The Impact of Medicaid Expansion on Health Care Access, Utilization, and Health

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Abstract

Under the Affordable Care Act (ACA), 32 states expanded Medicaid coverage to include adults with household incomes up to 138% of the Federal Poverty Level. Today, Medicaid remains a subject of intense state and federal budgetary and policy debates. To analyze the impact of the ACA's Medicaid expansion on adults in poverty, I used national data from the 2011-2016 Behavioral Risk Factor Surveillance System to assess trends in health access, preventive service utilization, and health outcomes. I further stratified the analysis to investigate differential impacts on subpopulations including breakdowns by income, race, and age. As measured by rates of uninsurance, inability to afford doctor visits, and lacking a personal doctor, health care access improved significantly more in states that expanded Medicaid than those that did not. Medicaid expansion was associated with a 5.4% decrease in the uninsured rate and a 1.9% increase in the probability of having a routine checkup in the past 12 months. Whites and adults ages 55-64 experienced some of the greatest gains in health care access and routine checkup utilization. Health status improvement approached significance nationally but was significant among those in the $10,000-$14,999 income group. Medicaid expansion was also associated with increases in diagnoses of high blood pressure and high cholesterol. These findings indicate sustained improvements in access to care and evidence of changes in utilization and health that differ by population subgroups. Federal and state policymakers should weigh these benefits in considering Medicaid reforms and Medicaid expansion adoption.

Introduction

"Medicare and Medicaid did not just make our country better; they reaffirmed its greatness and established a legacy that we must carry forward today," declared President Barack Obama in 2015 (Obama, 2015). Fifty years earlier, President Lyndon B. Johnson signed the Social Security Amendments of 1965 into law, establishing Medicare and Medicaid. As a government safety-net health insurance program, Medicaid initially covered low-income families with children, people who were blind or disabled, and low-income seniors. President Obama would later expand upon Johnson's signature Medicaid law.

Over the years, Medicaid has grown to become the nation's largest insurer. Today, Medicaid insures more than 70 million Americans, including children, pregnant women, and low-income adults (Centers for Medicare & Medicaid Services, 2017). Although jointly funded by the federal government and states, states administer Medicaid under federal guidelines. As a result, each state's Medicaid program differs somewhat in eligibility requirements, benefits, reimbursement rates, and administration.

During the 2008 presidential election, Barack Obama campaigned on a promise to increase access to health care in part through an expansion of Medicaid. On March 23, 2010, President Obama signed into law the Patient Protection and Affordable Care Act (ACA), which expanded Medicaid and subsidized private insurance for Americans with incomes between 100 and 400% of the federal poverty level (FPL). A key provision of the ACA, Medicaid expansion opened eligibility to adults with incomes up to 138% FPL (Snyder, 2015). For enrollment in coverage for 2018, this translate into the annual household income limits in Table 1.

Table 1. Annual household incomes by household size for selected federal poverty level (FPL) percentages

Persons in Household	100% FPL	138% FPL	250% FPL	400% FPL
1	$12,060	$16,642	$30,150	$48,240
2	$16,240	$22,411	$40,600	$64,960
3	$20,420	$28,179	$51,050	$81,680
4	$24,600	$33,948	$61,500	$98,400
5	$28,780	$39,716	$71,950	$115,120
6	$32,960	$45,484	$82,400	$131,840
7	$37,140	$51,253	$92,850	$148,560
8	$41,320	$57,021	$103,300	$165,280
9+	If your household is larger than 8 people, add $4,180 for each additional person.			

Source: ezHealthmart

The federal government funded 100% of the cost of expansion from 2014 to 2016 but has and will continue reducing its share to 90% by 2020 (Snyder, 2015). States would gradually increase their cost share to 10% of the added cost of insuring newly-eligible Medicaid beneficiaries by 2020.

In July 2012, the U.S. Supreme Court, in *National Federation of Independent Business v. Sebelius*, held that the ACA's mandated Medicaid expansion unconstitutionally coerced states and exceeded Congress's authority under the spending clause. The ruling enabled individual states to decline Medicaid expansion. As of today, 32 states, including the District of Columbia, have expanded Medicaid, while 19 have not ("Medicaid and CHIP Eligibility Levels," 2016).

Although expansion under the ACA was officially set to begin in 2014, the ACA offered states the option to expand Medicaid earlier than 2014 for some low-income childless adults.

Among the few states that accepted the early offer, most expanded partially with full implementation in 2014. In 2010, Connecticut and the District of Columbia became the first states to expand their Medicaid programs under the early option. California, Minnesota, New Jersey, and Washington followed with expansions in 2011. The vast majority of expansion states implemented Medicaid expansion in January 2014. Some states expanded later in the year or in subsequent years.

Opt-out states are generally Republican-controlled. Republican state legislatures cite the reduction in federal expansion funding over time, uncertainty of long-term federal funding, and opposition in principle to larger government entitlements as reasons for opting out. In particular, state policymakers worry that a potential repeal and replacement of the ACA would compromise federal Medicaid funding and leave states with either greater financial burden or the political cost of slashing benefits.

More recently in the summer of 2017, the Republican-controlled Congress attempted to repeal and replace the ACA, including its Medicaid expansion provision. The House of Representatives introduced the American Health Care Act and the Senate introduced the Better Care Reconciliation Act. While the House version passed on a party-line vote, the Senate bill narrowly failed when three of the 52 Republican senators voted against the bill. Although Medicaid expansion survived these repeal attempts, many in Congress vow to reform Medicaid through cuts to Medicaid funding and transitioning the program to block grants to states. In addition, Seema Verma, Administrator of the Centers for Medicare and Medicaid Services (CMS), has proposed reforms through the federal rule-making process (Verma, 2017).

As political leaders continue debating the future of the Medicaid program, researchers continue to evaluate the impact of Medicaid expansion. In expanding Medicaid, the ACA sought

to improve the health of Americans through expanding health insurance coverage and increasing access to medical care. My analysis investigates how health care access, preventive service utilization, and health outcomes have changed, as well as what demographic subgroups have benefited most from Medicaid expansion.

Main Question

The central question of this research is, “What is the impact of Medicaid expansion under the Affordable Care Act on health access, preventive service utilization, and health outcomes nationally and in particular populations?”

This thesis seeks to (1) quantify any differences observed between expansion and non-expansion states in the years before and after the ACA Medicaid expansion, and (2) examine the differential impact of Medicaid expansion on demographic subgroups by income level, race, age group, and urban/rural residence.

Health access in this paper is defined as rates of uninsurance, inability to afford doctor visits, and lacking a personal doctor (Centers for Disease Control and Prevention, 2016; Griffith, Evans, & Bor, 2017). Preventive service utilization is defined as having a routine checkup, flu shot, HIV test, blood pressure check, and cholesterol check. Health outcomes are defined as self-reported health status, days of poor physical health per 30 days, days when poor physical or mental health limited usual activities per 30 days, prevalence of each of the 13 chronic illnesses, and an individual’s number of total chronic illnesses. These outcomes are further described in the methods section.

Theoretical Framework

In this section, I review the literature on what is currently known about (1) Medicaid expansion's impact on insurance coverage; (2) impact on other health care access measures and utilization (3) the Oregon Health Insurance Experiment; (4) health outcomes from previous state Medicaid expansions; (5) ACA Medicaid expansion and health outcomes; and (6) gaps in knowledge.

Impact on Insurance Coverage

It is well-established that the Affordable Care Act has reduced the uninsured rate (Frean, Gruber, & Sommers, 2017; Sommers, Gawande, & Baicker, 2017). Regarding the ACA's Medicaid expansion provision specifically, multiple studies have confirmed an association between Medicaid expansion status and reduced uninsurance (McMorrow, Kenney, Long, & Anderson, 2015; Sommers, Gunja, Finegold, & Musco, 2015). On average, expansion states experienced a 5.2% greater decrease in uninsurance than non-expansion states (Sommers et al., 2015). The association was even more pronounced among young adults ages 19-25; from 2013 through the first half of 2014, the young adult uninsurance rate fell 8.9% nationally, with an even greater—10.2%— drop in Medicaid expansion states (McMorrow et al., 2015).

