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Association of Medicaid Expansion with Rates of Utilization of Cardiovascular Therapies Among Medicaid Beneficiaries Between 2011 and 2018

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Abstract

Background: The Affordable Care Act expanded Medicaid eligibility allowing low-income individuals greater access to healthcare. However, the uptake of state Medicaid expansion has been variable. It remains unclear how the Medicaid expansion was associated with the temporal trends in use of evidence-based cardiovascular drugs.

Methods: We used the publicly available Medicaid Drug Utilization and Current Population Survey to extract filled prescription rates per 1000 Medicaid beneficiaries of statins, antihypertensives, P2Y12 inhibitors, and direct oral anticoagulants (DOAC). We defined expander states as those who expanded Medicaid on January 1, 2014, and non-expander states as those who had not expanded by December 31, 2018. Difference-in-differences (DID) analyses were performed to compare the association of the Medicaid expansion with per-capita cardiovascular drug prescription rates in expander versus non-expander states.

Results: Between 2011 and 2018, the total number of prescriptions among all Medicaid beneficiaries increased, with gains of 89.7% in statins (11.0 to 20.8 million), 76% in antihypertensives (35.3 to 62.2 million), and 37% in P2Y12 inhibitors (1.7 to 2.3 million).

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Medicaid expansion was associated with significantly greater increases in quarterly prescriptions (per 1000 Medicaid beneficiaries) of statins [DID estimate (95% CI): 22.5 (16.5 to 28.6), P<0.001], antihypertensives [DID estimate (95% CI): 63.2 (47.3 to 79.1), P<0.001], and P2Y12 inhibitors [DID estimate (95% CI): 1.7 (1.2 to 2.2), P<0.001]. Between 2013 and 2018, more than 75% of the expander states had increases in prescription rates of both statins and antihypertensives. In contrast, 44% of non-expander states saw declines in statins and antihypertensives. The Medicaid expansion was not associated with higher DOAC prescription rates [DID estimate (95% CI) 0.9 [−0.3 to 2.1], P=0.142).

Conclusions: The 2014 Medicaid expansion was associated with a significant increase in per-capita utilization of cardiovascular prescription drugs among Medicaid beneficiaries. These gains in utilization may contribute to long-term cardiovascular benefits to lower-income and previously underinsured populations.

Keywords

Medicaid; health disparities; health services research; medical therapy

In the US, morbidity and mortality from cardiovascular disease (CVD) has declined substantially over time in association with improvements in population-level risk factor burden and greater use of evidence-based therapies.[1] From 2000 to 2010, the United States achieved a nearly 30% reduction in age-adjusted CVD mortality.[2] However, recent studies have shown a deceleration in the annual rate of decline in CVD mortality rates from 3.8% between 2000 and 2011 to 0.7% between 2011 and 2014.[2] Also, geographic and socioeconomic disparities have recently widened, with increasing total CVD burden in 12 states between 2010 and 2016[1] and stagnating improvements in CVD risk factor burden in the low-income population.[3–5]

Uninsured populations are disproportionately affected by CVD due to barriers in receiving primary care, routine medical screening, and evidence-based pharmacotherapies.[6, 7] These disparities are apparent in the poor control of risk factors such as hyperlipidemia[4] and hypertension,[5] and higher downstream burden of adverse cardiovascular events. In 2014, the Affordable Care Act (ACA) permitted states to expand Medicaid eligibility to include non-elderly adults earning up to 138% of the federal poverty line, allowing millions of previously uninsured individuals to become eligible for Medicaid.[8] Greater access to care by expanding Medicaid insurance coverage was an essential step in addressing health disparities among low-income individuals who have a high burden of chronic medical conditions including CVD.[9,10] However, the expansion of Medicaid eligibility was variable, with only 24 states and Washington DC expanding on January 1, 2014. Though a few additional states expanded their respective Medicaid program in the subsequent years, 19 states had still deferred expanding Medicaid by the end of 2018.

Prior studies have reported a significant reduction in the proportion of uninsured individuals, greater access to care, and lower rates of cardiovascular mortality within the first few years after Medicaid expansion.[11] However, the association of Medicaid expansion with changes in the use of evidence-based cardiovascular pharmacotherapies over longer-term follow-up has not been characterized. Accordingly, we evaluated the temporal differences in utilization

patterns for cardioprotective therapies in Medicaid expander vs. non-expander states from 2011 to 2018.

Methods

The data from the Medicaid State Drug Utilization Dataset and Current Population Survey are publicly available and accessible at [https://www.medicaid.gov/medicaid/prescription-drugs/state-drug-utilization-data/index.html] and [https://www.census.gov/programs-surveys/cps.html], respectively.

