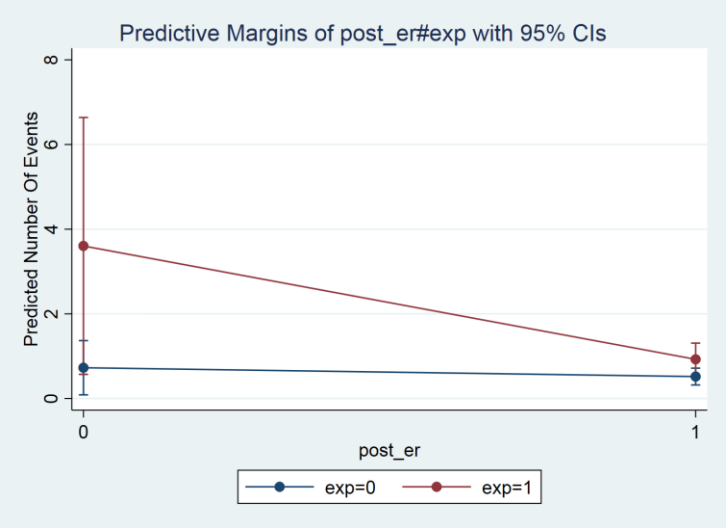

Figure E-2. Margins plot indicating the change in the yearly count of asthma-associated ED visits among low-income nonelderly adults by Medicaid Expansion Status, Pre-Post Medicaid Expansion

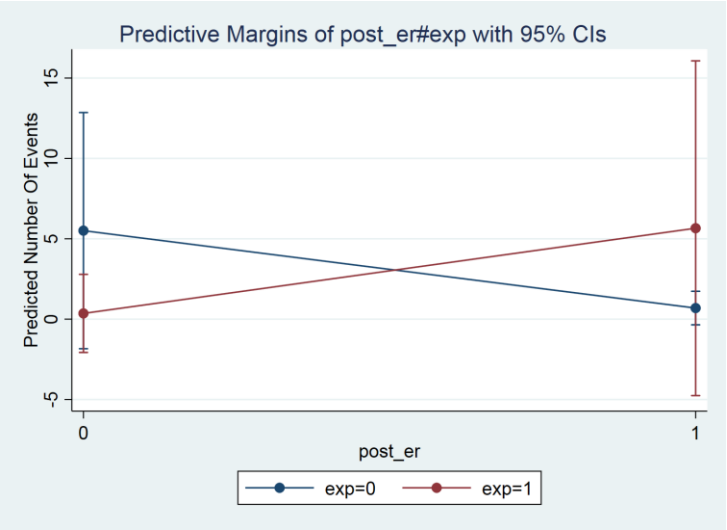

Figure E-3. Margins plot indicating the change in the yearly count of CHF-associated ED visits among low-income nonelderly adults by Medicaid Expansion Status, Pre-Post Medicaid Expansion

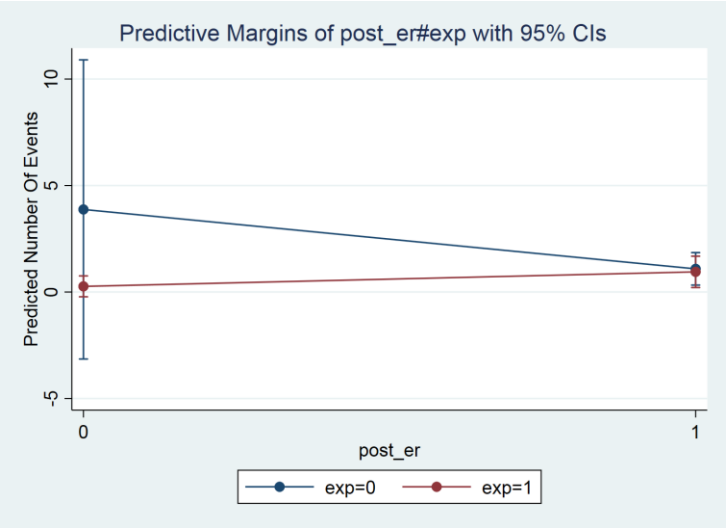

Figure E-4. Margins plot indicating the change in the yearly count of COPD-associated ED visits among low-income nonelderly adults by Medicaid Expansion Status, Pre-Post Medicaid Expansion

