

ECON 470 Final Project Preliminary Analysis

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1 Motivation

The U.S. has long suffered from low healthcare insurance coverage and the subsequent poor health outcomes of its people. Understanding the impact of health care coverage on people's health status is crucial to designing the most effective policy to target people with the most urgent needs. This policy brief aims to access how various measures of health status are affected by the adoption of Medicaid expansion. The history of this topic dates back to the passage of the Patient Protection and Affordable Care Act (ACA) in 2010, which allowed states to expand their Medicaid programs to cover individuals with incomes up to 138% of the federal poverty level. However, the Supreme Court ruled in 2012 that the decision to expand Medicaid was up to each state, leading to a patchwork of different eligibility criteria across the country. While most states have expanded their Medicaid programs since 2014, the trend of adoption seems to halt as the remaining states are determined to opt out the Medicaid expansion. In this policy brief, the analysis will consider the self-reported health status, health care coverage, various demographic measures, and different chronic disease indicators. With a better understanding on the efficacy of Medicaid expansion on improving the health status of people, especially those who are lower-income, policy makers can better examine the costs and benefits of existing policies and potentially find better solutions.

2 Data and Descriptive Statistics

The analysis uses Medicaid expansion data from the Kaiser Family Foundation (KFF) and health status data from Behavioral Risk Factor Surveillance System (BRFSS) from data from 2011 to 2019. KFF provides state-level data on the Medicaid expansion status in each year. BRFSS is an annual mobile and landline telephone survey of health behaviors, chronic conditions, and use of preventative measures for adults ages 18 years and above. The BRFSS, conducted by state health departments in partnership with the Centers for Disease Control and Prevention (CDC), provides state-level data on health-related risk behaviors and chronic health conditions as well as health care access. The final data is constructed from matching the two data set by the full name of the state, which allows further analysis on the differences in various health status measures between status that have adopted Medicaid expansion and states that have not adopted. To compare the same group of states before and after the Medicaid expansion, this section focuses only on states that expanded Medicaid in 2014 and those that did not.

2.1 Health Care Coverage Overview

Figure 1 displays the average health care coverage rate by Medicaid expansion status from 2011 to 2019. Since coverage under the Medicaid expansion became effective in 2014, people in states that have adopted the Medicaid expansion tend to have higher health care coverage rate on average, which suggests that adoption of Medicaid expansion may have led to more health care coverage.

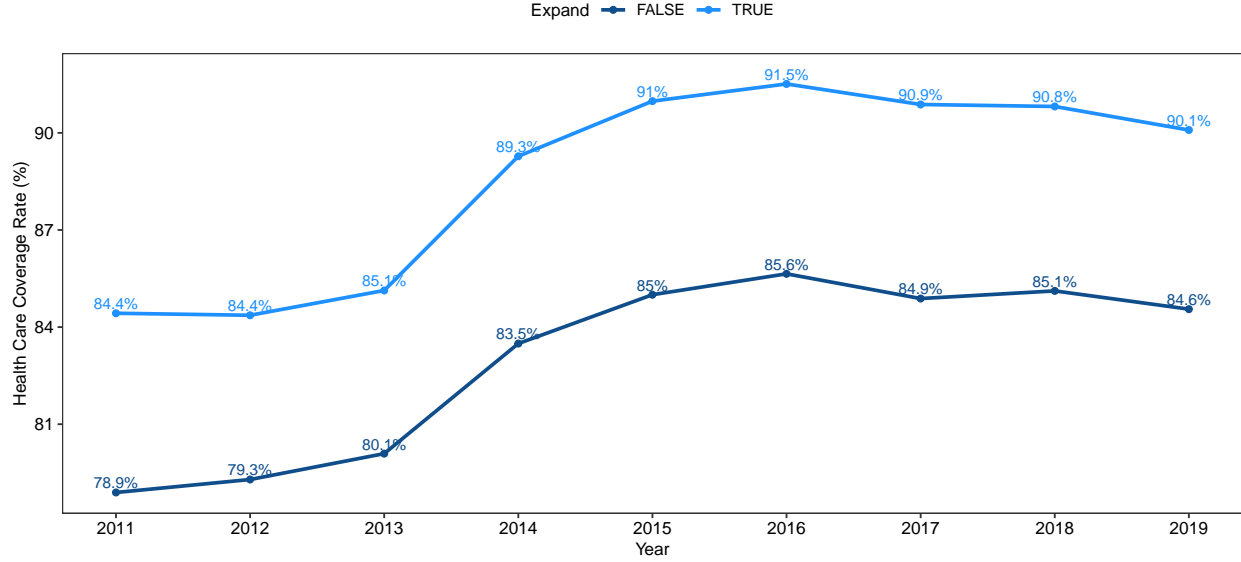


Figure 1: Average Health Care Coverage Rate by Medicaid Expansion Status from 2011 to 2019

Table 1 displays the summary statistics and Figure 2 displays the distribution of healthcare coverage rate by Medicaid expansion status from 2011 to 2019. The box plot shows that the third quartile of health care coverage rate in states that have expanded Medicaid has been higher than the first quartile of health care coverage rate in states that have not expanded Medicaid. The observation is in line with the previous suggestion that the adoption of Medicaid expansion may have led to more health care coverage.

Table 1: Summary Statistic of Health Care Coverage Rate by Medicaid Expansion Status from 2011 to 2019

Year	Not Expanded						Expanded					
	Mean	Min	Q2	Median	Q3	Max	Mean	Min	Q2	Median	Q3	Max
2011	78.9	70.2	75.8	79.1	81.8	87.3	84.4	72.7	81.5	85.2	87.4	93.3
2012	79.3	69.4	77.8	79.0	81.4	87.9	84.4	74.5	81.2	84.8	88.1	94.2
2013	80.1	72.0	76.9	80.5	82.8	88.4	85.1	77.2	82.2	85.3	89.1	93.9
2014	83.5	75.1	81.8	83.9	85.7	91.5	89.3	82.9	87.6	89.8	91.4	95.4
2015	85.0	76.6	83.1	86.0	86.8	92.6	91.0	85.5	89.4	91.6	92.8	94.9
2016	85.6	78.3	83.6	86.3	87.2	91.3	91.5	85.4	90.3	91.7	93.2	94.8
2017	84.9	75.8	83.4	85.6	86.1	92.7	90.9	84.1	89.5	91.2	92.4	94.7
2018	85.1	77.1	84.0	85.4	87.0	90.8	90.8	86.4	89.1	91.1	92.5	93.7
2019	84.6	76.2	83.3	85.1	86.2	90.9	90.1	83.4	88.7	90.7	91.8	94.2