Data Sources

We used the publicly available 2011–2018 Medicaid State Drug Utilization[12] dataset, which reports aggregated, de-identified quarterly state-level claims data for covered outpatient prescription drugs paid for by state Medicaid agencies since the start of the Medicaid Drug Rebate Program. This dataset includes claims for beneficiaries enrolled in Medicaid Fee for Service or Managed Medicaid. We limited our analysis to key evidence-based cardiovascular pharmacotherapies, namely, statins, antihypertensives (seven classes, including angiotensin-converting enzyme [ACE] inhibitors, angiotensin receptor blockers [ARB], beta-blockers, calcium channel blockers, mineralocorticoid receptor antagonists, thiazide diuretics, and loop diuretics), P2Y12 inhibitors (clopidogrel, prasugrel, ticagrelor), and direct oral anticoagulants (DOAC; [dabigatran, approved 2010]; [rivaroxaban, approved 2011]; [apixaban, approved 2012]; [edoxaban, approved 2015]) as detailed in Table 1. The Current Population Survey from the U.S. Census Bureau was used to identify the annual number of state Medicaid beneficiaries. Our study was deemed to be non-human research by the UT Southwestern Medical Center Institutional Review Board and was exempt from approval.

State Medicaid Expansion Status

Medicaid expander states were defined as those that implemented ACA Medicaid expansion on or before January 1, 2014 (Arkansas, Arizona, California, Colorado, Connecticut, District of Columbia, Delaware, Hawaii, Iowa, Illinois, Kentucky, Massachusetts, Maryland, Minnesota, North Dakota, New Jersey, New Mexico, Nevada, New York, Ohio, Oregon, Rhode Island, Vermont, Washington, and West Virginia).[13] Late-expander states who expanded Medicaid between 1/2/2014 and 12/31/2018 (Alaska, Indiana, Louisiana, Michigan, Montana, New Hampshire, Pennsylvania) were excluded from the primary analysis. The remaining states were defined as Medicaid non-expanders (Alabama, Florida, Georgia, Idaho, Kansas, Maine, Missouri, Mississippi, North Carolina, Nebraska, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Wisconsin, and Wyoming). Kansas was excluded from the state-level analysis due to incomplete reporting of Medicaid data in 2013.

Statistical Analysis

The study period was divided into pre-expansion (1/1/2011 to 12/31/2013) and post-expansion (1/1/2014 to 12/31/2018) and the changes in the total number of Medicaid beneficiaries and total number of cardiovascular prescriptions post expansion were estimated. After stratifying states by their Medicaid expansion status (expander vs. non-

expander states), aggregate totals of prescriptions and beneficiaries in the pre- vs. post-expansion period were calculated for the two groups. Our primary outcome of interest was the number of quarterly filled prescriptions per 1000 Medicaid beneficiaries.

Differences in the average quarterly prescription rates (per 1000 Medicaid beneficiaries) for these cardiovascular therapies were compared between the pre-expansion vs. post-expansion periods within the expander and non-expander state groups using paired T-tests, with normality assessed with skewness between −2 and +2. Differences in the temporal trends in prescription rates during the pre- and post-expansion period across the non-expander vs. expander states were compared using a quasi-experimental difference-in-differences (DID) analysis. The parallel trends assumption was confirmed visually. Sensitivity analyses were also performed, excluding Washington DC and the six states (CA, CT, MA, MN, NJ, and WA) that provided additional Medicaid coverage before the ACA's Medicaid expansion from the expander group, and including the late-expander states as part of the non-expansion group. To account for the possible roll-over period effect, additional sensitivity analyses were also conducted comparing the prescription rates in pre-expansion period (2011–2013) to the first-year post-expansion (2014) and subsequent years (2015–2018) separately to isolate the immediate post-expansion (2014 alone) and sustained post-expansion (2015–2018) effects on the prescription rate.

We also compared each state's prescription rate in 2013 (year prior to Medicaid expansion) with their 2018 prescription rate and represented these findings onto maps of the United States based on expansion status.

Statistical analyses were performed using R version 3.6.3 (R Foundation, Vienna) and GraphPad Prism. A two-sided p-value less than or equal to 0.05 was considered statistically significant.

Results

National Trends in Cardiovascular Medication Use Among Medicaid Beneficiaries

Between 2011 and 2018, the total number of Medicaid beneficiaries among all 50 states and Washington DC increased by 21.2% from 55.6 to 67.6 million. Over the study period, the number of prescriptions of cardiovascular medications among all Medicaid beneficiaries increased substantially, with gains of 89.7% in statins (11.0 million to 20.8 million), 76% in antihypertensives (35.3 million to 62.2 million), and 37% in P2Y12 inhibitors (1.7 million to 2.3 million). The prescription rates for DOACs, which were approved for use shortly before the start of the study period, also increased substantially (28,229 to 1.5 million).