Frean et al. 2017 quantified the contribution of Medicaid expansion to the observed reductions in uninsurance. Among the newly-eligible, Medicaid expansion increased coverage by 9% and 14% in 2014 and 2015, respectively, and accounted for 12% of the ACA's total effect on the uninsurance rate (Frean et al., 2017). The study attributed an even greater 18% coverage increase to new enrollment of those previously eligible for pre-ACA Medicaid. The authors credit this result to the so-called "woodwork effect," in which the ACA's publicity prompted those previously unaware or unmotivated to enroll in Medicaid under standard eligibility criteria.

The effect was observed in all states, regardless of expansion status. Consequently, studies of Medicaid expansion's effect on health outcomes should consider whether any observed changes are attributable to expanded eligibility or are influenced by increased participation under the pre-ACA Medicaid eligibility.

Impact on Health Care Access and Utilization

Multiple studies have established that the ACA and its Medicaid expansion have improved access to care in terms of insurance coverage, affordability of care, and access to physicians (Decker, Lipton, & Sommers, 2017; Frean et al., 2017; Griffith et al., 2017; McMorrow et al., 2015; Shartzer, Long, & Anderson, 2016; Sommers et al., 2015). Studies comparing expansion and non-expansion states have found a change in the hospital payer mix, improved patients' reported affordability of care, and reduced out-of-pocket expenditures (Dranove, Garthwaite, & Ody, 2016; Miller & Wherry, 2017; Sommers, Gawande, et al., 2017; Sommers et al., 2015; Sommers, Maylone, Blendon, Orav, & Epstein, 2017).

Studies also suggest increases in utilization of some preventive services, although the evidence is sometimes mixed (Dranove et al., 2016; Simon, Soni, & Cawley, 2017; Sommers, Maylone, et al., 2017; Wherry & Miller, 2016). For instance, studies have found conflicting evidence on expansion's impact on primary care visits (Miller & Wherry, 2017; Shartzer et al., 2016; Simon et al., 2017; Wherry & Miller, 2016). With at most two years of post-expansion data in these studies, the different findings may reflect developing changes not yet detectable in every health care utilization survey. A recent review that considered studies of both the ACA's Medicaid expansion and earlier coverage expansions concluded that expanding coverage generally increases access to care and utilization of health care services (Sommers, Gawande, et

al., 2017). Studies with more recent data are needed to better understand how the ACA's Medicaid expansion specifically impacts health care utilization behavior.

Oregon Health Insurance Experiment

In the landmark 2008 Oregon Health Insurance Experiment on Medicaid coverage expansion, the state of Oregon randomly gave Medicaid eligibility to some low-income, able-bodied adults through a lottery ("Oregon Health Study," n.d.). In this randomized controlled trial, health access, utilization, and health outcomes were measured and compared between those who won the lottery and those who did not.

The Oregon Experiment found mixed results. In the first two years, studies found no significant improvements in physical health outcomes, such as blood pressure, hypertension, and cholesterol (Baicker et al., 2013). Medicaid coverage did result in increased diagnoses of diabetes and depression. There was also increased utilization of medication and preventive services, as well as near elimination of catastrophic out-of-pocket expenditures (Baicker et al., 2013). Furthermore, a greater proportion of Medicaid enrollees reported having improvements in one-year health-related quality of life and mental-health compared to the control group, but no differences were observed in self-reported physical health or happiness (Baicker et al., 2013). These results suggest that a national Medicaid expansion such as the ACA's may have different effects on self-reported health and quality of life.

However, the Oregon Experiment participants differ from those covered under ACA Medicaid expansion. The Oregon experiment included adults up to 100% FPL, while the ACA expansion covers those up to 138% FPL. Oregon's population also differs from the national population in terms of race, poverty, uninsurance rate, disability, and population density ("QuickFacts Oregon," n.d.). Furthermore, each state's unique administration of Medicaid

affects the program's impact on patients. As a result, Oregon provides some insight into potential outcomes but is not a perfect predictor of health outcomes in a national expansion of Medicaid.

Early State Expansions

Prior to the ACA, several states unilaterally expanded Medicaid eligibility. These case studies offer further insight to how expansion influences health. New York, Maine, and Arizona expanded their Medicaid programs in September 2001, November 2001, and October 2002, respectively. All three states extended coverage to childless adults up to 100% FPL. Arizona and New York further covered parents with incomes up to 200% and 150% FPL, respectively.

When compared to their neighbor states without expansion, these three states saw improvements in all-cause mortality and self-reported health status (Sommers, Baicker, & Epstein, 2012). Medicaid expansion was associated with a 6.1% — or 19.6 deaths per 100,000 — reduction in adjusted mortality (Sommers et al., 2012). Expansion was also associated with a 2.9% decrease in the rate of delayed care due to cost, as well as significant increases in rates of self-reported "excellent" or "very good" health (Sommers et al., 2012).

With an analysis period from five years before expansion to five years after, Sommers *et al.* 2012 offers insight into the longitudinal effects of expansion. The study observed a gradually increasing magnitude of mortality reduction from the time of expansion implementation. If this pattern holds true for the ACA's Medicaid expansion, then the impact on mortality and other health measures may take years to become observable or manifest fully.

In 2006, Massachusetts expanded its Medicaid program to children in families with household income up to 300% FPL as part of a larger reform that also included subsidized private insurance for adults up to 300% FPL and an individual mandate for insurance coverage. Although not an expansion of Medicaid to childless adults, Massachusetts's subsidized health

care increased access to insurance for many low-income adults who would theoretically qualify for an ACA-type Medicaid expansion. The reforms were associated with improvements in both physical and mental health, as well as increased utilization of certain preventive services (Van Der Wees, Zaslavsky, & Ayanian, 2013).

Together, the results of these pre-ACA coverage expansions suggest that a national Medicaid expansion would improve public health but benefits might take time to develop.

Medicaid Expansion and Health Outcomes

The impact of the ACA's Medicaid expansion on health outcomes is less clear. To date, few studies have addressed this question, and the findings often conflict.

Upon implementation of the ACA, inpatient mortality improved significantly for insured individuals, regardless of payer, but not for the uninsured in both expansion and non-expansion states (Anderson et al., 2016). Changes in mortality pre- and post-ACA did not differ between hospitals in expansion and non-expansion states. The data suggest that post-ACA insurance status is associated with reduced mortality and that Medicaid expansion status likely did not hurt the insured population's overall mortality.

National studies have found some or no improvement in self-reported health status as a result of Medicaid expansion (Miller & Wherry, 2017; Simon et al., 2017; Sommers, Blendon, Orav, & Epstein, 2016; Wherry & Miller, 2016). However, these analyses only extend to the second year of Medicaid expansion. Discernible changes in health outcomes may take years to develop and manifest in the data.

An analysis of Kentucky (expansion), Arkansas (expansion), and Texas (non-expansion) that included three years of post-expansion data did find an association between expansion and improved self-reported health status (Sommers, Maylone, et al., 2017). At two years post-

expansion, the authors found increased access to primary care, reduced ED visits, increased outpatient visits, and increased chronic disease management (Sommers et al., 2016). The discrepancy in health status findings between this study and national studies indicate that further long-range research on health outcomes is needed.

Medicaid expansion studies have found increased diagnoses of some chronic diseases. Two found increased diagnoses of diabetes (Kaufman, Chen, Fonseca, & McPhaul, 2015; Wherry & Miller, 2016) and one for high cholesterol (Wherry & Miller, 2016). These increases are interpreted as discovery of undiagnosed existing cases as opposed to actual increases in disease prevalence due to Medicaid expansion.