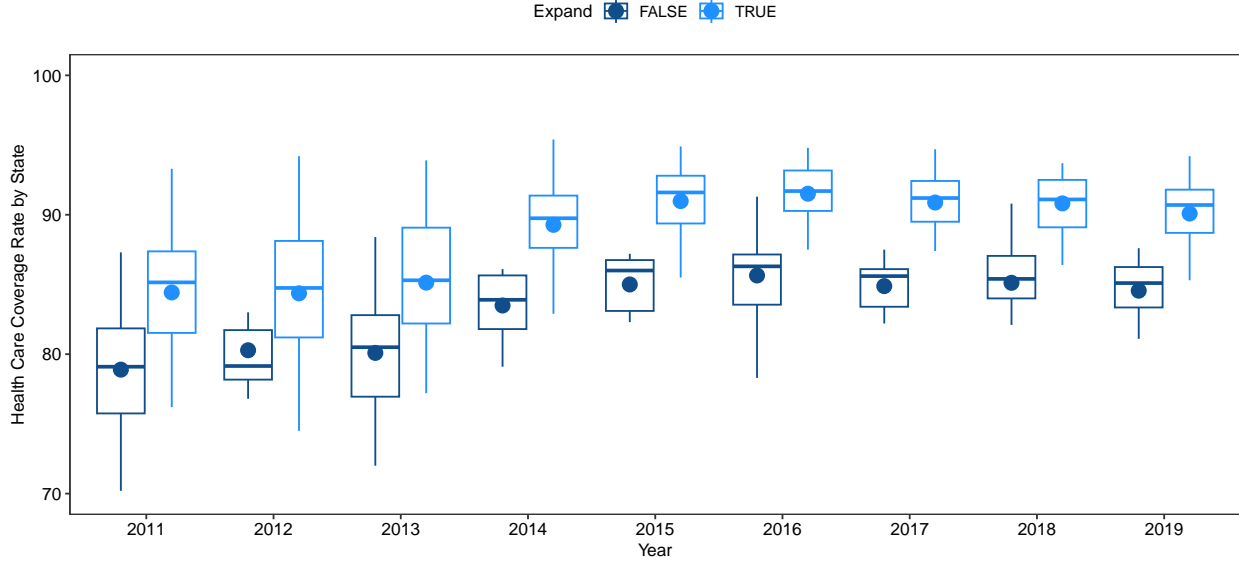


Figure 2: Distribution of Health Care Coverage Rate by Medicaid Expansion Status from 2011 to 2019

2.2 Health Care Coverage Demographics

Figure 3 displays the average health care coverage rate by gender and Medicaid expansion status from 2011 to 2019. Female tends to have higher health care coverage rate on average than male regardless of Medicaid expansion. Since 2014, both male and female in states that have adopted the Medicaid expansion tend to have higher health care coverage rate on average. The differences of health care coverage rate between states that have expanded and that have not expanded seem to be identical for male and female. The Medicaid expansion may be benefiting both genders equally and cannot close the gender gap of health care coverage.

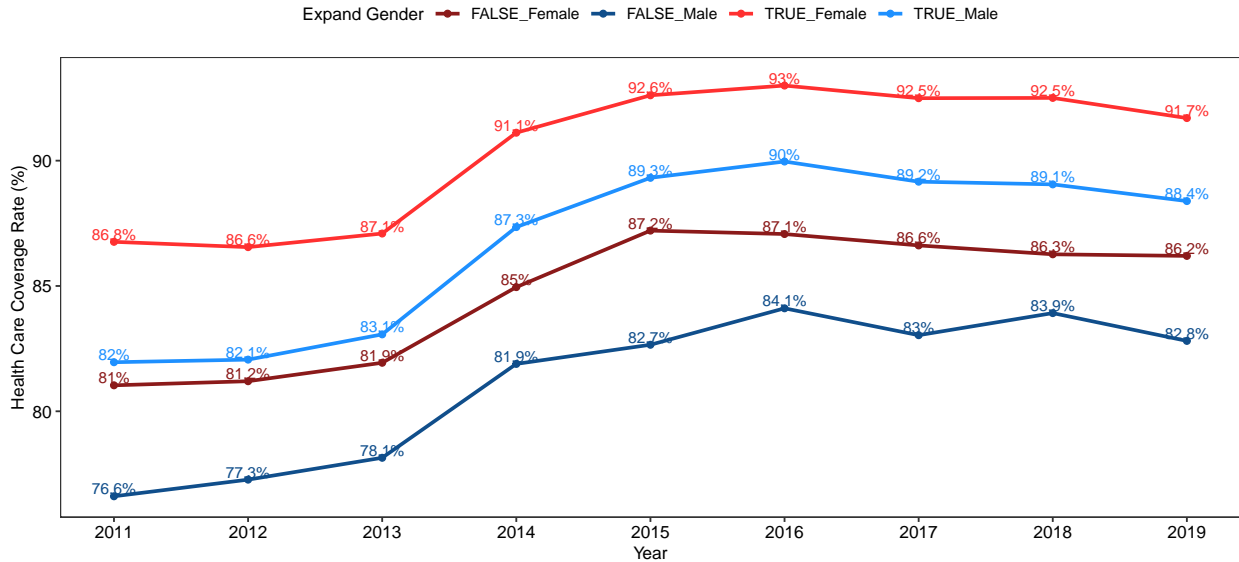


Figure 3: Average Health Care Coverage Rate by Gender and Medicaid Expansion Status from 2011 to 2019

Figure 4 displays the average health care coverage rate by household income and Medicaid expansion status from 2011 to 2019. People earning higher household income tends to have higher health care coverage rate on average than their less affluent counterparts regardless of Medicaid expansion. Since 2014, people from all household income levels in states that have adopted the Medicaid expansion tend to have higher health care coverage rate on average. The differences of health care coverage rate between states that have expanded and that have not expanded seem to be more for people earning lower household income. The Medicaid expansion may be benefiting the less affluent people more and may effectively mitigate the lack of health care coverage among the less-paid.