Trends in Cardiovascular Medication Use Among Non-Expander and Expander States

Between 2011 and 2018, the total number of Medicaid beneficiaries in non-expander states increased by 10.5% (19.9 to 22.0 million) while beneficiaries in expander states increased by 28.4% (29.2 million to 37.5 million). Total prescriptions of all included drug classes increased in both expander and non-expander states over the study period (Table 1). Among non-expander states, there were increases in average quarterly prescriptions/1000 beneficiaries for statins (35.7 to 38.0 [P=0.004]), antihypertensives (128.9 to 135.8

[P=0.013], and DOACs (0.3 to 2.5 [P<0.001]) from the pre-expansion (2011–2013) to the post-expansion period (2014–2018) (Figure 1, Table 2). The quarterly per-capita prescriptions of P2Y12 inhibitors decreased from the pre- to post-expansion periods (6.6 to 5.9 [P<0.001], Table 2).

Among expander states, the average quarterly prescription rates for these medications increased from the pre-expansion period to the post-expansion period [statins (61.3 to 86.2, P<0.001]); antihypertensives (196.3 to 266.4, P<0.001); P2Y12 inhibitors (7.8 to 8.8, P<0.001); and DOACs (0.3 to 3.4, P<0.001) (Figure 1, Table 2). In the DID analysis, compared with the non-expander states, the Medicaid expander states had a significantly greater increase in prescription rates of statins (DID estimate [95% CI]: 22.5 [16.5 to 28.6], P<0.001), antihypertensives (DID estimate [95% CI]: 63.2 [47.3 to 79.1], P<0.001), and P2Y12 inhibitors (DID estimate [95% CI]: 1.7 [1.2 to 2.2], P<0.001) from the pre-expansion to the post-expansion period (Table 2). Further subgroup analysis demonstrated a consistently greater increase in prescription rates for each class of antihypertensive therapy in the expander vs. non-expander states (Table 2). The Medicaid expansion was not associated with a significantly greater increase in the prescription rate of DOACs in the expander vs. non-expander states (DID estimate [95% CI]: 0.9 [−0.3 to 2.1], P=0.142). Similar patterns of results were noted in the sensitivity analyses excluding the seven states that provided additional Medicaid coverage before January 1, 2014 and including the late-expander states as part of the non-expansion group (Table 3). In sensitivity analysis comparing the prescription rates in the pre-expansion period to the first-year post-expansion (2014) and subsequent years (2015–2018) separately, the magnitude of increases in the per-capita prescription rates in the expander vs. non expander states was less substantial in the first year of the Medicaid expansion, but increased in the subsequent years (Table 4).

State-Level Trends in Cardiovascular Medication Use

In the state-level analysis comparing changes in prescription rates from 2013, the year before Medicaid expansion, to 2018, a greater proportion of expansion states noted increases in the prescription of statins (84% expander states with an increase vs. 44% non-expanders) (Figure 2), antihypertensives (76% expander vs. 50% non-expander) (Figure 3) and P2Y12 inhibitors (52% expander vs. 28% non-expander) (Figure 4) among Medicaid beneficiaries. All states had increases in the prescription rate of DOACs. Comprehensive state-level gains in prescription rates of all four classes were seen in 52% (13 of 25) expander states, compared with 22% of non-expander states (4 of 18, with Kansas excluded). Widespread state-level decreases in prescription rates of both statins and antihypertensives were noted in 16% (4 of 25) of expansion states and 44% (8 of 18) of non-expansion states. Among expander states, the greatest increase in prescription rates of statins, antihypertensives, and P2Y12 inhibitors were noted in North Dakota, Delaware, and Washington state. Among non-expander states, the greatest decline was observed in South Carolina, Alabama, and Maine.

Discussion

Our study findings demonstrate that the expansion of the Medicaid program in 2014 was associated with a significant increase in the use of evidence-based cardiovascular

pharmacotherapies among Medicaid beneficiaries. More than 75% of expansion states had an increase in the prescription rates of both statins and antihypertensive agents. In contrast, 44% of non-expansion saw declines in these classes. DOAC use increased in all states irrespective of expansion status, potentially driven by their rapid uptake following Food and Drug Administration (FDA) approvals. These findings highlight the potential impact of policy-level changes in access to health insurance on public health outcomes mediated via population-level changes in evidence-based cardiovascular pharmacotherapies.

Studies of the 2014 Medicaid expansion using early survey data have demonstrated significant improvements in insurance coverage and access to health care, greater utilization of annual physician visits, decreases in cost-related medication nonadherence, fewer delays to care, and better self-reported health. These favorable changes in care patterns were observed in the first two to three years post-expansion of Medicaid and were mainly assessed in a limited number of states.[14–18] But more recent national data have also demonstrated the association of the Medicaid expansion on increasing access to evidence-based pharmacotherapies for diabetes.[19] Our study adds to the existing literature by providing objective, national-level data over a longer follow-up period, demonstrating more meaningful increases in the prescription rates of evidence-based cardiovascular prescriptions among expansion vs. non-expansion states.