Gaps in Knowledge

As Congress considers reforms to the eligibility, payment structure, and administration of Medicaid, studying the longer-term impacts of Medicaid expansion is important for informing future policymaking. To date, few studies of Medicaid expansion have used high-quality data beyond 2015. Adding newly available data from 2016, my study's objectives are two-fold: 1) help clarify the impact of Medicaid expansion on health care access, preventive service utilization, and health outcomes and 2) investigate the differential impact of Medicaid expansion by income group, race, age group, and urban/rural residence.

This is the first research study to comprehensively investigate how Medicaid expansion affects health care access, preventive service utilization, and health measures using one dataset with three years of post-Medicaid expansion data. In addition, I analyze chronic illness diagnoses measures not previously examined by other studies on a national scale. Finally, the analysis breaks down changes in outcomes by several demographic variables to elucidate how population subgroups benefit differently from Medicaid expansion.

Methods & Data

Study Design & Data Source

A difference-in-differences study design was used to estimate the differences between expansion and non-expansion states in the change in outcomes pre- and post-Medicaid expansion. I used data from the 2011-2016 Behavioral Risk Factor Surveillance System (BRFSS), a publicly available dataset from the Centers for Disease Control and Prevention. BRFSS is a national telephone survey of health that includes questions on health-related behaviors, chronic health conditions, and use of preventive services with more than 400,000 adult respondents annually. I merged cross-sectional data from each year into one dataset for time-series analysis.

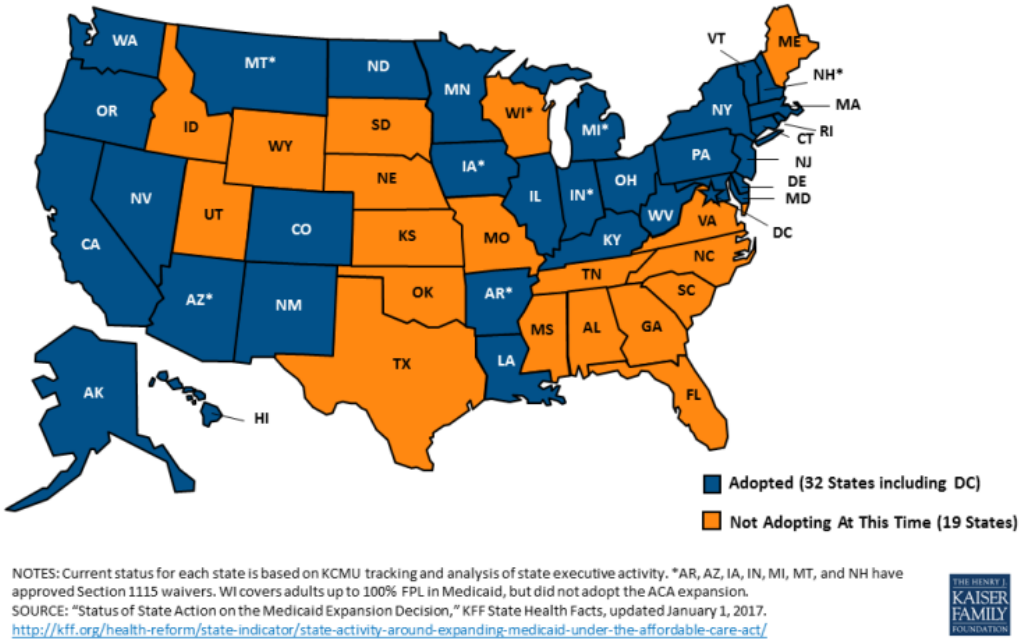
Inclusion Criteria

Respondents in 46 states were included in my sample. State expansion status was determined based on the Center for Medicare & Medicaid Services published State Medicaid and CHIP Income Eligibility Standards ("Medicaid and CHIP Eligibility Levels," 2016). Figure 1 geographically depicts expansion and non-expansion states.

The 32 expansion states are Alaska (9/1/2015), Arizona, Arkansas, California, Colorado, Connecticut, Delaware, District of Columbia, Hawaii, Illinois, Iowa, Kentucky, Louisiana (7/1/2016), Maryland, Massachusetts, Montana (1/1/2016), Minnesota, Nevada, New Jersey, New Mexico, New York, North Dakota, Ohio, Oregon, Rhode Island, Vermont, Washington, West Virginia, and Michigan (4/1/2014), New Hampshire (8/15/2014), Pennsylvania (1/1/2015), and Indiana (2/1/2015). All listed states expanded in January 2014 except those with alternative dates listed. The 19 non-expansion states were defined as Alabama, Florida, Georgia, Idaho, Kansas, Maine, Mississippi, Missouri, Nebraska, North Carolina, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Wisconsin, and Wyoming.

Of the 32 expansion states, I excluded four states (DE, NY, MA, and VT) and the District of Columbia from my sample because they already provided coverage options for low-income adults prior to Medicaid expansion.

Figure 1. Map of the current status of state Medicaid Expansion decisions



NOTES: Current status for each state is based on KCMU tracking and analysis of state executive activity. *AR, AZ, IA, IN, MI, MT, and NH have approved Section 1115 waivers. WI covers adults up to 100% FPL in Medicaid, but did not adopt the ACA expansion.
SOURCE: "Status of State Action on the Medicaid Expansion Decision," KFF State Health Facts, updated January 1, 2017.
http://kff.org/health-reform/state-indicator/state-activity-around-expanding-medicaid-under-the-affordable-care-act/

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I included respondents between the ages of 18-64 with household incomes up to 100% of the national Federal Poverty Level (FPL). Although Medicaid expansion covered adults up to 138% FPL, I limited inclusion to those up to 100% FPL to reduce confounding from adults in non-expansion states from 100% to 138% FPL, who qualify for subsidies on the ACA private insurance marketplace. Reported income and household size were considered in determining a household's likely eligibility for Medicaid. Since BRFSS reported income in categorical income brackets, I used the bracket closest to the 100% FPL threshold as the upper limit of inclusion. I further excluded respondents of unknown sex, race, employment, income, education, household size, and marital status.

Main Study Variables

The main predictor of interest was Medicaid expansion status. The first set of outcomes pertained to poor health access: uninsured status, inability to see a doctor due to cost, and lacking a personal doctor or health care provider. These variables were reported as binary yes or no answers.

The second set of outcomes related to utilization: having a routine checkup in the past 12 months, having a flu shot in the past 12 months, ever receiving a HIV test, ever having blood cholesterol checked, and currently taking blood pressure medication. Each of the above measures were analyzed as binary yes/no variables.

The third set of outcomes was health-related: self-reported health status, days of physical health not good in the past 30 days, days when poor physical or mental health limited usual activities in the past 30 days, and chronic illness diagnoses, all self-reported by survey respondents. Health status was reported as excellent, very good, good, fair, or poor. I generated a binary variable with excellent, very good, and good health as one level, and fair and poor health as another. I analyzed health status both in its linear and binary forms. Chronic illness was defined as: prior diagnosis of heart attack, coronary artery disease or angina, stroke, asthma, any cancer except skin cancer, skin cancer, chronic obstructive pulmonary disorder (COPD)/ emphysema/chronic bronchitis, depression, kidney disease, diabetes, high blood pressure, and high blood cholesterol. Each chronic illness variable was structured as either a yes or no. Chronic illnesses were analyzed both individually and as an index, which is a summation of a respondent's reported chronic illnesses excluding high blood pressure and high blood cholesterol (Akinyemiju, Jha, Moore, & Pisu, 2016). The variables related to blood pressure and high cholesterol were only available in odd-numbered years. Thus, only data from BRFSS 2011, 2013, and 2015 were analyzed for these outcomes.