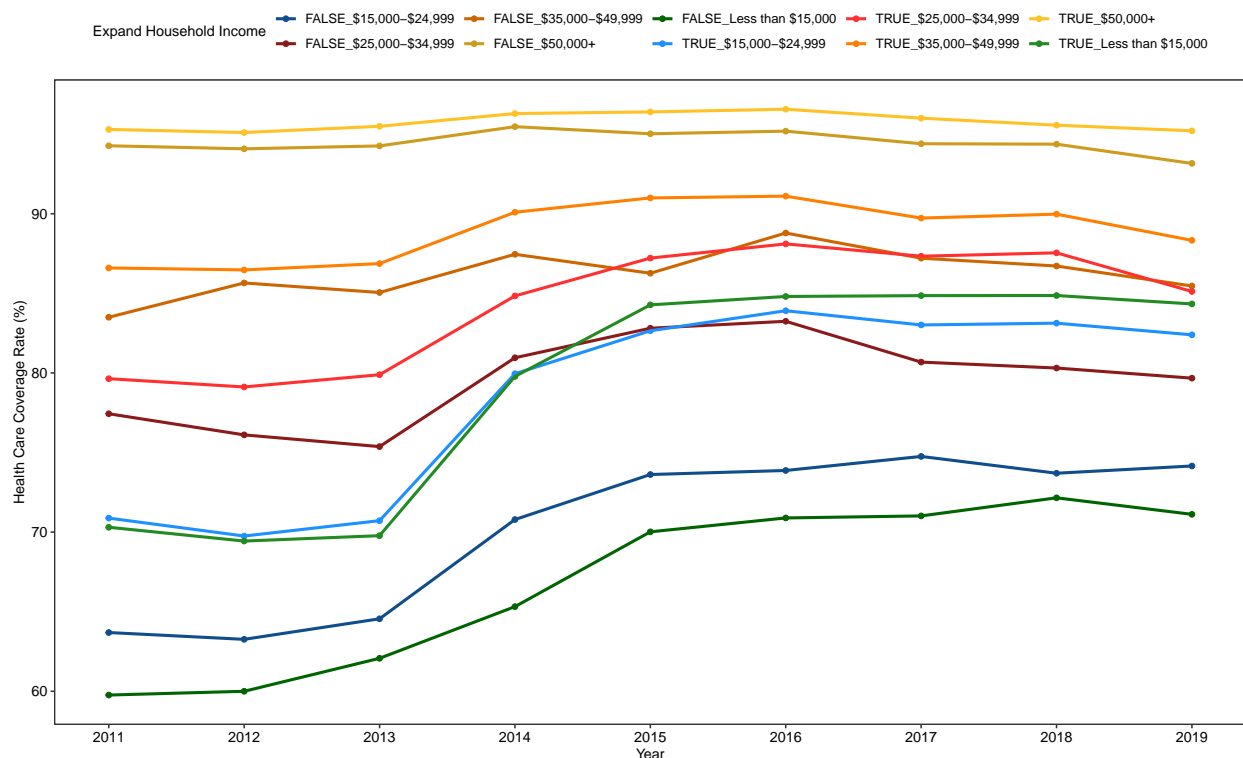


Figure 4: Average Health Care Coverage Rate by Household Income and Medicaid Expansion Status from 2011 to 2019

2.3 Health Status

Figure 5 displays the health status by response from 2011 to 2019. People are asked for their judgement of their overall health status and may answer excellent, very good, good, fair, or poor. Since 2014, there is little difference in the percentage of each response made by people in states that have adopted the Medicaid expansion comparing to states that have not adopted. The Medicaid expansion may not be able to improve people's perception of their own health status despite increasing the health coverage rate.

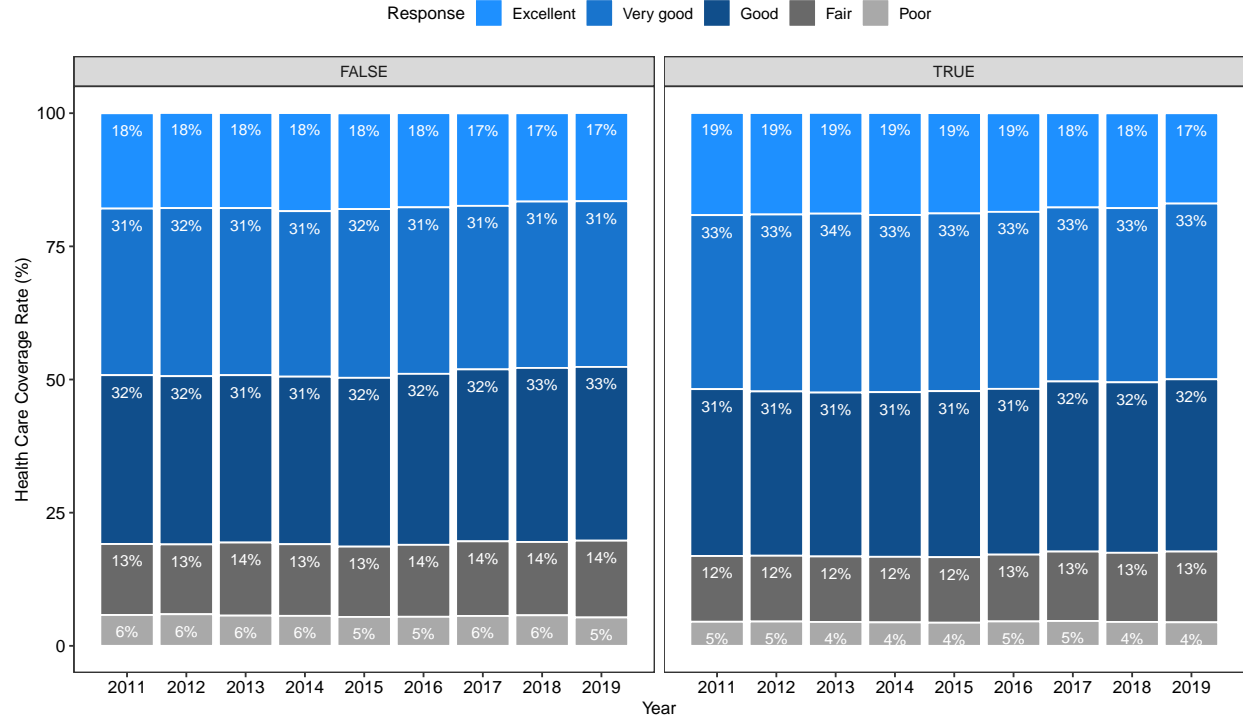


Figure 5: Health Status by Response from 2011 to 2019

Table 2 displays the summary statistics of the percentage of health status being excellent by Medicaid expansion status from 2011 to 2019.

Table 2: Summary Statistic of Health Care Coverage Rate by Medicaid Expansion Status from 2011 to 2019

Year	Not Expanded						Expanded					
	Mean	Min	Q2	Median	Q3	Max	Mean	Min	Q2	Median	Q3	Max
2011	17.9	14.2	17.2	18.0	19.0	20.1	19.2	13.4	17.8	19.2	21.0	22.8
2012	17.9	15.4	16.9	17.8	18.9	20.2	19.0	12.5	18.1	19.4	21.1	23.6
2013	17.9	15.5	16.9	18.0	18.6	19.9	18.9	12.9	17.9	18.9	20.8	23.9
2014	18.4	16.0	17.2	18.1	19.0	22.2	19.2	13.5	18.0	19.0	20.6	24.0
2015	18.0	15.8	17.1	18.2	18.9	19.6	18.8	13.0	18.1	18.9	20.4	22.6
2016	17.7	13.8	16.2	18.2	19.0	21.0	18.5	12.8	17.4	19.0	20.1	23.0
2017	17.4	14.6	16.0	17.5	18.4	20.8	17.7	11.8	16.1	18.0	19.6	21.5
2018	16.6	13.3	15.0	17.2	18.0	18.9	17.8	12.4	16.8	18.4	19.1	21.4
2019	16.6	12.7	15.4	15.8	18.2	20.4	17.0	10.4	16.5	17.5	17.9	20.8

Table 3 displays the summary statistics of the percentage of health status being poor by Medicaid expansion status from 2011 to 2019.