Prior studies have also demonstrated a significant improvement in all-cause and cardiovascular mortality rates among Medicaid expander states.[11] In contrast, in-hospital care quality and outcomes associated with acute cardiovascular events, such as hospitalization for heart failure or acute myocardial infarction, have been mostly unaffected by the Medicaid expansion.[20, 21] Thus, the reductions in cardiovascular and all-cause mortality in Medicaid expander states may be related to improvements in outpatient care of patients with chronic cardiovascular conditions, with greater rates of utilization and adherence to evidence-based therapies as noted in the present study.

Several factors may underlie the observed increase in the prescription rate of evidence-based cardiovascular medication in the Medicaid expander vs. non-expander states. First, the post-expansion newly eligible population that entered the Medicaid pool may have carried a disproportionately higher clinical need for cardiovascular medications compared with pre-expansion Medicaid beneficiaries, resulting in higher prescription utilization. Second, while the overall rate of physicians who accepted Medicaid did not significantly change in the post-expansion period, the overall access to care has increased in states with Medicaid expansion.[22] Prior studies have demonstrated that the Medicaid expansion was associated with greater increases in the number of advanced practice providers and support staff in community health centers.[23] This increase was likely driven the greater observed financial stability in health centers, as these clinics received a new influx of reimbursement from newly enrolled Medicaid recipients.[24] Reports have shown that health centers in expansion states were more likely to have unfilled job openings for social support services and mental health professions, suggesting a greater demand for providers to match patient volume.[25] Taken together, these factors likely contributed to better access to care, leading to a greater diagnosis of conditions such as diabetes, hypertension, hyperlipidemia, and coronary artery disease. This may have contributed to greater prescription rates of preventive therapies such

as statins and antihypertensive agents.[14–17, 26] Third, post-expansion Medicaid beneficiaries have benefitted from greater access to cardiovascular interventions such as coronary artery bypass grafting and percutaneous coronary intervention,[27] which may have contributed to the increased use of P2Y12 inhibitors. Consistent with our observations, Ghosh et al. observed increases in the use of cardiovascular medications among expansion states in the two years post-expansion.[28] Our study expands on these observations by evaluating the use of different cardiovascular medication classes up to five years after the Medicaid expansion.

In contrast with antihypertensives, statins, and P2Y12 inhibitors, we did not observe a significant difference in the use of DOACs in expander states. DOACs were approved shortly before the Medicaid expansion, and the early and rapid uptake of this medication across all states in the post-approval period may have blunted any relative utilization differences between the expander and non-expander states. Future studies are needed to determine if Medicaid expansion would contribute to greater prescriptions of these novel and expensive therapies in indicated Medicaid beneficiaries over long-term follow up.

Our study findings have important health policy implications. We note that the Medicaid expansion is associated with greater use of cardioprotective therapies in the low-income population. Medicaid beneficiaries are disproportionately at a higher lifetime risk for cardiovascular events,[9] and early implementation of effective preventive therapies may have substantial long-term benefits. In contrast with the Medicaid expander states, nearly half of the non-expander states had a decline in the prescription rates for statin and antihypertensive therapies in the post-expansion period. Some non-expander states such as Wisconsin, Alabama, North Carolina, and South Carolina observed increases in the absolute number of prescriptions, however the total Medicaid beneficiaries in these states increased to a greater extent, thus resulting in a relative decrease in prescriptions/1000 beneficiaries. It is plausible that the growth in access to primary care, preventative visits, and mental health care in these states may not have matched the modest increase in total Medicaid beneficiaries that occurred in the absence of Medicaid expansion.[29] This is particularly relevant as states with the largest burden of CVD, including Alabama, Mississippi, and Tennessee, have elected not to expand their Medicaid programs,[1] and prior studies have attributed 15,600 excess deaths over four years to the lack of expansion of Medicaid among these states.[30] As of August 2020, only 12 states had still not elected to expand Medicaid.[13] Future studies are needed to determine if the broadening of insurance coverage through the expansion of Medicaid or other similar health policies in these states may improve access to effective preventive therapies.

Our study has several limitations. First, although our design was quasi-experimental, we cannot exclude differential changes between expansion and non-expansion states that may have occurred unrelated to the Medicaid expansion. However, we are not aware of any significant change in clinical or demographic factors that coincided with Medicaid expansion in January 2014. Second, because the Medicaid State Drug Utilization dataset does not contain any individual-level data, we are unable to comment on the indication or appropriateness of prescribed cardiovascular medications or control for differences in demographics between expansion and non-expansion populations. Third, we also cannot comment on the pre-expansion medication use patterns of newly-eligible Medicaid

