The Uneven Geography of Medicaid Expansion: Opioid Mortality Across Urban and Rural America

Harshini Nuti[1]   Alejandra Reyes-Perez[2]

[1]Economics Student, Temple University
[2]Economics Student, University of Southern California

Faculty Mentors: Dr. Jean-Baptiste Tondji, University of Texas Rio Grande Valley
Dr. Shelley Harrow, U.S. Department of Health and Human Services

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Background

- The opioid crisis is the longest ongoing health crisis in the U.S., with more than 564,000 deaths between 1999 and 2020.[1]

- The Affordable Care Act (ACA), passed in 2010, enabled states to expand Medicaid coverage starting in 2014. As of 2025, 41 states and Washington, D.C., have opted into expansion.

- The ACA designated substance use disorder (SUD) treatment as an Essential Health Benefit, requiring coverage for SUD services in all Medicaid expansion plans and marketplace insurance plans.

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[1]Li, et al.,(2023). The Economic Impact of the Opioid Epidemic. Economic Insights of the Federal Reserve Bank of Philadelphia.

Research Question

How did Medicaid expansion affect prescription opioid-related outcomes in urban and rural areas?

Prior Research

- County-level analyses have found decreases in overall opioid deaths following Medicaid expansion.[2]

- Other studies report rising mortality among specific sociodemographic groups, highlighting the varied effects of Medicaid expansion on opioid-related mortality.

- Studies show that the mortality-reducing impact of Medicaid expansion is uneven across rural and urban areas, suggesting geographic disparities in its effectiveness.[3]

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[2]Kravitz-Wirtz et al.,(2020). Association of Medicaid expansion with opioid overdose mortality in the United States. JAMA Network Open.

[3]Mueller et al.,(2025). The uneven impact of Medicaid expansion on rural and urban Black, Latino/a, and White mortality. J Rural Health.

Our Research

- This study examines how trends in prescription opioid-related mortality differ between rural and urban areas, comparing states that expanded Medicaid to those that did not.

- Sparse literature exists on rural–urban differences in health outcomes. Geographic variation in healthcare access may obscure the true effectiveness of national policies like Medicaid expansion.

- We expect Medicaid expansion to have a greater impact in rural areas, where newly insured individuals may experience improved access to care due to expanded coverage for low-income populations.

Primary Data Sources:

- **Opioid Mortality Data** — CDC WONDER Multiple Cause of Death Database (1999–2021)
  - Age-adjusted mortality rates per 100,000 population (ages 64 and younger)
  - Aggregated into urbanization groups using NCHS 2013 Urban-Rural classification codes
  - Filtered for prescription opioid-related ICD-10 codes (T40.2–T40.4)

- **Demographic and Socioeconomic Data** — IPUMS NHGIS
  - County-level covariates: poverty rate, unemployment rate, race, sex, and age
  - Matched to mortality data by urbanization group and year

- **Political Data** — University of Kentucky Center for Poverty Research
  - State-level covariates: Democratic representation in the government

Data

Table: Summary Statistics by Urban vs. Rural

	Full sample		Urban		Rural	
	mean	sd	mean	sd	mean	sd
Opioid Deaths	113.81	179.53	145.90	208.14	46.27	46.62
Opioid Age-Adjusted Rate	12.17	10.58	12.17	11.30	12.16	8.46
Synthetic Opioid Deaths	93.98	175.08	114.34	197.53	35.44	44.85
Synthetic Age-Adj Rate	11.54	12.46	11.37	13.15	12.20	9.23
Pct Synthetic Deaths	0.49	0.26	0.48	0.27	0.50	0.23
Unemployment Rate	0.07	0.03	0.07	0.03	0.07	0.03
Poverty Rate	0.15	0.04	0.14	0.04	0.16	0.04
Percent White	0.80	0.14	0.78	0.14	0.85	0.13
Percent Male	0.50	0.01	0.49	0.01	0.50	0.01
Percent Age 25–44	0.25	0.03	0.26	0.03	0.23	0.02
Percent Democrat Control in Goverment	0.43	0.24	0.44	0.24	0.41	0.23
N	2223		1507		716	