Table 3: Summary Statistic of Health Care Coverage Rate by Medicaid Expansion Status from 2011 to 2019

Year	Not Expanded						Expanded					
	Mean	Min	Q2	Median	Q3	Max	Mean	Min	Q2	Median	Q3	Max
2011	5.8	3.6	4.9	5.6	7.0	7.8	4.5	3.0	3.6	4.1	4.8	8.7
2012	5.9	3.7	4.4	5.5	7.4	8.5	4.6	2.8	3.4	4.0	5.2	9.1
2013	5.7	3.8	4.4	5.3	6.6	8.5	4.5	2.9	3.4	4.1	4.8	8.8
2014	5.6	3.5	4.7	5.5	6.8	7.6	4.4	2.7	3.2	3.8	4.8	9.1
2015	5.4	3.2	4.2	5.2	6.3	8.5	4.3	2.5	3.4	4.0	4.8	9.3
2016	5.5	3.6	4.6	5.2	6.4	7.6	4.6	2.9	3.6	4.2	5.1	8.7
2017	5.6	4.2	4.6	5.4	6.3	8.0	4.7	3.0	3.7	4.3	4.9	8.7
2018	5.7	4.0	4.4	5.4	6.8	8.2	4.5	2.9	3.5	4.0	5.0	9.4
2019	5.3	4.1	4.7	5.2	6.0	7.1	4.4	2.9	3.4	4.0	5.0	8.6

3 Analysis: Tables and Figures

3.1 People of Household Income <\$15,000 with Poor or Fair Health Status

3.1.1 Summary Statistics

Focusing on states that expanded Medicaid in 2014 and those that did not. Table 4 displays the summary statistics and Figure 6 displays trend of the percent of people of household income less than \$15,000 with poor or fair health status from 2011 to 2019, separately by the Medicaid expansion status. The states that expanded Medicaid in 2014 seem to have a relatively lower percent even before 2014, which suggests that these states already had a lower percent of lower-income people with bad health status. After 2014, both states that expanded Medicaid in 2014 and those that experienced a sharp increase in the percent, suggesting that the health condition for lower-income people was worsening despite higher healthcare coverage.

Table 4: Summary Statistic of Percent of Lower-Income People with Bad Health Status from 2011 to 2019

Year	Not Expanded						Expanded					
	Mean	Min	Q2	Median	Q3	Max	Mean	Min	Q2	Median	Q3	Max
2011	39.7	33.8	38.0	40.2	42.1	45.1	37.0	27.2	33.6	36.9	38.8	50.6
2012	39.8	33.5	37.0	40.1	42.8	44.3	37.8	24.2	33.6	38.0	41.1	50.7
2013	41.4	35.2	39.4	41.4	43.8	48.2	36.9	24.0	33.5	36.9	38.7	51.1
2014	40.9	31.6	40.1	40.9	44.1	45.7	37.3	30.2	33.4	36.8	40.9	49.3
2015	40.8	29.8	39.2	41.7	45.3	46.7	38.2	24.4	34.1	37.5	42.4	54.1
2016	41.5	28.3	39.2	41.6	45.2	52.8	39.5	30.3	36.5	38.3	43.6	50.2
2017	44.1	40.0	41.5	43.1	46.3	50.2	41.4	32.5	36.7	41.0	44.7	54.1
2018	43.1	37.7	39.0	41.5	45.0	53.1	40.6	32.7	36.5	39.2	42.5	55.3
2019	45.0	39.1	42.8	45.4	47.5	49.1	41.2	33.6	36.8	40.7	45.1	53.8

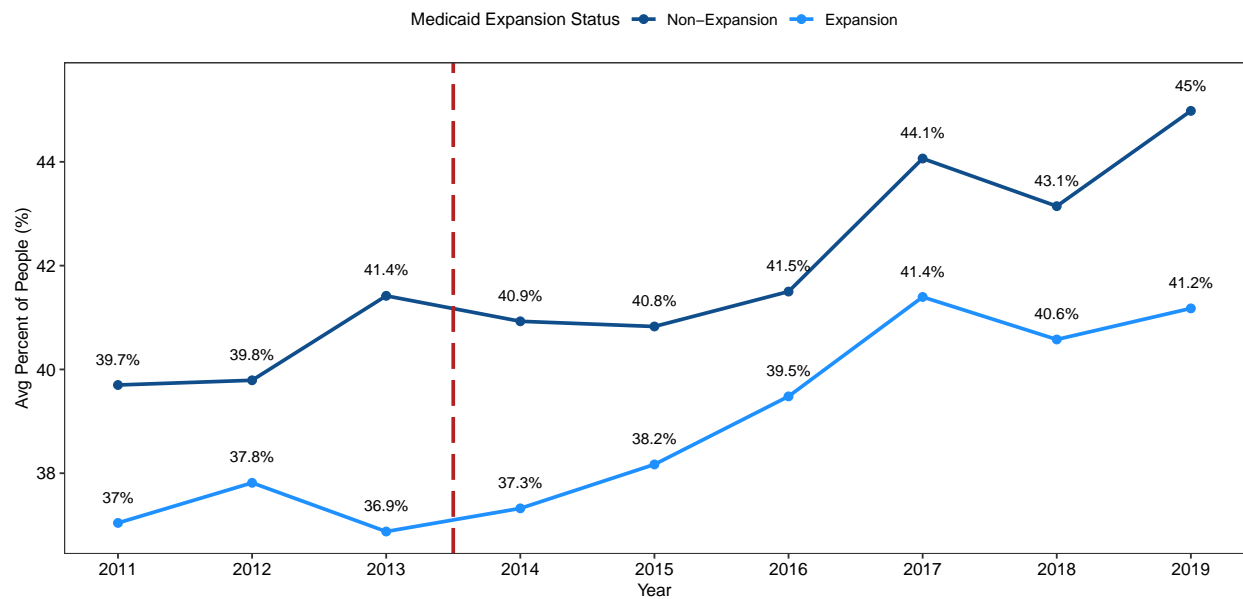


Figure 6: Average Percent of Lower-Income People with Bad Health Status from 2011 to 2019

3.1.2 Basic 2x2 DD Table

Focusing on states that expanded Medicaid in 2014 and those that did not. Table 5 displays a basic 2x2 DD table of the average percent of people of household income less than \$15,000 with poor or fair health status before and after 2014, separately for expansion and non-expansion states. The mean difference of percent rate in the pre-period is 3.0582. The mean difference of percent rate in the post-period is 2.8968. Thus, the Average Treatment Effects on Treated (ATT) is 0.1613.

Table 5: Average Percent of Lower-Income People with Bad Health Status

Group	Pre-Period	Post-Period
Non-Expansion	40.303	42.574
Expansion	37.245	39.677

3.1.3 Difference-in-Difference Model

Table 6 displays the standard DD and two-way fixed effects DD estimates of the effect of Medicaid expansion on the percent of people of household income less than \$15,000 with poor or fair health status, considering the fixed effects of state and year, including only states that expanded in 2014 versus all states. The ATT of Standard DD estimate is 0.1613 for states that expanded in 2014 or never expanded. The ATT of TWSE DD estimate is 0.1767 for states that expanded in 2014 or never expanded. The ATT of TWSE DD estimate with time-varying treatment is -1.1032 for all states that expanded or never expanded.

Table 6: Effect of Medicaid Expansion on Percent of Lower-Income People with Bad Health Status

	Standard DD	TWFE	Time-Varying Treatment
Intercept	40.3030*** (0.9425)		
Post 2014	2.2712* (1.1544)		
Expand	-3.0582** (1.1244)		
Post \times Expand	0.1613 (1.3775)	0.1767 (0.8535)	-1.1032 (0.7014)
N	332	332	449
R2	0.10	0.75	0.74

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

3.1.4 Event Study

Per Figure 7, for only states that expanded in 2014, the effect of Medicaid expansion is not clearly different prior to and after the reference year of 2013, as the estimates are all somewhat above zero, meaning that expanding Medicaid may not have a clear impact on the health condition of lower-income people.

Per Figure 8, for all states that ever expanded, the effect of Medicaid expansion is still not clearly different prior to and after the reference year to treatment of -1, as most estimates are slightly below zero, meaning that expanding Medicaid may not have a clear impact on the health condition of lower-income people.

