**Supplemental Digital Content**

Medicaid expansion and prescription trends: opioids, addiction therapies, and other drugs

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**Table 1: Classification of states by Medicaid expansion status**

|  |  |  |  |
| --- | --- | --- | --- |
| Had Not Expanded by 2016 | Expanded in 2014 | Expanded before 2014 | Expanded after 2014 |
| FloridaGeorgiaIdahoKansasMaineMississippiMissouriNebraskaNorth CarolinaOklahomaSouth CarolinaSouth DakotaTennesseeTexasUtahAlabamaVirginiaWisconsinWyoming | ArizonaArkansasColoradoDelawareHawaiiIllinoisIowaKentuckyMarylandMassachusettsMichiganNevadaNew HampshireNew MexicoNew YorkNorth DakotaOhioOregonRhode IslandVermontWest Virginia | CaliforniaConnecticutMinnesotaNew JerseyWashington | AlaskaIndianaMontanaLouisianaPennsylvania |

Source: Henry J. Kaiser Family Foundation1

**Table 2: Drug Group Classifications**

|  |  |
| --- | --- |
| Study Drug Group | First Data Bank Enhanced Therapeutic Category |
| Opioid Pain RelieversOpioid Addiction TherapiesAntidepressantsAntihypertensivesDiabetes MedicationsCholesterol LoweringContraceptives | Analgesic Narcotics\*AntidepressantsAntihypertensivesDiabetic TherapiesAntihyperlipidemicsContraceptives |

\*Opioid Addiction Therapies were identified as Analgesic Narcotics containing buprenorphine or buprenorphine/naloxone.

Source: First Data Bank2

**Difference-in-differences regression models**

To test the association between expansion and prescribing trends, we estimated models of the form:

$\left(1\right) prescriptions per enrollee\_{st}=β\_{0}+δ\_{s}+γ\_{t}+γ\_{t,expand}+β\_{1}unemployment\_{st}+ε\_{st}$

where $δ\_{s}$ = fixed effects for each state, *s*; $γ\_{t}$ = fixed effects for each year, *t* (2010 to 2016, omitting 2013 as reference); $γ\_{t, expand}$ = fixed effects for each year, *t* (2010 to 2016, omitting 2013) interacted with an indicator of whether that state was an expansion state ($γ\_{t, expand}$ equals one in year *t* only if a state was one of the 26 that expanded in 2014); and *unemploymentst =* unemployment rate by state and year.3

We modeled prescriptions per enrollee (rather than total prescriptions) to examine differences in drug receipt between pre-expansion and post-expansion Medicaid population while accounting for the change in size of the Medicaid population. To construct Medicaid prescriptions measures per enrollee (including child enrollees), we obtained Medicaid enrollment data by state and year from the Kaiser Family Foundation.4,5 Although children comprise a large part of the Medicaid program, child enrollment was not markedly affected by expansion,5 thus changes in enrollment since 2010 reflect primarily the addition of adult Medicaid enrollees. Each regression had 280 observations (prescriptions per enrollee in 40 states over 7 years).

 To allow for interaction between state overdose rate and expansion status, we estimated models of the form:

$\left(2\right) prescriptions per enrollee\_{st}=β\_{0}+δ\_{s}+γ\_{t}+γ\_{t,expand}+γ\_{t, high overdose}+ γ\_{t,expand,high overdose}+ β\_{1}unemployment\_{st}+ε\_{st}$

where $γ\_{t, high overdose}$ represents fixed effects for each year, t (2010 to 2016, omitting 2013) interacted with an indicator of whether that state had a high pre-period overdose rate, and $γ\_{t, expand, high overdose}$ represents for each year, an interaction between a year indicator, an expansion state indicator, and a high overdose rate indicator. We defined a high overdose rate as greater than eight age-adjusted opioid poisoning deaths per 100,000 state residents, 2010-2013. This category included 20 states (listed in descending order of age-adjusted death rate: West Virginia, Nevada, Kentucky, Utah, Rhode Island, Oklahoma, New Mexico, Ohio, Delaware, Tennessee, New Hampshire, Massachusetts, Maryland, Missouri, Vermont, Arizona, Oregon, Wisconsin, North Carolina, and Wyoming).6