Statistical Analysis

I conducted regression analysis to investigate changes in outcomes pre- and post-Medicaid expansion between expansion and non-expansion states over the study period. Non-expansion states provided a control for outcome changes in expansion states unrelated to Medicaid expansion. Three years of post-expansion data were analyzed for most states. States expanding later than January 2014 were in the treatment group beginning with their quarter of implementation.

For the years 2011 to 2016, I analyzed each outcome as a function of an annual time trend over the six years, with an interaction term between a state's expansion status and time period relative to Medicaid expansion implementation. In addition to the analysis comparing the entire pre- to post-Medicaid expansion periods, I derived estimates for each post-expansion year (2014, 2015, 2016) to investigate trends in the impact of Medicaid expansion over time. The model adjusted for age, sex, race, marital status, employment, income, urban or rural residence, landline or cellphone survey type, and household size as well as state and quarter fixed effects. Equation 1 describes the regression model.

Equation 1: $Outcome_{isq} = \beta_0 + \beta_3(Treat \times Post) + \beta_x X_i + \Omega_s + \pi_q + \varepsilon_{isq}$

where i is the individual survey respondent, s is the state, and q denotes the interview quarter. X_i includes the demographic variables sex, age, race, marital status, income category, employment status, education level, household size, and urban/rural/cellphone group. Ω captures state fixed effects, and π captures quarter fixed effects. "Post" is the variable stratifying time by pre- and post- policy intervention and is 0 for pre-expansion or non-expansion and 1 beginning the quarter of expansion implementation. As the coefficient of interest, β_3 describes the interaction between the treatment (Medicaid expansion) and time of policy intervention (post); it

captures the difference-in-differences estimate of an outcome attributable to the policy intervention (Medicaid expansion).

The difference-in-differences design assumed that the pre-ACA trends in health outcomes between expansion and non-expansion states were similar (parallel trends assumption). Following previous studies, I used linear regression for interpretation of the marginal effects and applied robust standard errors clustered at the state level to account for heteroscedasticity and intrastate correlation (Decker, Kostova, Kenney, & Long, 2013; Griffith et al., 2017; Miller & Wherry, 2017). All regression analyses were performed using BRFSS sample weights for national representativeness and adjustment for non-response bias ("Behavioral Risk Factor Surveillance System Weighing BRFSS Data BRFSS 2014," n.d.).

If the initial analysis of an outcome yielded a p-value for a parameter estimate of 0.10 or less, subgroup analysis was performed for each income group, race, age group, and urban/rural residence. Outcomes were further tested for interactions between Medicaid expansion treatment and income category, race, age group, and urban/rural residence using Wald testing. The p-value condition was incorporated to reduce the chance of significant results attributable to non-hypothesis driven data mining. The analyses of interactions between demographic variables and Medicaid expansion treatment follows the formula in Equation 1 with an adjustment to the interaction term. Equation 2 describes the model for interaction regressions:

Equation 2: $Outcome_{isq} = \beta_0 + \beta_3(DemographicVariable \times TreatPost) + \beta_x X_i + \Omega_s + \pi_q + \varepsilon_{isq}$

The income categories were collapsed levels of the income variable provided in BRFSS: less than $10,000; $10,000 to $14,999; $15,000 to $19,999; and $20,000 to $49,999. The race categories were non-Hispanic white, black, American Indian or Alaska Native, Hispanic, and other. Henceforth, "white" refers to "non-Hispanic white." For the urban/rural residence

variable, data was only available for the landline portion of the survey, so the analysis compared urban landline, rural landline, and cellphone respondents. The urban/rural residence was divided by whether a respondent lived inside a Metropolitan Statistical Area.

All statistical analyses were performed using Stata Statistical Software: Release 15.0 (StataCorp LP, College Station, TX). P-values of 0.05 or less were considered statistically significant.

Results

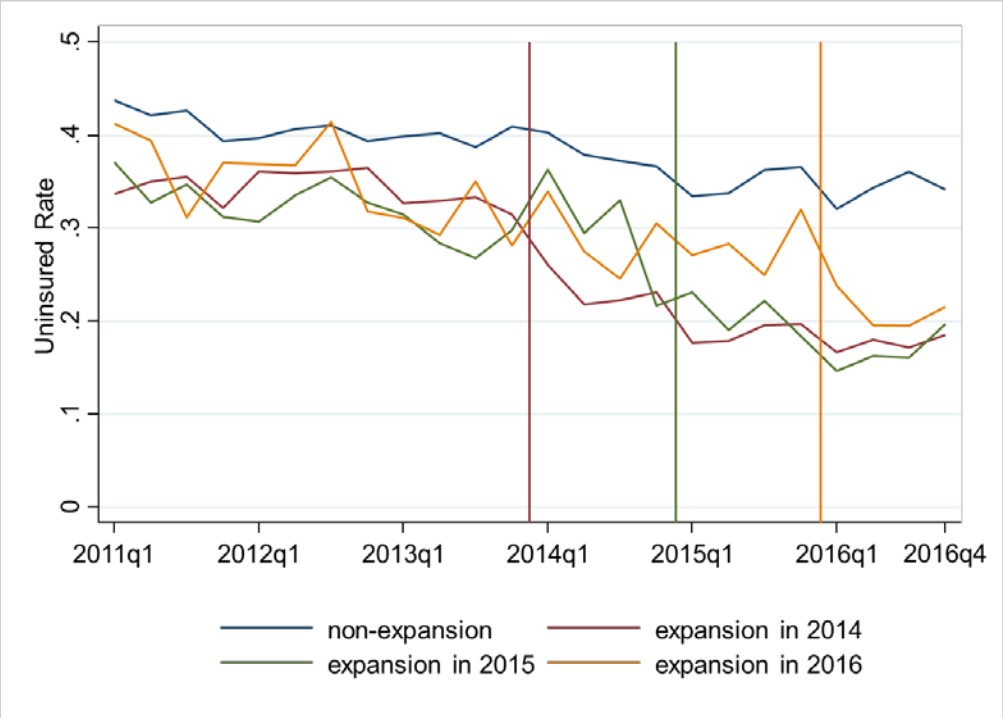
A total of 162,475 observations from 2011 to 2016 were included in this study. They represent low-income households from 27 expansion states and 19 non-expansion states who are or would be likely-eligible for Medicaid under expansion rules. Descriptive statistics of the expansion and non-expansion cohorts are available in Appendix 1 and 2.

Health Care Access

Figure 2 shows unadjusted trends in the uninsurance rate in the study population. The trends suggest greater reductions in uninsurance in expansion states than in non-expansion states. For example, from Q1 of 2011 to Q4 of 2016, the unadjusted uninsurance rate dropped 9.5 percent in non-expansion states and 15.4 percent in states that expanded in 2014. In Q4 of 2016, the former had an unadjusted uninsurance rate of 33 percent, while the latter's was 19 percent. Non-expansion states also had higher uninsurance rates before and after policy implementation. Expansion states experienced steady reductions in uninsurance over time as opposed to a sudden level change in the first quarter of expansion implementation. Many reasons might explain this finding, including lags in information dissemination and Medicaid application processing time.

Adjusted regression analyses in Table 2 confirm a significant difference in the change in the uninsured rate between non-expansion and expansion states for all three years after Medicaid expansion. Medicaid expansion also decreased rates of inability to afford doctor visits in 2015 and 2016 and lacking a personal doctor or health care provider in all three years (Table 2). Overall (2014-2016), the rates of uninsurance, inability to afford doctor visits, and lacking a personal doctor dropped by 5.4%, 3.2%, and 4.6%, respectively, since implementation of Medicaid expansion began in 2014.

Figure 2. Graph of the proportion of uninsured stratified by state Medicaid expansion decision.



Source: Authors' analysis of data for 2011-16 from the Behavioral Risk Factor Surveillance System (BRFSS).
Notes: The horizontal trend lines represent states grouped by whether they expanded Medicaid in 2014 (red), 2015 (green), 2016 (yellow), or not at all (blue). The vertical lines represent the general time point when Medicaid expansion was implemented in the respective groups of states.