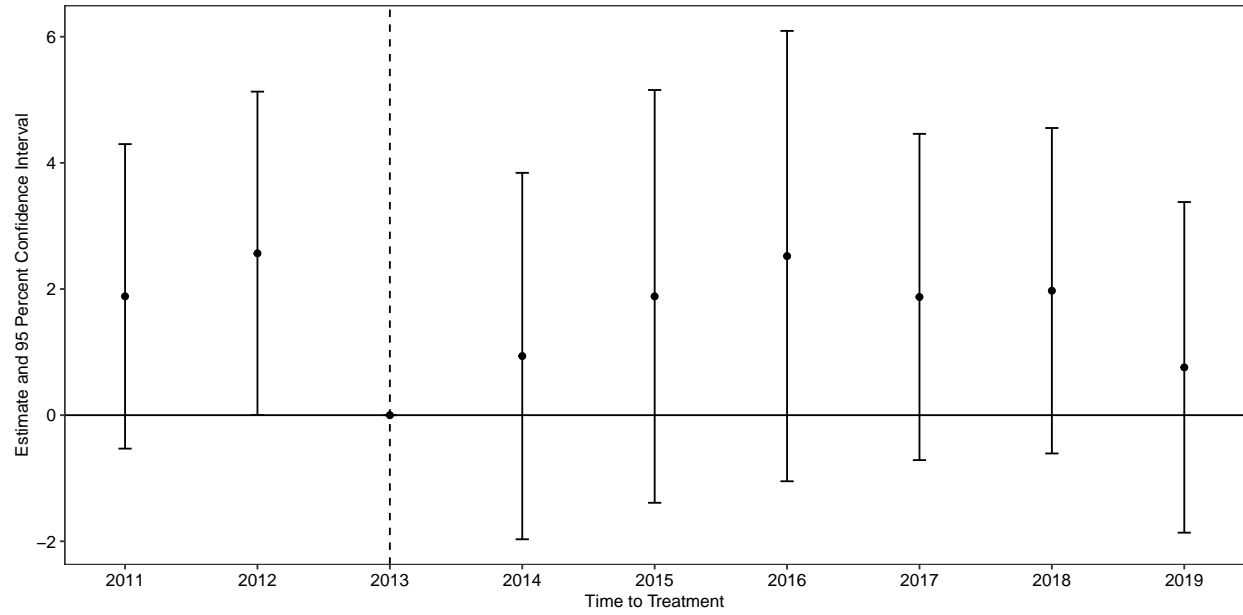


Figure 7: Event Study for Effects of Medicaid Expansion - States that Expanded in 2014

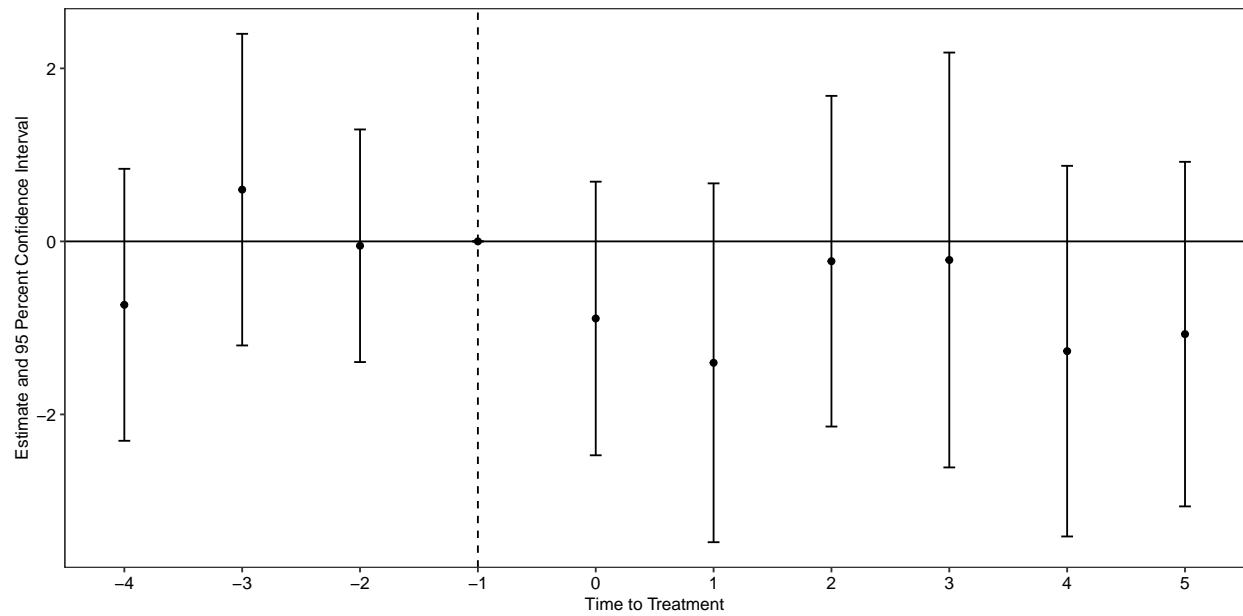


Figure 8: Event Study for Effects of Medicaid Expansion - All Expansion States

3.2 People of Household Income <\$15,000 with Chronic Obstructive Pulmonary Disease (COPD)

3.2.1 Summary Statistics

Focusing on states that expanded Medicaid in 2014 and those that did not. Table 7 displays the summary statistics and Figure 9 displays trend of the percent of people of household income less than \$15,000 with COPD from 2011 to 2019, separately by the Medicaid expansion status. The states that expanded Medicaid in 2014 seem to have a relatively lower percent even before 2014, which suggests that these states already had a lower percent of lower-income people with COPD. After 2014, both states that expanded Medicaid in 2014 and those that experienced a sharp increase in the percent, suggesting that the health condition for lower-income people was worsening despite higher healthcare coverage.

Table 7: Summary Statistic of Percent of Lower-Income People with COPD from 2011 to 2019

Year	Not Expanded						Expanded					
	Mean	Min	Q2	Median	Q3	Max	Mean	Min	Q2	Median	Q3	Max
2011	14.0	10.2	12.5	13.7	14.8	19.9	12.3	7.2	9.8	11.8	13.1	21.6
2012	14.5	9.3	13.9	14.8	15.7	19.4	13.3	7.1	9.8	12.0	15.7	22.8
2013	15.9	7.8	13.4	16.4	18.5	22.9	13.1	7.1	9.1	12.1	15.1	24.3
2014	16.2	9.8	13.2	15.5	18.6	23.3	14.1	6.8	10.4	12.9	15.1	25.7
2015	15.5	9.4	13.9	15.6	17.1	21.3	14.3	6.2	10.6	13.6	17.4	28.1
2016	16.3	10.0	15.0	16.8	17.4	22.5	15.0	7.1	11.7	13.3	18.8	28.4
2017	17.3	8.3	15.3	17.4	19.6	24.3	16.0	7.3	12.7	14.7	18.6	30.3
2018	18.2	8.3	16.6	18.4	20.8	26.0	15.9	7.0	12.1	13.6	18.9	33.3
2019	16.5	10.1	13.5	15.9	19.4	24.9	16.1	6.5	12.1	15.8	18.4	33.0