beneficiaries. However, nearly 80% of the newly eligible adult Medicaid population was previously uninsured and likely faced barriers to accessing these medications.[31] Fourth, the datasets do not provide any information about medication adherence, so it is unclear to what extent prescriptions were taken as prescribed. We are also unable to directly link prescriptions to any individual clinical outcomes. Fifth, since Medicaid is a state health insurance program, there may be inherent differences in the healthcare systems and delivery models between expander and non-expander states which may account for some of the observed differences in prescription rates of cardiovascular medications. This is particularly relevant considering the baseline differences in prescription rates of these therapies among the expander vs. non-expander states before Medicaid expansion. However, the quasi-experimental analysis approach used in the present study accounts for these baseline differences and the observed results are reflective of differences in prescription of cardiovascular therapies that is attributable to Medicaid expansion. Also, to the best of our knowledge there were no other large changes in state Medicaid program structure during the study period aside from the Medicaid expansion that could account for the observed differences. Sixth, due to limitations in the dataset, we were unable to assess whether populations in expander states that were unaffected by the Medicaid expansion, such as the non-dual Medicare beneficiaries, had similar trends in cardiovascular prescription usage. Finally, our study sample includes exclusively people enrolled in Medicaid and does not capture low-income adults who gained private health insurance under the ACA private insurance marketplaces. It is therefore possible that a higher proportion of low-income adults in non-expansion states gained private health insurance and that the association of the Medicaid expansion with cardiovascular prescription rates for low-income adults may be overestimated in our study.

In conclusion, since the Medicaid expansion, expander states had higher prescription rates of statins, antihypertensives, and P2Y12 inhibitors compared with non-expansion states. These findings are consistent with other studies demonstrating improvement access to care, patient satisfaction, and clinical outcomes among states with Medicaid expansion and highlight the role of effective health policies in promoting cardiovascular health in the community.

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Nonstandard Abbreviations and Acronyms

ACA	Affordable Care Act
ACE	Angiotensin-converting enzyme
ARB	Angiotensin receptor blockers
DOACs	Direct oral anticoagulants
DID	Difference-in-differences

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What is Known

- Medicaid expansion is associated with greater access to care and lower rates of cardiovascular mortality

What the Study Adds

- Medicaid expansion is associated with a higher rate of prescriptions for evidence-based, preventative cardiovascular medications, including statins, antihypertensives, and P2Y12 inhibitors
- In the first five years post-expansion, no significant association was observed between the Medicaid expansion and the prescription rate of direct oral anticoagulant prescriptions