Data
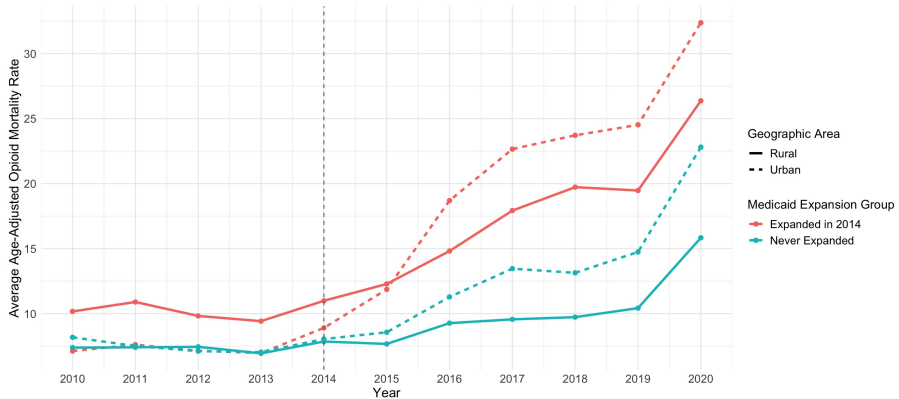
Figure: Opioid Mortality Trends by Urban-Rural Classification

Model: Staggered Difference-in-Differences

We estimate group-time average treatment effects ($\text{ATT}_{g,t}$) for each treatment cohort g and time t:

$$\text{ATT}_{g,t} = \mathbb{E}\left[Y_t(1) - Y_t(0) \mid G = g\right], \quad \text{for } t \geq g$$

- $Y_t(1)$: Outcome under treatment; $Y_t(0)$: Counterfactual without treatment
- $G = g$: Group of units first treated in period g
- Control group: "Not-yet-treated" units at time t
- Covariates included in estimation:
    - Poverty rate, unemployment rate, percent male, percent white

Results

Table: ATT Estimates by Relative Year (Urban vs. Rural, Demographic)

Relative Year	Urban ATT (SE)	Rural ATT (SE)
Pre-Treatment Avg.	0.029 (0.020)	-0.021 (0.033)
Post-Treatment Avg.	**0.220 (0.102)**	-0.085 (0.319)
-4 Years	0.046 (0.054)	–
-3 Years	-0.069 (0.110)	-0.102 (0.077)
-2 Years	0.097 (0.083)	-0.076 (0.073)
-1 Year	0.041 (0.077)	0.115 (0.063)
Year of Expansion	0.001 (0.055)	-0.019 (0.090)
+1 Year	**0.261 (0.069)**	-0.102 (0.283)
+2 Years	0.231 (0.133)	-0.113 (0.335)
+3 Years	**0.310 (0.152)**	-0.115 (0.562)
+4 Years	0.297 (0.219)	-0.074 (0.434)

Bolded values are statistically significant at the 5% level. Controls include unemployment rate, poverty rate, percent male, and percent white. Outcome variable is the log of the age-adjusted opioid death rate. On average there was a 22% increase in prescription opioid mortality post-Medicaid expansion in urban areas.
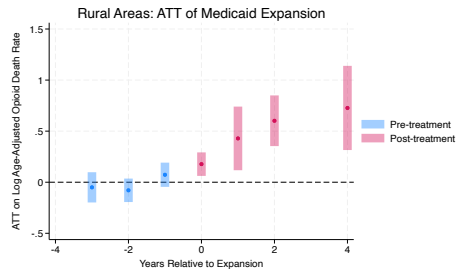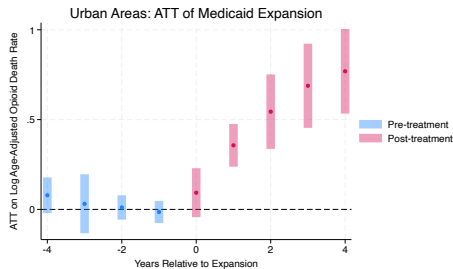
Results