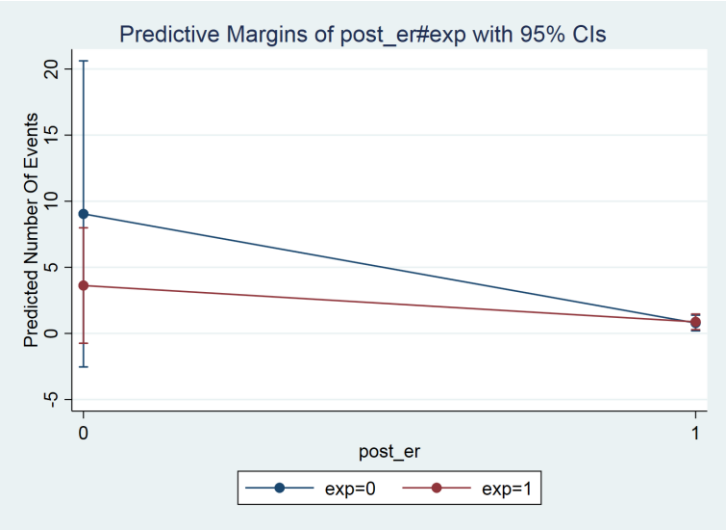

Figure E-5. Margins plot indicating the change in the yearly count of UTI-associated ED visits among low-income nonelderly adults by Medicaid Expansion Status, Pre-Post Medicaid Expansion

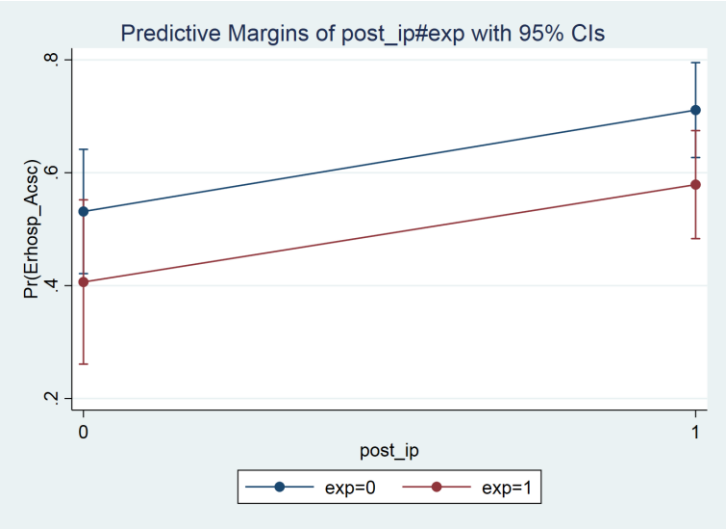

Figure E-6. Margins plot indicating the change in ACSC-associated ED hospitalizations among low-income nonelderly adults by Medicaid Expansion Status, Pre-Post Medicaid Expansion

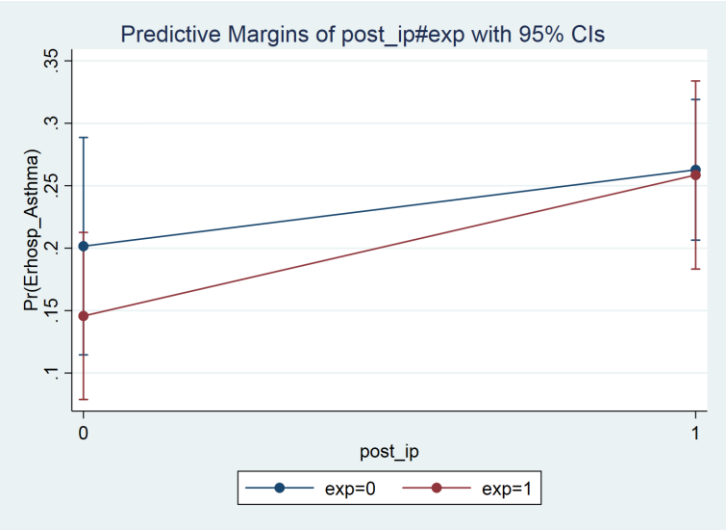

Figure E-7. Margins plot indicating the change in asthma-associated ED hospitalizations among low-income nonelderly adults by Medicaid Expansion Status, Pre-Post Medicaid Expansion