Table 2. Percentage changes in health access, utilization, and health outcomes in expansion states compared to non-expansion states after Medicaid expansion

	2014 % Change (SE)	2015 % Change (SE)	2016 % Change (SE)	2014-2016 % Change (SE)
Access				
Uninsurance Rate	-3.8*** (1.2)	-6.0*** (1.3)	-6.1*** (1.3)	-5.4*** (0.9)
Cannot afford doctor visits	-2.2* (1.2)	-2.6** (1.3)	-5.3*** (1.3)	-3.2*** (0.9)
No personal doctor	-4.4*** (1.2)	-4.5*** (1.3)	-4.7*** (1.3)	-4.6*** (0.9)
Health care Utilization				
Routine Checkup	1.0 (1.3)	2.8** (1.1)	1.8 (1.0)	1.9** (1.0)
Flu shot	1.1 (1.2)	-1.1 (1.3)	1.7 (1.2)	0.3 (0.9)
HIV test	0.9 (1.3)	3.4** (1.4)	1.8 (1.4)	1.9* (1.0)
Taking BP Medication	N/A	0.1 (2.2)	N/A	0.3 (2.2)
Blood Cholesterol Check	N/A	2.0 (1.4)	N/A	2.2 (1.4)
Health Status				
General Health (collapsed)	2.0* (1.1)	1.0 (1.2)	1.0 (1.1)	1.5* (0.8)
General Health (uncollapsed) [#]	-4.1 (2.7)	-1.3 (2.9)	-1.0 (2.8)	-2.5 (2.0)
Days of physical health not good (per month) [#]	23.9 (22.4)	-11.3 (23.9)	-37.3 (23.6)	-7.4 (16.6)
Days of poor physical or mental health (per month) [#]	-2.1 (28.5)	-28.2 (29.6)	-55.8* (30.4)	-34.8* (21.0)
Chronic Illness Diagnoses				
Index (sum of diabetes through kidney disease) [#]	-2.0 (2.8)	1.0 (3.0)	3.2 (3.0)	0.8 (2.1)
Diabetes	-1.1 (0.8)	-0.1 (0.8)	-0.6 (0.8)	-0.6 (0.6)
Cancer	-0.2 (0.5)	-0.5 (0.5)	-0.4 (0.5)	-0.1 (0.4)
Skin Cancer	0.1 (0.3)	0.1 (0.3)	-0.0 (0.3)	0.0 (0.2)
Depression	-0.0 (1.0)	0.7 (1.1)	0.8 (1.1)	0.3 (0.8)

Heart Attack	-0.8* (0.5)	-0.4 (0.5)	0.4 (0.5)	-0.2 (0.4)
Coronary Artery Disease	-0.7 (0.4)	0.1 (0.4)	0.0 (0.4)	-0.2 (0.3)
Stroke	0.2 (0.4)	-0.4 (0.4)	0.7 (0.4)	0.2 (0.3)
Asthma	-0.5 (0.9)	-0.0 (1.0)	-0.5 (1.0)	-0.1 (0.7)
COPD/emphysema/bronchitis	0.6 (0.7)	1.3* (0.7)	0.8 (0.7)	0.8 (0.5)
Arthritis	1.0 (0.9)	0.1 (0.9)	1.8* (0.9)	0.8 (0.7)
Chronic Kidney Disease	-0.4 (0.4)	0.1 (0.5)	0.8* (0.5)	0.3 (0.3)
High Blood Pressure [#]	N/A	2.2* (1.2)	N/A	2.4** (1.2)
High Cholesterol [#]	N/A	6.2*** (1.6)	N/A	6.0*** (1.6)

Source: Author's analysis of data for 2011-16 from BRFSS.
Notes: The exhibit displays the results of difference-in-differences analyses in outcomes associated with Medicaid expansion for each year after Medicaid expansion (2014, 2015, 2016) and all years combined (2014-2016). The estimates should be interpreted as the percentage difference in each outcome between expansion states and non-expansion states, when comparing pre- to post-Medicaid expansion time periods.
N/A denotes years for which data was not available. 2014-2016 differ from 2015 because a small sample of 2016 survey data was included in the 2015 data release.
SE denotes standard error.
[#] The estimates for these variables should not be interpreted as percentage changes as they are not binary variables and linear regression coefficients for no-binary outcomes cannot be interpreted as percentages.
*p < 0.010 **p < 0.05 ***p < 0.01, Significance is defined at the 0.05 level.

Utilization

The probability of having had a routine checkup in the past 12 months increased more for expansion states than non-expansion states in 2015 and overall, but not in other post-expansion years (Table 2). Medicaid expansion states also saw greater gains in the probability of their residents having ever had a HIV test in 2015. I found no difference in the probability of having a flu shot in the past year, ever having blood cholesterol checked, or currently taking blood pressure medication.

Health and Chronic Illness

The change in the collapsed general health status of Medicaid expansion states approached significance in 2014 (2.0%, p=0.063) and overall (1.5%, p=0.066) in comparison to non-expansion states (Table 2). No differences were found in analyses of uncollapsed general health, days of physical health not good per month, and days when poor physical or mental health limited activities per month.

Table 2 also reports the difference-in-differences estimates for chronic illness diagnoses. Diagnoses of high blood pressure and high cholesterol increased more in expansion states than non-expansion states but not for other chronic illnesses. Analysis of the chronic illness summation index also yielded non-significant results.

Table 3a. Percentage changes in health access and utilization outcomes associated with Medicaid expansion in subgroup analyses and interaction testing.

	Uninsurance Rate % Change (SE)	**Cannot Afford Doctor Visits** % Change (SE)	**No personal doctor** % Change (SE)	**Routine Checkups** % Change (SE)	**HIV Test** % Change (SE)
Overall	-5.4*** (0.9)	-3.2*** (0.9)	-4.6*** (0.9)	1.9** (1.0)	1.9* (1.0)
Household Income					
<$10k (ref)	-9.5*** (1.4)	-3.6** (1.4)	-5.7*** (1.5)	3.0** (1.5)	-0.2 (1.5)
$10k to <$15k	-7.2*** (1.8)	-7.3*** [a] (2.0)	-3.2* (1.8)	2.5 (2.0)	0.8 (2.0)
$15k to <$20k	-0.3 (1.8)	-1.7 (1.9)	-3.0 (1.9)	-0.5 (2.0)	1.3 (2.0)
$20k to <$50k	-4.4** [b] (2.1)	-1.0 (2.1)	-5.7*** (2.1)	2.1 (2.2)	5.6** (2.3)
Race					
White (ref)	-10.4*** (1.1)	-6.5*** (1.1)	-4.1*** (1.1)	5.2*** (1.2)	3.2*** (1.2)
Black	-5.5** [b] (2.0)	-0.3 [a] (2.1)	-5.2*** (2.0)	3.8* (2.0)	-3.1 (2.2)
American Indian	-1.5 [a] (3.3)	-5.5 (3.7)	2.8 (3.9)	-1.8 (4.0)	-1.3 (4.0)
Other	-1.6 [a] (3.8)	2.1 (3.8)	3.5 (3.8)	-3.8 [a] (4.2)	6.9* [a] (3.9)
Hispanic	0.2 [b] (2.0)	-2.0 [b] (2.1)	-5.9*** (2.1)	-0.9 [b] (2.2)	2.9 (2.3)
Age					
18-24 (ref)	-5.8** (2.6)	-1.7 (2.4)	-5.1* (2.8)	1.6 (2.8)	1.7 (2.6)
25-34	-0.7 (1.9)	-1.3 (2.0)	-3.6* (2.0)	1.1 (2.1)	3.4 (2.1)
35-44	-2.3 (1.8)	-4.1** [a] (1.9)	-2.9 (1.8)	0.7 (1.9)	3.5* [a] (2.0)
45-54	-6.8*** [a] (1.8)	-4.9** [a] (1.9)	-5.3*** (1.8)	2.4 [a] (1.9)	-0.5 [b] (2.1)
55-64	-12.7*** (1.8)	-4.1** (1.9)	-6.5*** (1.7)	5.0*** (1.8)	3.2 [b] (2.0)
Urban/Rural/Cellphone					
Urban Landline (ref)	-5.3*** (1.5)	-2.6* (1.5)	-4.1*** (1.5)	0.9 (1.6)	3.4** (1.7)
Rural Landline	-10.0*** (2.0)	-3.3 (2.1)	-3.4* (1.9)	5.1** (2.2)	4.5** (2.1)
Cellphone	-8.8*** (2.1)	-4.7** (2.3)	-6.7*** (2.3)	5.2** (2.3)	-0.1 (2.5)

Table 3b. Percentage changes in health outcomes associated with Medicaid expansion in subgroup analyses and interaction testing.