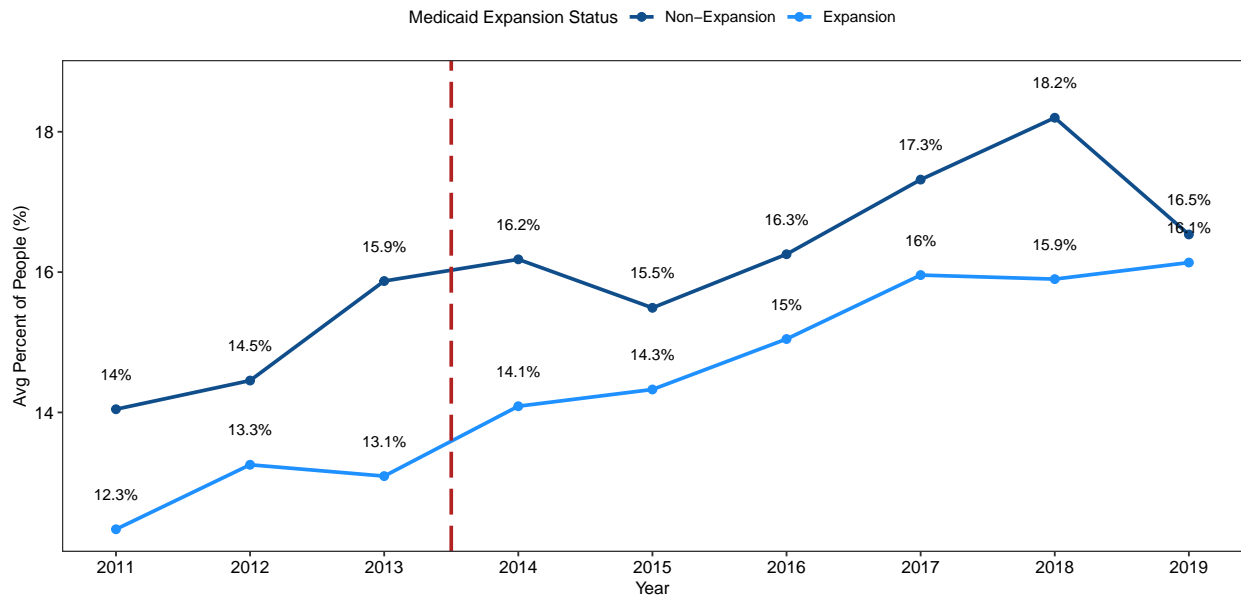


Figure 9: Average Percent of Lower-Income People with COPD from 2011 to 2019

3.2.2 Basic 2x2 DD Table

Focusing on states that expanded Medicaid in 2014 and those that did not. Table 8 displays a basic 2x2 DD table of the average percent of people of household income less than \$15,000 with COPD before and after 2014, separately for expansion and non-expansion states. The mean difference of percent rate in the pre-period is 1.8973. The mean difference of percent rate in the post-period is 1.4312. Thus, the Average Treatment Effects on Treated (ATT) is 0.4662.

Table 8: Average Percent of Lower-Income People with COPD

Group	Pre-Period	Post-Period
Non-Expansion	14.791	16.664
Expansion	12.894	15.232

3.2.3 Difference-in-Difference Model

Table 9 displays the standard DD and two-way fixed effects DD estimates of the effect of Medicaid expansion on the percent of people of household income less than \$15,000 with COPD, considering the fixed effects of state and year, including only states that expanded in 2014 versus all states. The ATT of Standard DD estimate is 0.4662 for states that expanded in 2014 or never expanded. The ATT of TWSE DD estimate is 0.4406 for states that expanded in 2014 or never expanded. The ATT of TWSE DD estimate with time-varying treatment is 0.1122 for all states that expanded or never expanded.

Table 9: Effect of Medicaid Expansion on Percent of Lower-Income People with COPD

	Standard DD	TWFE	Time-Varying Treatment
Intercept	14.7909*** (0.8415)		
Post 2014	1.8727+ (1.0306)		
Expand	-1.8973+ (1.0038)		
Post \times Expand	0.4662 (1.2302)	0.4406 (0.6219)	0.1122 (0.4895)
N	331	331	447
R2	0.07	0.84	0.83

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

3.2.4 Event Study

Per Figure 10, for only states that expanded in 2014, the effect of Medicaid expansion is not clearly different prior to and after the reference year of 2013, as the estimates are all somewhat above zero, meaning that expanding Medicaid may not have a clear impact on the health condition of lower-income people.

Per Figure 11, for all states that ever expanded, the effect of Medicaid expansion is still not clearly different prior to and after the reference year to treatment of -1, as most estimates are slightly below zero, meaning that expanding Medicaid may not have a clear impact on the health condition of lower-income people.

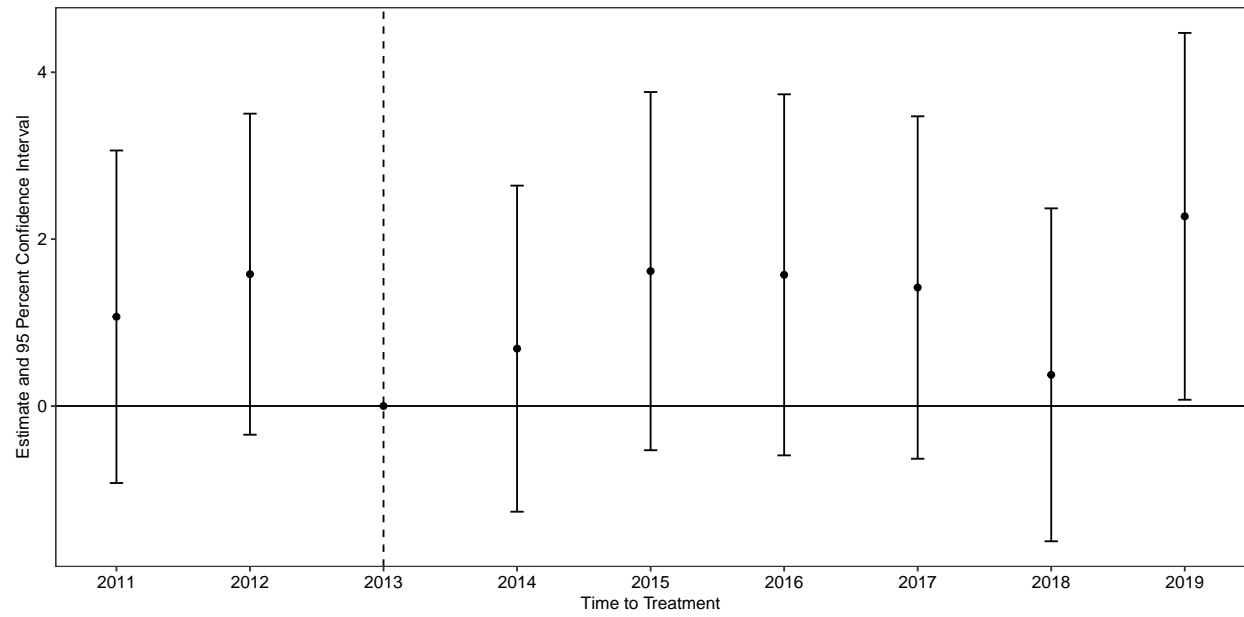


Figure 10: Event Study for Effects of Medicaid Expansion - States that Expanded in 2014