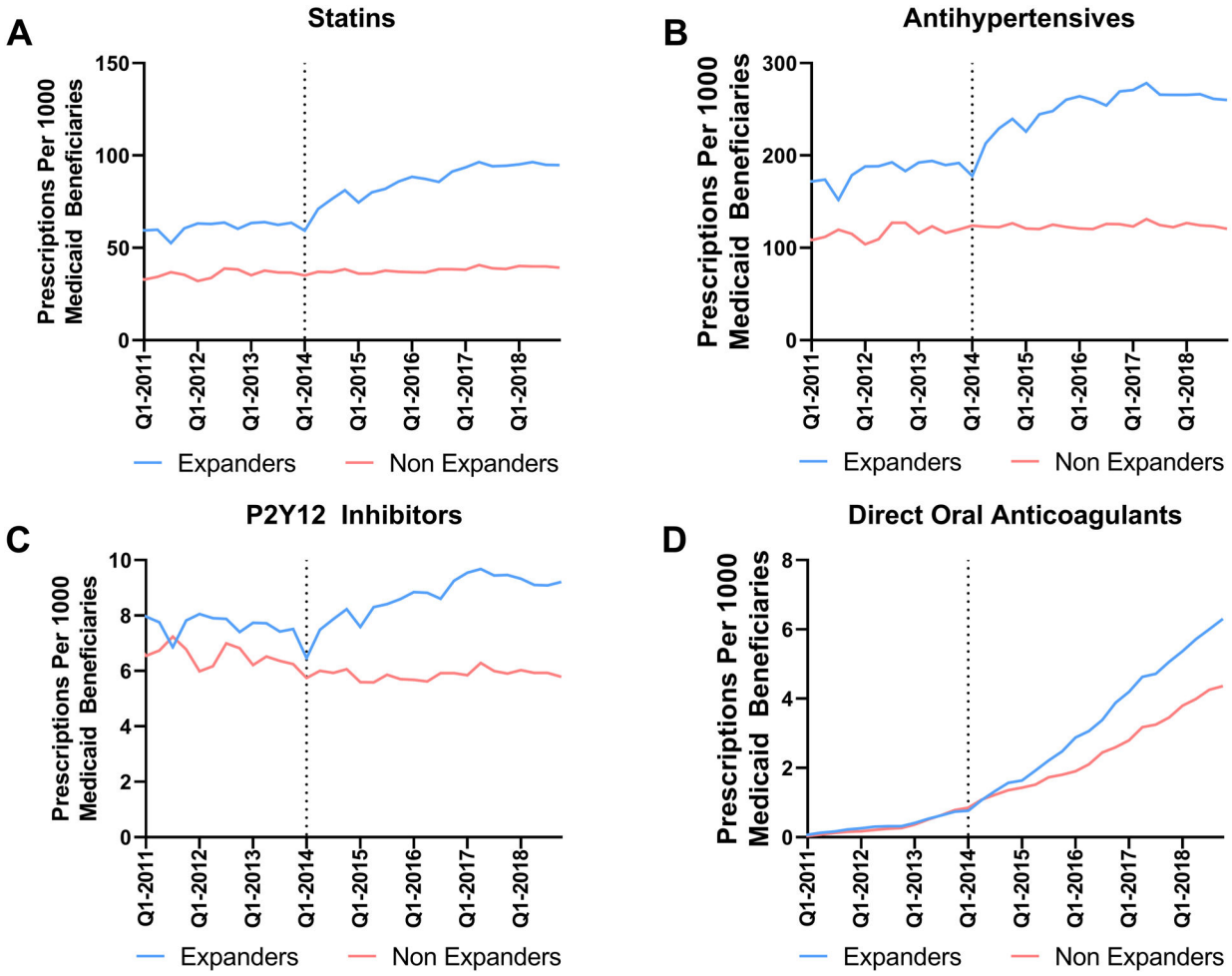

Figure 1: Trends in Quarterly Prescriptions/1000 Beneficiaries of statins, P2Y12 inhibitors, antihypertensives, and direct oral anticoagulants between 2011 to 2018 among expander and non-expander states.

1A: Statins. 1B: Antihypertensives. 1C: P2Y12 inhibitors. 1D: Direct Oral Anticoagulants.

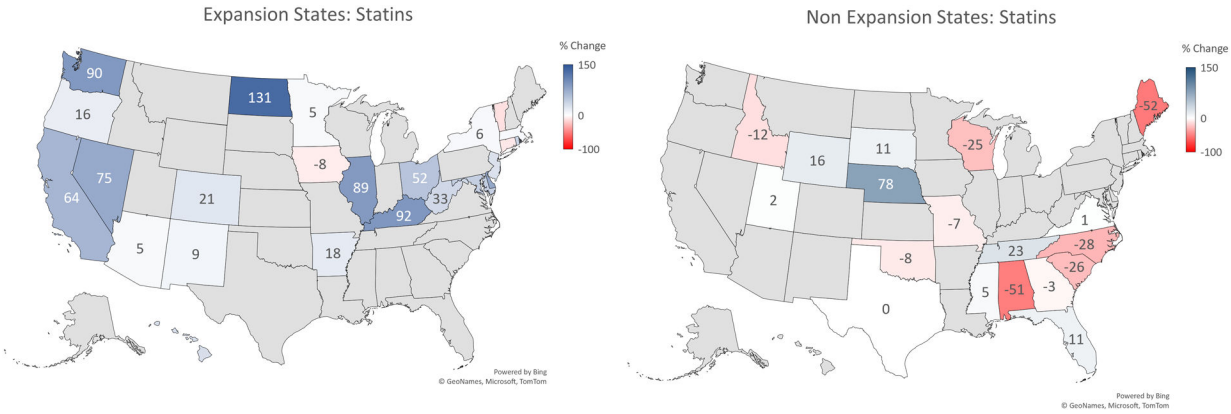

Figure 2:

State-Level Percent Change in Annual Statin Prescriptions/1000 Medicaid beneficiaries between 2013 (year prior to Medicaid expansion) and 2018.

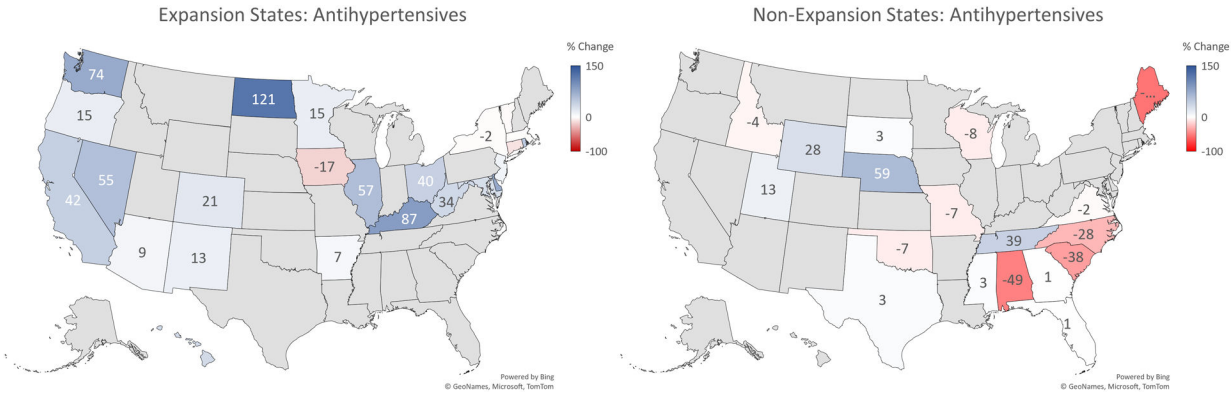

Figure 3:

State-Level Percent Change in Annual Antihypertensive Prescriptions/1000 Medicaid beneficiaries between 2013 (year prior to Medicaid expansion) and 2018.