	High Blood Pressure % Change (SE)	**High Cholesterol** % Change (SE)	**Days of poor health** [#] % Change (SE)	**General Health (Good/Bad)** % Change (SE)
Overall	2.4** (1.2)	6.0*** (1.6)	-34.8* (21.0)	1.5* (0.8)
Household Income				
<$10k (ref)	0.4 (2.0)	0.7 (2.5)	-81.7 (58.5)	2.6* (1.4)
$10k to <$15k	-1.8 (2.5)	10.0*** (3.2)	27.4 (67.4)	3.8** (1.7)
$15k to <$20k	3.2 (2.4)	9.3*** (3.3)	-24.1 [a] (68.8)	-1.3 (1.7)
$20k to <$50k	7.7*** (2.8)	3.8 (3.6)	-102.5* (61.7)	2.0 (1.8)
Race				
White (ref)	-0.1 (1.6)	5.2*** (2.0)	-37.4 (37.7)	0.9 (1.0)
Black	5.4* (3.1)	3.0 (3.2)	-38.5 [b] (64.4)	0.8 (1.9)
American Indian	-9.3* (5.3)	9.1 (6.5)	-150.1 (128.6)	4.3 (3.4)
Other	-2.0 (4.9)	7.8 (5.8)	-101.3 (145.7)	0.5 (3.2)
Hispanic	3.6 (2.5)	9.8*** (3.7)	-59.1 (93.7)	3.1 [b] (1.9)
Age				
18-24 (ref)	3.4 (2.5)	7.5 (4.7)	-44.3 (66.0)	0.8 (1.8)
25-34	2.0 (2.3)	8.0** (3.4)	-93.6 (63.8)	2.8* (1.7)
35-44	0.8 (2.6)	8.9*** (3.4)	3.6 (72.2)	2.2 (1.8)
45-54	-0.8 (2.9)	-0.2 (3.3)	-104.8 (77.3)	2.3 (1.9)
55-64	5.3* (3.0)	8.0** (3.1)	6.2 (79.9)	0.8 (1.9)
Urban/Rural/Cell Phone				
Urban Landline (ref)	2.1 (2.3)	3.3 (2.7)	3.2 (53.9)	2.3* (1.4)
Rural Landline	-0.1 (3.3)	0.8 (3.5)	-24.1 (62.4)	0.2 (1.8)
Cellphone	-14.8 (9.8)	-11.4 (14.0)	-128.2* (68.2)	2.4 (2.0)

Source: Author's analysis of data for 2011-16 from BRFSS.
Notes: The tables display the results of difference-in-differences analyses in outcomes associated with Medicaid expansion stratified by demographic subgroups. The estimates should be interpreted as the percentage difference in each outcome between expansion states and non-expansion states, when comparing pre- to post-Medicaid expansion time periods. Regarding Wald interaction testing, significant differences in the estimates between one group and the reference group (ref) were denoted with the subscripts a and b.
SE denotes standard error.
[#] The estimate for "days of poor physical or mental health per 30 days" should not be interpreted as a percentage change, since linear regression coefficients cannot be interpreted as percentages for non-binary variables.
*p < 0.010 **p < 0.05 ***p < 0.01, [a] p < 0.05 [b] p < 0.01

Subgroup Analysis

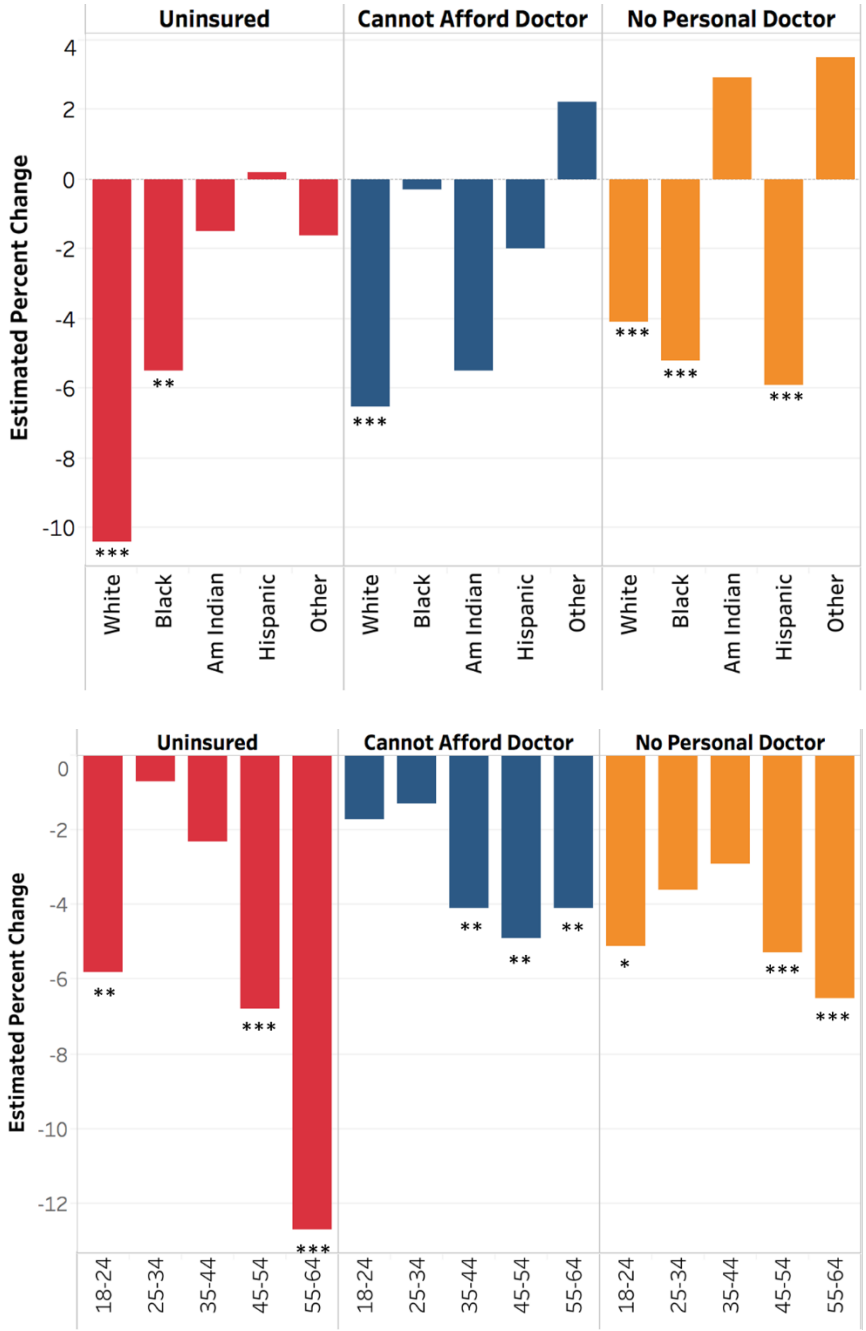
Table 3 displays the results of subgroup difference-in-differences analysis and interaction testing between demographic variables and Medicaid expansion. Only outcomes from Table 2 with p-values of 0.10 or less in the overall (2014-2016) results were included in subgroup analysis. Subgroup analysis involved two tests: 1) testing for significance differences in the change of a health outcome between respondents in expansion states and non-expansion states of a common demographic group (e.g. females in expansion states vs. females in non-expansion states), and 2) Wald interaction tests for differences in the estimates between groups of a demographic variable (e.g. white vs. black vs. Hispanic).