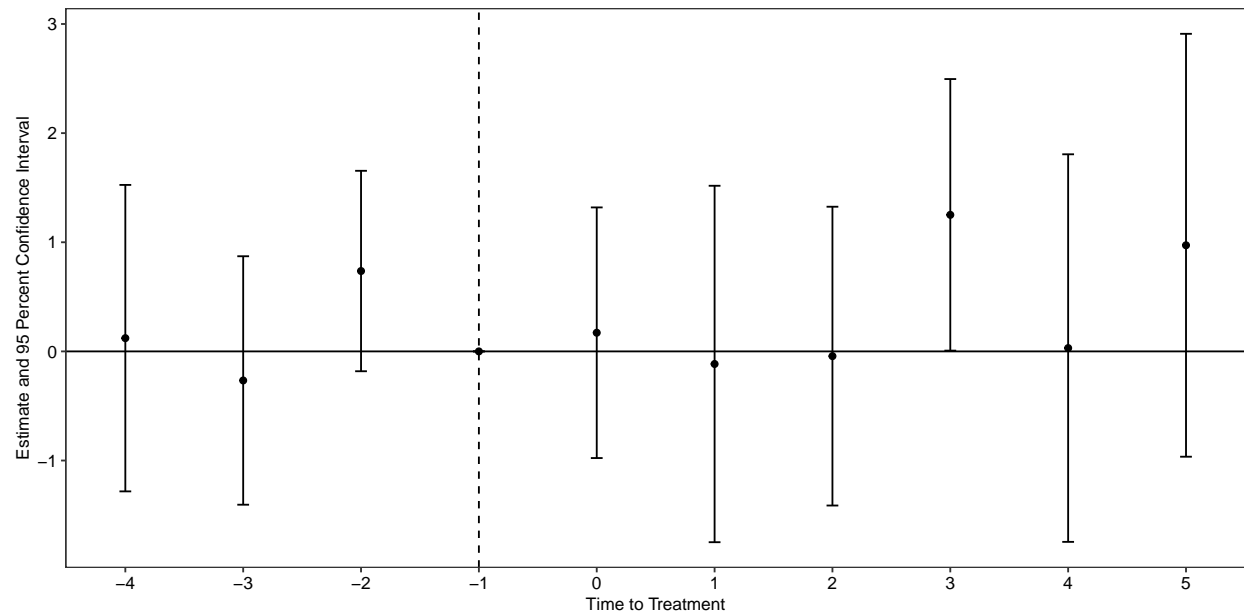


Figure 11: Event Study for Effects of Medicaid Expansion - All Expansion States

3.3 People of Household Income <\$15,000 with Depression

3.3.1 Summary Statistics

Focusing on states that expanded Medicaid in 2014 and those that did not. Table 10 displays the summary statistics and Figure 12 displays trend of the percent of people of household income less than \$15,000 with depression from 2011 to 2019, separately by the Medicaid expansion status. The states that expanded Medicaid in 2014 seem to have a relatively lower percent even before 2014, which suggests that these states already had a lower percent of lower-income people with depression. After 2014, both states that expanded Medicaid in 2014 and those that experienced a sharp increase in the percent, suggesting that the mental health condition for lower-income people was worsening despite higher healthcare coverage.

Table 10: Summary Statistic of Percent of Lower-Income People with depr from 2011 to 2019

Year	Not Expanded						Expanded					
	Mean	Min	Q2	Median	Q3	Max	Mean	Min	Q2	Median	Q3	Max
2011	29.7	24.3	26.8	29.6	32.7	36.0	31.8	18.7	25.9	31.0	36.8	46.1
2012	33.0	26.9	30.2	32.4	36.0	38.8	32.7	17.9	28.6	32.5	37.3	44.1
2013	34.3	26.7	31.8	33.3	38.7	41.6	34.0	20.1	28.2	36.0	39.8	47.7
2014	34.5	26.6	32.5	33.6	36.8	40.8	35.0	17.9	28.3	37.0	41.8	46.6
2015	32.9	26.6	31.0	33.4	34.8	37.6	33.5	19.6	28.9	33.9	39.4	51.7
2016	32.0	17.4	28.7	33.2	36.8	37.9	34.1	20.6	29.0	32.9	39.6	46.4
2017	35.8	28.9	30.6	36.0	40.0	43.0	36.7	21.4	31.6	37.0	42.2	52.9
2018	35.2	25.2	30.9	36.3	39.4	42.8	34.3	20.9	29.1	33.1	40.8	47.5
2019	34.5	23.0	27.6	35.8	41.3	44.0	34.0	21.1	28.7	31.7	40.0	49.7

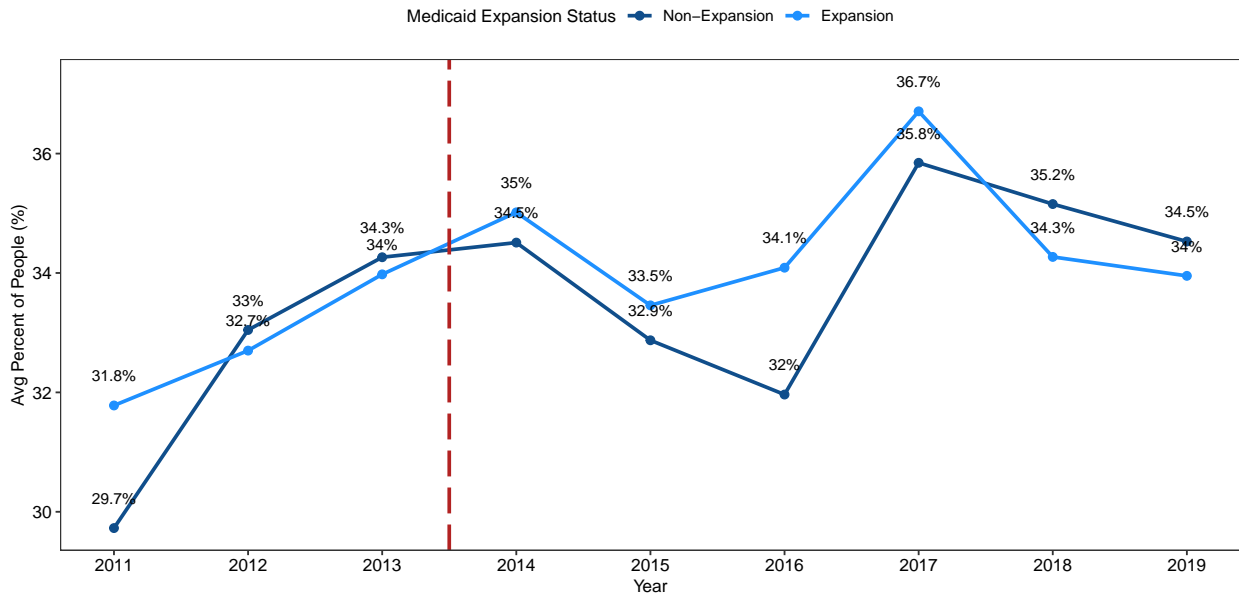


Figure 12: Average Percent of Lower-Income People with depr from 2011 to 2019

3.3.2 Basic 2x2 DD Table

Focusing on states that expanded Medicaid in 2014 and those that did not. Table 11 displays a basic 2x2 DD table of the average percent of people of household income less than \$15,000 with depression before and after 2014, separately for expansion and non-expansion states. The mean difference of percent rate in the pre-period is -0.4738. The mean difference of percent rate in the post-period is -0.4404. Thus, the Average Treatment Effects on Treated (ATT) is -0.0334.