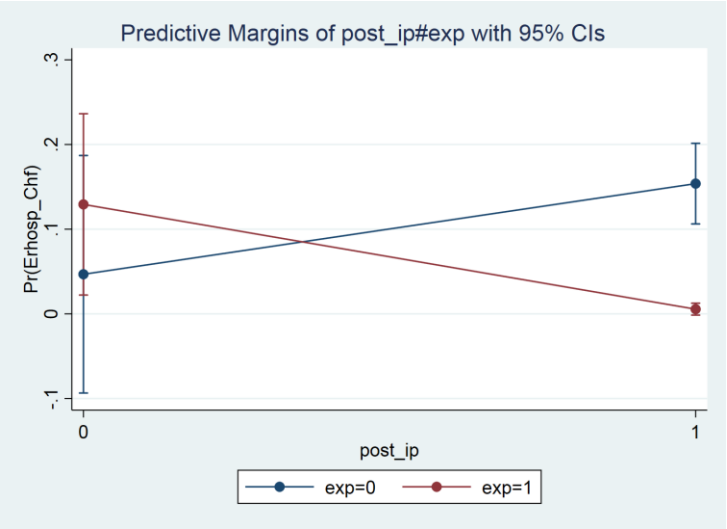

Figure E-8. Margins plot indicating the change in CHF-associated ED hospitalizations among low-income nonelderly adults by Medicaid Expansion Status, Pre-Post Medicaid Expansion

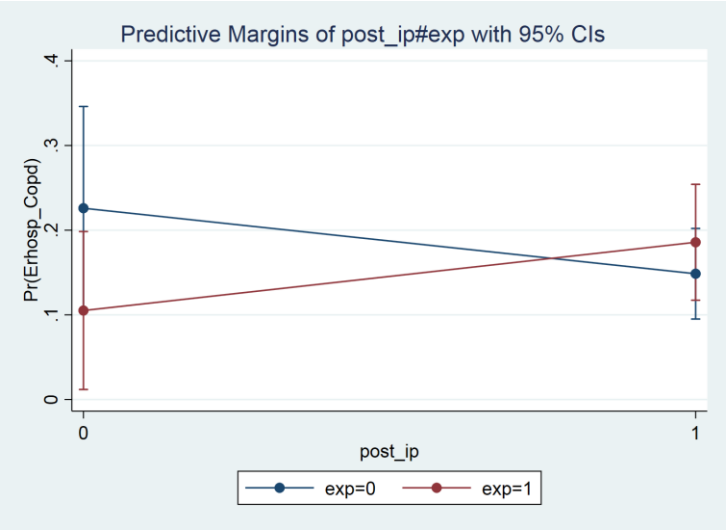

Figure E-9. Margins plot indicating the change in COPD-associated ED hospitalizations among low-income nonelderly adults by Medicaid Expansion Status, Pre-Post Medicaid Expansion

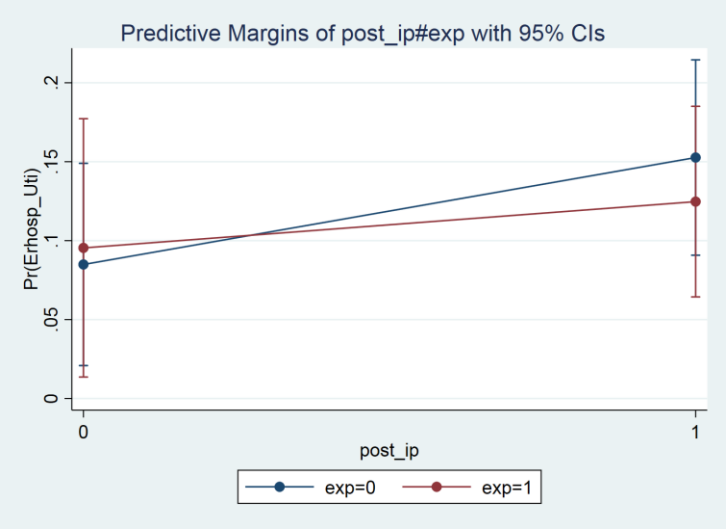

Figure E-10. Margins plot indicating the change in UTI-associated ED hospitalizations among low-income nonelderly adults by Medicaid Expansion Status, Pre-Post Medicaid Expansion