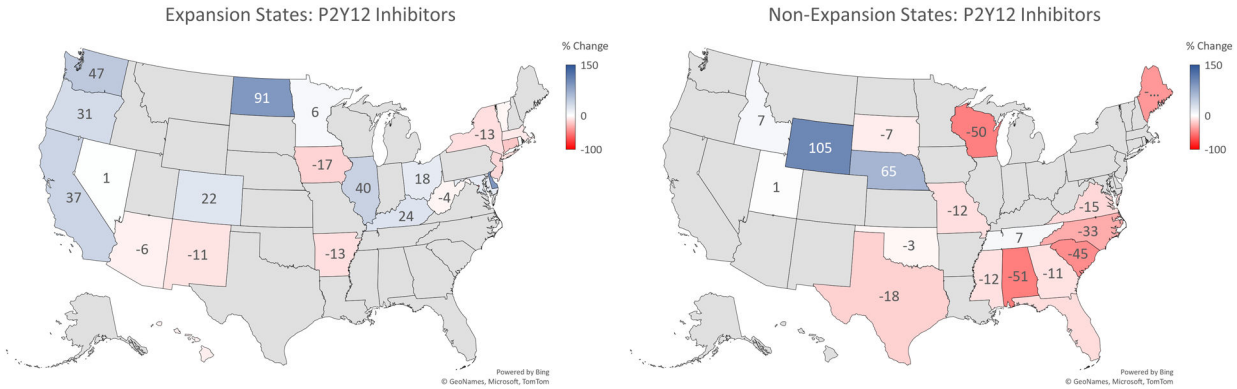

Figure 4:

State-Level Percent Change in Annual P2Y12 Receptor Blocker Prescriptions/1000 Medicaid beneficiaries between 2013 (year prior to Medicaid expansion) and 2018.

Table 1.

Average number of Medicaid beneficiaries with prescription for different cardiovascular therapies per quarter in the pre-expansion and post-expansion periods

Drug Class	Average quarterly prescription in Medicaid expander states		Average quarterly prescription in Medicaid non-expander states	
	Pre-Expansion (2011–2013)	Post-Expansion (2014–2018)	Pre-Expansion (2011–2013)	Post-Expansion (2014–2018)
Statins	1,812,468	3,187,415	726,405	831,806
Antihypertensives	5,801,550	9,847,958	2,622,405	2,971,034
ACEI	1,625,950	2,673,797	745,881	777,212
ARB	575,106	1,303,753	217,508	335,581
BB	1,436,117	2,295,951	667,622	741,507
CCB	992,172	1,763,280	443,817	523,672
MRA	118,561	233,492	68,072	86,497
Loop Diuretics	392,036	565,349	253,185	264,359
Thiazide Diuretics	661,609	1,012,337	226,320	242,206
P2Y12 inhibitors	226,531	320,360	133,121	128,357
DOAC	10,098	127,425	6,112	53,980
Total no. of Medicaid Beneficiaries During the Time Period	29,541,647	36,856,090	20,334,618	21,877,889

ACEI - angiotensin-converting enzyme inhibitors, ARB - angiotensin receptor blockers, BB - beta blockers, CCB - calcium channel blockers, MRA - mineralocorticoid receptor antagonists; DOAC: direct oral anticoagulant

Table 2:

Average number of quarterly prescriptions per 1000 Medicaid beneficiaries in the pre-expansion and post-expansion periods, and difference-in-differences analysis assessing changes in quarterly prescriptions per 1000 Medicaid beneficiaries before and after the Medicaid expansion.

Drug Class	Average quarterly prescription (per-1000 beneficiaries) in Medicaid expander states		Average quarterly prescription (per-1000 beneficiaries) in Medicaid non-expander states		Pre vs. Post-Expansion DID Analysis	
	Pre-Expansion (2011–2013)	Post-Expansion (2014–2018)	Pre-Expansion (2011–2013)	Post-Expansion (2014–2018)	DID estimate (95% CI)	P-value
Statins	61.3	86.2	35.7	38.0	22.5 (16.5 to 28.6)	<0.001
Antihypertensives	196.3	266.4	128.9	135.8	63.2 (47.3 to 79.1)	<0.001
ACEI	55.0	72.4	36.7	35.6	18.5 (14.5 to 22.5)	<0.001
ARB	19.4	35.2	10.7	15.3	11.1 (7.0 to 15.2)	<0.001
BB	48.6	62.1	32.8	33.9	12.5 (9.2 to 15.8)	<0.001
CCB	33.6	47.7	21.8	23.9	12.0 (8.8 to 15.3)	<0.001
MRA	4.0	6.3	3.4	4.0	1.7 (1.0 to 2.3)	<0.001
Loop Diuretics	13.3	15.3	12.5	12.1	2.4 (1.5 to 3.3)	<0.001
Thiazide Diuretics	22.4	27.4	11.1	11.1	5.09 (3.9 to 6.3)	<0.001
P2Y12 inhibitors	7.7	8.7	6.6	5.9	1.68 (1.2 to 2.2)	<0.001
DOAC	0.3	3.4	0.3	2.5	0.9 (−0.3 to 2.1)	0.142

DID: Difference-in-difference; ACEI - angiotensin-converting enzyme inhibitors, ARB - angiotensin receptor blockers, BB - beta blockers, CCB - calcium channel blockers, MRA - mineralocorticoid receptor antagonists; DOAC: direct oral anticoagulant

The pre-expansion period includes 2011-Quarter 1 to 2013-Quarter 4. The post-expansion period includes 2014-Quarter 1 to 2018-Quarter 4.