**Table 3. Difference-in-difference estimates of changes in prescriptions per enrollee associated with Medicaid Expansion**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Adjusted difference between expansion and non-expansion states(95% confidence interval) | Model significance |
| Opioid Pain Relievers |  |  |
|  | 2010 | -0.064 (-0.180, 0.052) | F(13,39) = 34.14 |
|  | 2011 | -0.047 (-0.113, 0.018) | p<0.0001 |
|  | 2012 | -0.028 (-0.090, 0.034) |  |
|  | 2013 | (reference year) |  |
|  | 2014 | -0.014 (-0.086, 0.059) |  |
|  | 2015 | 0.038 (-0.038, 0.114) |  |
|  | 2016 | 0.042 (-0.051, 0.135) |  |
| Opioid Addiction Therapies |  |
|  | 2010 | -0.011 (-0.029, 0.006) | F(13,39) = 6.47 |
|  | 2011 | -0.007 (-0.021, 0.007) | p<0.0001 |
|  | 2012 | -0.005 (-0.014, 0.004) |  |
|  | 2013 | (reference year) |  |
|  | 2014 | 0.006 (0.000, 0.012) |  |
|  | 2015 | 0.015 (0.002, 0.029) |  |
|  | 2016 | 0.042 (0.010, 0.074) |  |
| Antidepressants |  |  |
|  | 2010 | -0.013 (-0.095, 0.070) | F(13,39) = 4.02 |
|  | 2011 | -0.030 (-0.097, 0.037) | p=0.0004 |
|  | 2012 | -0.024 (-0.090, 0.042) |  |
|  | 2013 | (reference year) |  |
|  | 2014 | -0.016 (-0.077, 0.044) |  |
|  | 2015 | 0.058 (-0.009, 0.126) |  |
|  | 2016 | 0.071 (-0.016, 0.157) |  |
| Antihypertensives |  |  |
|  | 2010 | -0.231 (-0.391, -0.071) | F(13,39) = 6.08 |
|  | 2011 | -0.151 (-0.249, -0.053) | p<0.0001 |
|  | 2012 | -0.062 (-0.160, 0.035) |  |
|  | 2013 | (reference year) |  |
|  | 2014 | 0.006 (-0.103, 0.116) |  |
|  | 2015 | 0.142 (0.016, 0.268) |  |
|  | 2016 | 0.202 (0.046, 0.357) |  |
| Diabetes |  |  |
|  | 2010 | -0.055 (-0.097, -0.014) | F(13,39) = 10.87 |
|  | 2011 | -0.038 (-0.072, -0.005) | p<0.0001 |
|  | 2012 | -0.013 (-0.043, 0.017) |  |
|  | 2013 | (reference year) |  |
|  | 2014 | 0.000 (-0.029, 0.029) |  |
|  | 2015 | 0.048 (0.009, 0.087) |  |
|  | 2016 | 0.080 (0.035, 0.125) |  |
| Cholesterol Lowering |  |  |
|  | 2010 | -0.034 (-0.078, 0.010) | F(13,39) = 11.22 |
|  | 2011 | -0.022 (-0.057, 0.013) | p<0.0001 |
|  | 2012 | -0.004 (-0.031, 0.024) |  |
|  | 2013 | (reference year) |  |
|  | 2014 | 0.012 (-0.010, 0.035) |  |
|  | 2015 | 0.052 (0.021, 0.082) |  |
|  | 2016 | 0.073 (0.033, 0.113) |  |
| Contraceptives |  |  |
|  | 2010 | -0.008 (-0.020, 0.003) | F(13,39) = 17.02 |
|  | 2011 | -0.005 (-0.015, 0.006) | p<0.0001 |
|  | 2012 | -0.005 (-0.015, 0.006) |  |
|  | 2013 | (reference year) |  |
|  | 2014 | 0.000 (-0.007, 0.008) |  |
|  | 2015 | 0.000 (-0.008, 0.008) |  |
|  | 2016 | 0.001 (-0.007, 0.010) |  |
| Other |  |  |  |
|  | 2010 | -0.657 (-1.899, 0.584) | F(13,39) = 39.52 |
|  | 2011 | -0.720 (-1.417, -0.023) | p<0.0001 |
|  | 2012 | -0.619 (-1.330, 0.091) |  |
|  | 2013 | (reference year) |  |
|  | 2014 | -0.631 (-1.337, 0.075) |  |
|  | 2015 | -0.086 (-0.816, 0.644) |  |
|  | 2016 | 0.225 (-0.564, 1.013) |  |
| All |  |  |  |
|  | 2010 | -1.074 (-2.691, 0.544) | F(13,39) = 23.83 |
|  | 2011 | -1.019 (-1.951, -0.088) | p<0.0001 |
|  | 2012 | -0.759 (-1.728, 0.209) |  |
|  | 2013 | (reference year) |  |
|  | 2014 | -0.636 (-1.591, 0.319) |  |
|  | 2015 | 0.266 (-0.737, 1.269) |  |
|  | 2016 | 0.736 (-0.387, 1.858) |  |