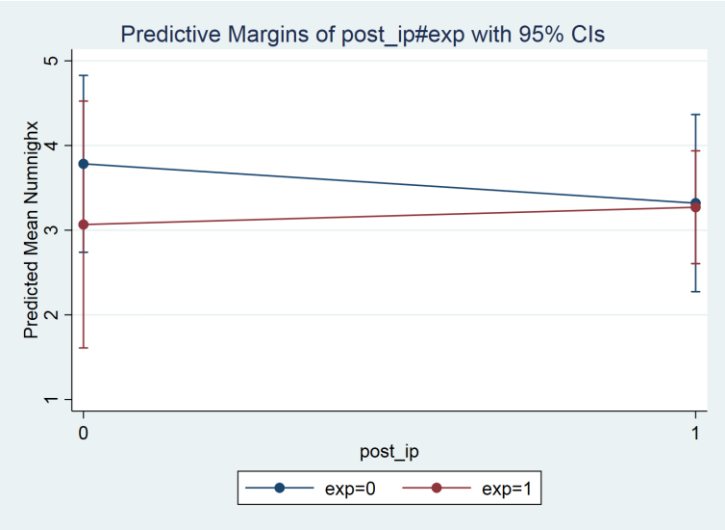

Figure E-11. Margins plot indicating the change in asthma-associated length of stay (LOS) among low-income nonelderly adults by Medicaid Expansion Status, Pre-Post Medicaid Expansion

APPENDIX F
DISCUSSION SECTION SUPPLEMENTAL TABLES

Table F-1. Proportion of Outcome Measures by Medicaid Expansion Status, Pre-Medicaid Expansion

Outcome Measure (%)	Medicaid Expansion Status		
	Non Expansion States	Expansion States	Total
Insurance Status***			
Yes	72.68	77.05	74.50
No	27.32	22.95	25.50
Usual Source of Care			
Yes	83.04	83.51	83.24
No	16.96	16.49	16.76
Timely Check-ups			
Yes	70.28	70.92	70.55
No	29.72	29.08	29.45

Note: All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

Table F-2. Proportion of Outcome Measures by Medicaid Expansion Status, Post-Medicaid Expansion

Outcome Measure (%)	Medicaid Expansion Status		
	Non Expansion States	Expansion States	Total
Insurance Status***			
Yes	79.97	89.93	84.08
No	20.03	10.07	15.92
Usual Source of Care			
Yes	84.44	85.71	84.97
No	15.56	14.29	15.03
Timely Check-ups			
Yes	73.74	74.74	74.15
No	26.26	25.26	25.85

Note: All estimates were calculated using survey weights
***Indicates significant differences at P < 0.001
** Indicates significant differences at P < 0.01
* Indicates significant differences at P < 0.05

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BIOGRAPHICAL SKETCH

Shenae Kimberly Samuels was born in January 1989 in St. Andrew, Jamaica and moved to Florida in June 2014. Shenae obtained a Bachelor of Science in Health Education from the University of Florida in May 2010. After finishing her bachelor's degree, Shenae became interested in the influence of health policy on adverse health behaviors and health outcomes. As a result of this interest, Shenae later pursued and obtained a Master of Public Health with a concentration in public health management and policy in May 2013. Through her Master of Public Health studies, Shenae became further interested in health disparities research and its intersection with health policy. In 2014, Shenae began her PhD studies in health services research at the University of Florida where she further explored her interests in health disparities research. This ultimately led to her dissertation topic focused on the impact of Medicaid expansion on access to care and utilization among individuals with ambulatory care sensitive conditions.