Although health access measures improved overall, certain populations benefited more than others. Whites showed differences between expansion and non-expansion states in reductions in uninsurance (10.4%), cannot afford doctor visits (6.5%), and lacking a personal doctor (4.1%). Interaction testing found that whites experienced significantly more gains in insurance coverage than all other racial groups (Table 3a). The youngest and oldest non-elderly adults saw significant gains in coverage with adults ages 55-64 experiencing a 12.7% drop in uninsurance. Whites were the only racial group to see a significant drop in inability to afford doctor visits. Figure 3 illustrates the health access results by race and age from Table 3.

Lowest income earners (<$10,000) and older non-elderly adults experienced some of the greatest reductions in unaffordability under Medicaid expansion. In addition, the lowest income

earning group was the only income group to see reductions in all three measures of poor health access.

Figure 3. Percentage changes in poor health care access after Medicaid expansion for low-income adults in expansion states compared to non-expansion states by race and age.



The figure displays estimated percentage differences in the change in health care access outcomes for individuals of a particular race or age group in expansion states with those of the same race or age group in non-expansion states, from pre-expansion to post-expansion periods. Note: graphical depiction of selected results in Table 3.
*p < 0.05 **p < 0.01 ***p < 0.001

Male, white, low-income, rural, and older non-elderly respondents drove the overall comparative increase in routine checkups in expansion states versus non-expansion states. Whites and adults ages 55-64 in expansion states experienced 5.2% and 5.0% larger increases in the probability of having had a routine checkup in the past 12 months compared to their counterparts in non-expansion states. In addition, Medicaid expansion was associated with increases in the probability of having a HIV test for whites.

While the overall analysis of self-reported general health (collapsed to good/bad) approached significance (p=0.066), subgroup analysis uncovered significant improvement among those in the $10,000 to $14,999 annual income category and nearly-significant improvements in several other subgroups. White and Hispanic respondents in expansion states had 5.2% and 9.8%, respectively, greater increases in high cholesterol diagnoses than their non-expansion state counterparts. However, interaction testing did not detect significant differences among the race groups in trends for diagnoses of either high blood pressure or high cholesterol attributable to Medicaid expansion.

Discussion

Using nationally-representative survey data, this study examined the impact of the ACA's Medicaid expansion on health care access, preventive service utilization, and self-reported health outcomes. This paper contributes to the body of research on Medicaid expansion in three key areas. First, it provides the first comprehensive national study of Medicaid expansion that includes three years of post-expansion data. Second, it analyzes chronic illness diagnoses not previously examined in studies of Medicaid expansion using BRFSS. Third, it includes subgroup analyses that delineate how policy implementation impacts different population subgroups.

Similar to previous studies, this study found significant improvements in health access in terms of insurance coverage, affordability of care, and having a personal health care provider (Decker et al., 2017; Griffith et al., 2017; Miller & Wherry, 2017; Simon et al., 2017). Across all three measures, adults ages 45-64 saw some of the most significant gains in access. As these adults will soon age into Medicare, policymakers should note the potential benefit earlier access to care might have on chronic illness progression and long-term Medicare expenditures.

Several other demographic differences in changes in health access are noteworthy. While white respondents reported gains in all three measures, several races had significantly less improvement in insurance coverage, which indicates that the benefits of Medicaid expansion are not evenly distributed among low-income populations of all races. However, the smaller or insignificant changes in uninsurance for other races are not necessarily unexpected. Even before the ACA, Native Americans and Alaska Natives were eligible for health benefits through the federal Indian Health Service ("Indian Health Manual (IHM)," n.d.). Medicaid has a five-year waiting period after receiving qualified immigration status, and undocumented immigrants are not eligible for the program ("Health coverage for lawfully present immigrants," n.d.). Since a

large proportion of immigrants of Hispanic descent are recent immigrants or undocumented, these eligibility restrictions may explain, at least in part, Medicaid expansion's limited impact on health care access for Hispanics (Yee, 2017).

While rural residents saw large gains in insurance coverage, their improvement in the probability of having a personal doctor lagged that of their urban counterparts. As the life expectancy gap widens between urban and rural residents, it is especially important that rural populations have affordable access to care beyond just having health insurance (Singhal, Hux, Alibhai, & Oliver, 2014; Soni, Hendryx, & Simon, 2017). My results indicate that insurance expansion helps with coverage but further policy action may be needed to improve access to health care providers in rural communities, which face major provider shortages (Glenn, 2013).

This study also documents an increase in utilization of routine checkups. Although previous national Medicaid expansion studies found null results, those studies used less conservative income-based inclusion criteria (Miller & Wherry, 2017; Simon et al., 2017; Wherry & Miller, 2016). Furthermore, my positive finding aligns with results from the Oregon Health Insurance Experiment (Baicker et al., 2013). Medicaid expansion was associated with increased health care access and utilization of routine checkups in adults ages 55-64. As this population ages, more frequent routine checkups may have implications on future service utilization and health outcomes. In addition, I found an increase in HIV-testing in 2015 that aligns with the previously-published literature (Simon et al., 2017). However, Medicaid expansion was not associated with more increased checkups or HIV tests in 2016, suggesting that uptake of coverage may lead to only temporary spikes in utilization of some preventive services. Future longitudinal studies will be needed to understand the long-term behavioral responses to coverage expansion.

The impact of Medicaid expansion on self-reported health status remains less clear. With a difference in the good/bad health status outcome approaching significance (p=0.066), my study does not conclusively elucidate Medicaid expansion's impact on national trends in health status. This result is not unexpected considering the conflicting evidence in the literature as to insurance expansion's impact on health (Baicker et al., 2013; Black, Espín-Sánchez, French, & Litvak, 2017; Miller & Wherry, 2017; Simon et al., 2017; Sommers et al., 2012, 2015; Sommers, Maylone, et al., 2017; Wherry & Miller, 2016). Nonetheless, significant improvements in health status for individuals with income between $10,000-$14,999 suggest that Medicaid expansion is helping at least some low-income adults see health benefits. Furthermore, substantial health improvements from recent insurance coverage require time to manifest. Additional longitudinal studies are needed to fully understand how health insurance expansions impacts health.

Finally, I find evidence that Medicaid expansion has increased the diagnoses of high blood pressure and high blood cholesterol but not for other chronic conditions. Importantly, these findings are likely attributable to patients discovering existing cases perhaps from increased interaction with health care providers, as it is unlikely that Medicaid expansion caused increases in disease prevalence.

Limitations

Due to the nature of the Medicaid expansion policy, a truly experimental design with random-assignment was not possible for my study. Instead, I relied upon a quasi-experimental design that controlled for a host of potential confounding variables and has been applied in multiple Medicaid expansion studies (Decker et al., 2017; Griffith et al., 2017; Miller & Wherry, 2017; Simon et al., 2017). My difference-in-differences methodology relied upon the assumption

of parallel trends between non-expansion and expansion states in accounting for other national policy implementations and trends.