Urban Areas: ATT of Medicaid Expansion

Rural Areas: ATT of Medicaid Expansion
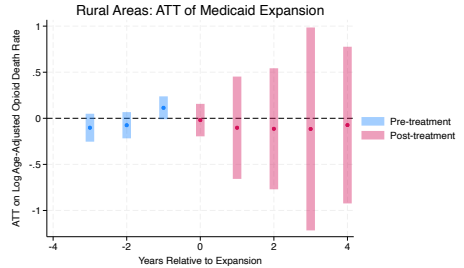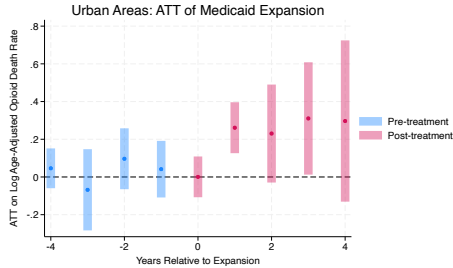
Control Variables: Poverty Rate, Unemployment Rate, Percent White, and Percent Male. Medicaid expansion in rural areas had inconclusive results.

Results

Table: ATT Estimates by Relative Year (Urban vs. Rural, Demographic and Political Controls)

Relative Year	Urban ATT (SE)	Rural ATT (SE)
Pre-Treatment Avg.	0.027 (0.025)	-0.019 (0.028)
Post-Treatment Avg.	**0.490 (0.078)**	**0.484 (0.127)**
-4 Years	0.079 (0.051)	–
-3 Years	0.031 (0.084)	-0.051 (0.075)
-2 Years	0.011 (0.034)	-0.079 (0.059)
-1 Year	-0.014 (0.031)	0.073 (0.061)
Year of Expansion	0.093 (0.070)	**0.177 (0.059)**
+1 Year	**0.356 (0.060)**	**0.428 (0.159)**
+2 Years	**0.544 (0.106)**	**0.602 (0.127)**
+3 Years	**0.688 (0.119)**	–
+4 Years	**0.769 (0.120)**	**0.727 (0.210)**

Bolded values are statistically significant at the 5% level. All specifications include controls for unemployment rate, poverty rate, percent white, percent male, and percent of democratic control. Outcome variable is the log of the age-adjusted opioid death rate. On average there was a 49% increase in prescription opioid mortality post-Medicaid expansion in urban areas.

Results

Urban Areas: ATT of Medicaid Expansion

Rural Areas: ATT of Medicaid Expansion

Control Variables: Poverty Rate, Unemployment Rate, Percent White, Percent Male, and Percent Democrat Control in Government. Post-Medicaid expansion, there was a statistically significant increase in prescription opioid mortality rates for rural areas.

Limitations

- **Geographic Aggregation:** Mortality data is aggregated by urbanization group, limiting our ability to analyze within-group variation across rural and urban areas.
- **Omitted Variables:** This analysis does not account for important factors such as uninsurance rates, provider density, and state-level opioid-related policy interventions.
- **Sociodemographic Variation:** This analysis does not examine differences in outcomes across sociodemographic groups (e.g., race, gender), which may help explain underlying geographic disparities.
- **Confounding Trends:** A spike in fentanyl deaths occurred around the same time as Medicaid expansion, complicating causal interpretation.

Conclusion

- Opioid mortality does appear to shift following Medicaid expansion, particularly in urban areas, where mortality increases were most evident.
- Results in rural areas are inconclusive and suggests there is variation in the effects of Medicaid expansion.
- These patterns likely reflect multiple pathways: while expansion may increase access to opioids through coverage, it also expands access to SUD treatment.
- Our findings suggest that the impact of Medicaid expansion on opioid-related outcomes is not uniform across regions. Understanding these underlying geographic differences is essential to ensure that all populations benefit equitably from health policies.