**Table 4. Association between Medicaid expansion and opioid prescriptions, including early- and late-expansion states**

|  |  |
| --- | --- |
|  | Difference-in-differences estimate of changes in prescriptions per enrollee associated with Medicaid expansion  |
| Drug Class | *Regression Coefficient\* (95% CI)* | *Percent Change\*\**  |
|  |  |
| Opioid Pain Relievers | 0.069 (-0.009, 0.148) | 11.1 |
| Opioid Addiction Therapies | 0.033 ( 0.013, 0.053) | 87.1 |
|  |  |  |
| Antidepressants | 0.122 ( 0.038, 0.207) | 22.4 |
| Antihypertensives | 0.233 ( 0.115, 0.350) | 24.6 |
| Diabetes | 0.097 ( 0.060, 0.133) | 28.1 |
| Cholesterol Lowering | 0.081 ( 0.051, 0.110) | 30.3 |
| Contraceptives | 0.002 (-0.006, 0.010) | 2.8 |
|  |  |  |
| Other Medications | 0.463 (-0.234, 1.161) | 6.7 |
| All Medications | 1.099 ( 0.132, 2.066) | 11.3 |
|  |  |  |

Source: Medicaid State Drug Utilization Data, 2010-2016.

Opioid pain relievers included all prescription opioids other than those classified as Opioid addiction therapies. Opioid addiction therapies included buprenorphine and buprenorphine/naloxone. Methadone dispensed by methadone addiction treatment centers does not appear in these data.

\*Regressions are adjusted for state and year fixed effects and unemployment.

\*\*Percent change is the regression coefficient divided by the 2013 average number of prescriptions per enrollee across states that expanded in 2014, weighted by the number of enrollees in each state.

**Table 5. Association between Medicaid expansion and all-payer per-capita opioid pain reliever prescriptions, using publicly-available data from the Centers for Disease Control and Prevention**

|  |  |  |
| --- | --- | --- |
|  |  | Adjusted difference between expansion and non-expansion states(95% confidence interval) |
| Opioid Pain Relievers |  |
|  | 2010 | 0.013 (-0.039, 0.066) |
|  | 2011 | 0.024 (-0.017, 0.065) |
|  | 2012 | 0.013 (-0.006, 0.031) |
|  | 2013 | (reference year) |
|  | 2014 | 0.016 ( 0.004, 0.027) |
|  | 2015 | 0.037 ( 0.006, 0.069) |
|  | 2016 | 0.028 (-0.021, 0.077) |

Comparing 2016 to 2013 opioid pain reliever prescriptions per adult resident in a state, Medicaid expansion states prescriptions count per capita was 0.028 prescriptions (3.7%) higher than non-expansion states, but the difference was not statistically significant at the 5% level.

**References**

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4. Medicaid Enrollment: June 2012 Data Snapshot. *Henry J Kaiser Family Foundation.* <https://kaiserfamilyfoundation.files.wordpress.com/2013/08/8050-06-medicaid-enrollment.pdf>.

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