One limitation of BRFSS is that the information was self-reported. Reported health status are reflections of a respondent's perceptions of health more than objective health measures. Nonetheless, self-reported health is a previously validated measure and predictive of mortality (DeSalvo, Bloser, Reynolds, He, & Muntner, 2006; Miilunpalo, Vuori, Oja, Pasanen, & Urponen, 1997). Chronic illness diagnoses are also self-reported and not confirmed by medical records. Since people are subject to cognitive deficiencies (e.g., memory loss), sometimes unaware of their conditions, or often go undiagnosed, disease prevalence may have been underestimated. For my study, the outcome of interest was not disease prevalence but rate of change in reported chronic conditions. Furthermore, prior studies have found comparable prevalence of chronic illness between BRFSS and other national studies (Pierannunzi, Hu, & Balluz, 2013).

Another limitation is that BRFSS does not record type of insurance. Ideally, the study sample would consist of only the uninsured and Medicaid recipients to fully exclude those newly receiving coverage through private insurance through the ACA exchange or other means. To best capture the Medicaid expansion population, I chose my cohort based on age, income, and household size criteria that closely matched Medicaid expansion eligibility rules following an approach similar to those used in previous studies (Griffith et al., 2017; Simon et al., 2017). Although the urban/rural data was only available for the landline portion of the survey, my regression was weighed, and I was concerned primarily with the difference-in-differences estimate attributable to Medicaid expansion.

Nonetheless, a systematic review of BRFSS validity and reliability studies found that the database's measures of health access, preventive service utilization, and health have high levels of test-retest reliability and validity (Pierannunzi et al., 2013).

Conclusion

Using three years of post-implementation data, I find that Medicaid expansion substantially improves access to health care and increases utilization of routine checkups. A repeal of Medicaid expansion would reverse these benefits, and the uninsured rate would rise. Although Medicaid expansion has survived multiple repeal attempts, policymakers considering scaling back Medicaid through budgetary or federal rule-making measures should consider these potential harms to public health. For the 19 non-expansion states, this study provides insight into the potential benefits to health care access, preventive service utilization, and health from expanding Medicaid.

This study also calls attention to how the benefits of Medicaid expansion differ by income, race, age, and urban/rural residence. The improvements in healthcare access and preventive service utilization seen for whites were not necessarily observed for other races. Future research should investigate reasons for these benefit disparities and study strategies to improve Medicaid expansion's impact on minority communities. In addition, adults ages 55-64, who will soon age into Medicare, experienced large gains in access and routine checkup utilization that have long-term implications on chronic illness progression and Medicare spending. These findings enhance our understandings of the benefits and benefit distribution of coverage expansion important to consider in future health policy reforms.

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Appendix

Appendix 1. Descriptive statistics of the study cohort stratified by expansion and non-expansion states (n=162,475)

Characteristics	Non-expansion (n = 74,360)	Expansion (n=88,115)
Sex		
Male	25,350 (34)	32,132 (37)
Female	49,010 (66)	55,983 (64)
Age		
18-24	7,299 (10)	9,483 (11)
25-29	6,468 (9)	7,408 (8)
30-34	8,038 (11)	9,031 (10)
35-39	8,106 (11)	9,176 (10)
40-44	7,703 (10)	9,103 (10)
45-49	8,165 (11)	9,712 (11)
50-54	9,916 (13)	11,891 (13)
55-59	9,998 (13)	11,950 (14)
60-64	8,667 (12)	10,361 (12)
Race		
White	39,598 (53)	45,669 (52)
Black	16,003 (22)	10,994 (12)
Native American	3,291 (4)	4,775 (5)
Hispanic	12,574 (17)	19,686 (22)
Other	2,894 (4)	6,991 (8)
Marital status		
Married	23,571 (32)	27,078 (31)
Divorced	16,482 (22)	18,540 (21)
Never married	20,891 (28)	27,183 (31)
Other	13,416 (18)	15,314 (17)
Employment		
Employed for wages	22,218 (30)	26,132 (30)
Self-employed	5,132 (7)	6,235 (7)
Out of work >1 year	7,345 (10)	9,295 (11)
Out of work <1 year	5,245 (7)	6,335 (7)
Homemaker	6,898 (9)	8,538 (10)
Student	4,408 (5)	5,338 (6)
Retired	2,493 (3)	3,253 (4)
Unable to work	20,981 (28)	22,989 (26)
Income Level		
<$10k	29,191 (39)	35,498 (40)
$10k-$15k	16,106 (22)	18,872 (21)
$15-$20k	15,225 (20)	17,578 (20)
$20k-$50k	13,838 (19)	1,167 (18)

Table 1 (Continued). Descriptive statistics of the study cohort (n=162,475)

Characteristics	Non-expansion (n = 74,360)	Expansion (n=88,115)
Education		
Less than high school	17,279 (23)	19,706 (22)
High School	29,109 (39)	33,923 (39)
Some college	19,997 (27)	24,042 (27)
College graduate	7,975 (11)	10,444 (12)
Survey Type		
Urban Landline	20,060 (27)	31,336 (36)
Rural Landline	27,844 (37)	27,378 (31)
Cellphone	26,456 (36)	29,401 (33)
Household Size		
1	12,093 (16)	14,894 (17)
2	14,209 (19)	16,194 (18)
3	14,025 (19)	16,229 (18)
4	14,358 (19)	16,984 (19)
5+	19,675 (26)	23,814 (27)

Appendix 2. Descriptive statistics for outcome variables analyzed in regression analysis

Variable	Range	Expansion Avg	Non-expansion Avg	Coding
Uninsurance	0-1	0.38	0.27	0=insured, 1=uninsured
Could not afford to see doctor in past 12 months (medical unaffordability)	0-1	0.37	0.30	0=No, 1=Yes
Have a personal doctor or health care provider	0-1	0.32	0.29	0=No, 1=Yes
Self-reported general health status (collapsed)	0-1	0.61	0.62	0=Fair or Poor Health, 1=Good, Very Good, or Excellent Health
Self-reported general health status (uncollapsed)	1-5	3.1	3.1	1=Excellent, 2=Very Good, 3=Good, 4=Fair, 5=Poor
Days of physical health not good (in past 30 days)	0-30	8.1	7.9	0-30 days
Days poor physical or mental health kept you from doing usual activities (in past 30 days)	0-30	9.4	9.1	0-30 days
Routine checkup within the past 12 months	0-1	0.60	0.63	0=No, 1=Yes
Had flu shot in the past year	0-1	0.30	0.32	0=No, 1=Yes
Ever had HIV test	0-1	0.49	0.48	0=No, 1=Yes
Currently taking medicine for high blood pressure	0-1	0.75	0.72	0=No, 1=Yes
Ever had blood cholesterol checked	0-1	0.73	0.73	0=No, 1=Yes
Sum of a respondent's chronic illnesses (excluding high blood pressure and high cholesterol)	0-11	1.5	1.4	0-11=number of reported chronic illnesses
Ever told have diabetes	0-1	0.16	0.15	0=No, 1=Yes
Ever told had other cancer	0-1	0.07	0.07	0=No, 1=Yes
Ever told had skin cancer	0-1	0.03	0.03	0=No, 1=Yes
Ever told have a depressive disorder	0-1	0.35	0.34	0=No, 1=Yes
Ever told had myocardial infarction (heart attack)	0-1	0.06	0.06	0=No, 1=Yes
Ever told had angina or coronary heart disease	0-1	0.06	0.05	0=No, 1=Yes
Ever told had stroke	0-1	0.06	0.05	0=No, 1=Yes
Ever told had asthma	0-1	0.20	0.21	0=No, 1=Yes

Ever told have COPD, emphysema, or chronic bronchitis	0-1	0.14	0.13	0=No, 1=Yes
Ever told have arthritis	0-1	0.35	0.33	0=No, 1=Yes
Ever told have kidney disease	0-1	0.04	0.04	0=No, 1=Yes
Ever told have high blood pressure	0-1	0.41	0.38	0=No, 1=Yes
Ever told blood cholesterol is high	0-1	0.44	0.43	0=No, 1=Yes