Table 11: Average Percent of Lower-Income People with Depression

Group	Pre-Period	Post-Period
Non-Expansion	32.345	34.145
Expansion	32.819	34.586

3.3.3 Difference-in-Difference Model

Table 12 displays the standard DD and two-way fixed effects DD estimates of the effect of Medicaid expansion on the percent of people of household income less than \$15,000 with depression, considering the fixed effects of state and year, including only states that expanded in 2014 versus all states. The ATT of Standard DD estimate is -0.0334 for states that expanded in 2014 or never expanded. The ATT of TWSE DD estimate is -0.1088 for states that expanded in 2014 or never expanded. The ATT of TWSE DD estimate with time-varying treatment is -0.5374 for all states that expanded or never expanded.

Table 12: Effect of Medicaid Expansion on Percent of Lower-Income People with Depression

	Standard DD	TWFE	Time-Varying Treatment
Intercept	32.3455*** (1.2155)		
Post 2014	1.8000 (1.4887)		
Expand	0.4738 (1.4501)		
Post \times Expand	-0.0334 (1.7765)	-0.1088 (1.0303)	-0.5374 (0.6872)
N	332	332	449
R2	0.02	0.80	0.79

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

3.3.4 Event Study

Per Figure 13, for only states that expanded in 2014, the effect of Medicaid expansion is not clearly different prior to and after the reference year of 2013, as the estimates are all positive from 2011 to 2017 and negative in 2018 and 2019, meaning that expanding Medicaid may not have a clear impact on the mental health condition of lower-income people.

Per Figure 14, for all states that ever expanded, the effect of Medicaid expansion is still not clearly different prior to and after the reference year to treatment of -1, as most estimates are below zero, meaning that expanding Medicaid may not have a clear impact on the mental health condition of lower-income people.

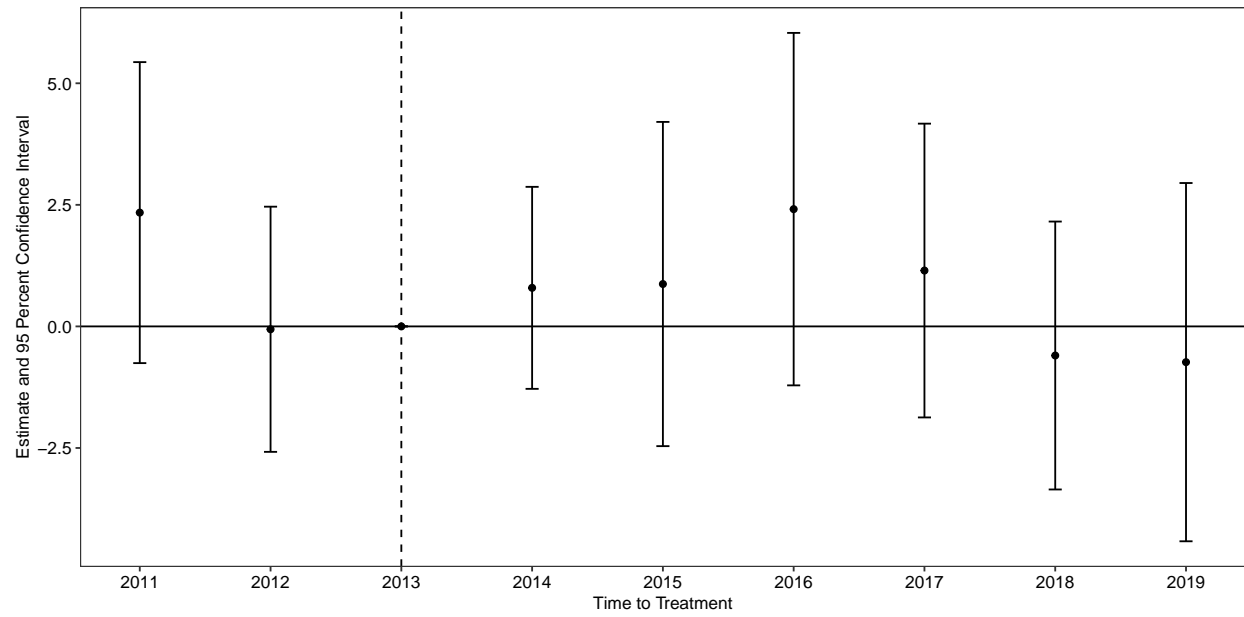


Figure 13: Event Study for Effects of Medicaid Expansion - States that Expanded in 2014

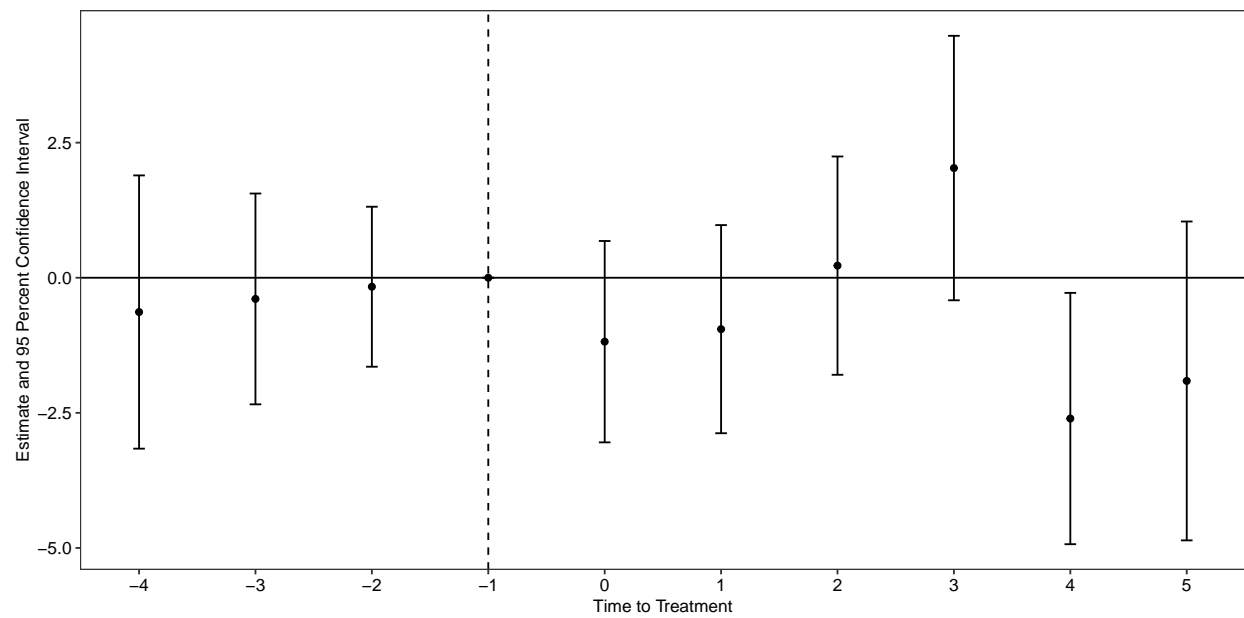


Figure 14: Event Study for Effects of Medicaid Expansion - All Expansion States