Table 3:

Sensitivity analysis evaluating the difference in prescription rates per 1000 Medicaid beneficiaries Medicaid expander vs. non-expander states before and after Medicaid expansions

	Sensitivity Analysis #1: Exclusion of the states that had expanded Medicaid before January 1, 2014		Sensitivity Analysis #2: Inclusion of seven late-expanding states into the non-expansion group	
Drug Class	**Difference-in-Differences Estimates (95% CI)**	**P-value**	**Difference-in-Differences Estimates (95% CI)**	**P-value**
Statins	20.0 (13.4 to 26.5)	<0.001	15.7 (9.1 to 22.4)	<0.001
Antihypertensives	57.1 (39.2 to 75.0)	<0.001	40.0 (22.9 to 57.0)	<0.001
ACEI	16.7 (12.0 to 21.4)	<0.001	11.9 (8.0 to 15.9)	<0.001
ARB	8.6 (5.0 to 12.2)	<0.001	7.2 (3.4 to 11.0)	0.004
Beta Blockers	12.4 (8.3 to 16.5)	<0.001	7.9 (4.2 to 11.5)	<0.001
CCB	11.3 (7.7 to 14.9)	<0.001	7.3 (3.6 to 11.1)	<0.001
MRA	1.8 (1.1 to 2.5)	<0.001	1.1 (0.4 to 1.9)	0.004
Loop Diuretics	2.2 (1.2 to 3.3)	<0.001	4.9 (2.6 to 7.3)	<0.001
Thiazide Diuretics	4.1 (2.5 to 5.6)	<0.001	2.9 (1.6 to 4.3)	<0.001
P2Y12 inhibitors	1.4 (0.8 to 2.1)	<0.001	1.0 (0.4 to 1.6)	0.002
DOAC	1.4 (0.1 to 2.7)	0.038	1.4 (−0.5 to 3.3)	0.152

ACEI: Angiotensin converting enzyme inhibitor; ARB: Angiotensin receptor blocker; CCB: Calcium channel blocker; MRA: Mineralocorticoid receptor antagonists; DOAC: Direct oral anticoagulants

Table 4:

Sensitivity analysis evaluating immediate (2011–2013 vs. 2014) and sustained (2011–2013 vs 2015–2018) effects of the Medicaid expansion on prescription rates per 1000 Medicaid beneficiaries.

	Sensitivity Analysis #3: Pre-expansion period (2011–2013) vs 2014 alone		Sensitivity Analysis #4: Pre-expansion period (2011–2013) vs 2015–2018 (exclusion of 2014)	
Drug Class	**Difference-in-Differences Estimates (95% CI)**	**P-value**	**Difference-in-Differences Estimates (95% CI)**	**P-value**
Statins	9.5 (3.2 to 15.8)	0.006	25.8 (21.5 to 30.1)	<0.001
Antihypertensives	24.6 (3.3 to 45.8)	0.031	72.9 (62.3 to 83.4)	<0.001
ACEI	7.8 (1.7 to 13.9)	0.018	21.2 (19.3 to 24.1)	<0.001
ARB	3.6 (0.3 to 7.0)	0.042	12.9 (9.8 to 16.1)	<0.001
Beta Blockers	4.4 (−0.5 to 9.2)	0.091	14.5 (12.3 to 16.7)	<0.001
CCB	5.4 (1.5 to 9.3)	0.012	13.7 (11.4 to 15.9)	<0.001
MRA	0.5 (−0.01 to 1.0)	0.069	2.0 (1.5 to 2.5)	<0.001
Loop Diuretics	0.1 (−1.1 to 1.4)	0.84	3.0 (2.3 to 3.6)	<0.001
Thiazide Diuretics	2.7 (0.7 to 4.8)	0.013	5.7 (4.7 to 6.6)	<0.001
P2Y12 inhibitors	0.5 (−0.2 to 1.1)	0.176	2.0 (1.6 to 2.4)	<0.001
DOAC	0.01 (−0.4 to 0.4)	0.959	1.1 (0.1 to 2.2)	0.037

ACEI: Angiotensin converting enzyme inhibitor; ARB: Angiotensin receptor blocker; CCB: Calcium channel blocker; MRA: Mineralocorticoid receptor antagonists; DOAC: Direct oral anticoagulants