**Final Deliverables Guide**  
**Analyzing the Impact of Medicaid Expansion on Non-Communicable Disease Outcomes Across the U.S.**

Team 32 – Non-Communicable Disease Team  
**Capstone Client:** Duke Health  
**Term:** Spring 2025

**1. Team Members**

* **Zheng (Richard) Xie**
* **Danielle Dawazhuoma**
* **Shrishti Agarwal**
* **Utkarsh Gupta**
* **Lizzie Wang**

**2. Project Overview**

This project investigates the causal effects of Medicaid expansion on key health outcomes related to non-communicable diseases (NCDs) across U.S. states. Using a natural experiment framework created by the staggered timing of Medicaid expansion under the ACA, we assess how expansion affected **deaths, DALYs (Disability-Adjusted Life Years), prevalence, and incidence** of high-burden NCDs.

The study draws on state-level panel data from 2010–2019 and employs **Difference-in-Differences (DiD)** and **Fixed Effects (FE)** models to estimate treatment effects across three expansion groups (Early, Mid, Late) compared to Never-expanded states.

**3. Data & Methodology**

**Dataset:**

* Source: IHME Global Burden of Disease Database
* Timeframe: 2010–2019
* Coverage: 50 U.S. states, categorized by Medicaid expansion year
* Metrics:
  + **Health Outcomes:** DALYs, Deaths, Prevalence, Incidence
  + **Demographics:** Age group, sex
  + **Policy Variables:** Expansion group (Early, Mid, Late, Never), Post indicator, Treatment group

**Disease Selection:**

Ten high-burden NCDs were selected using t-tests to compare pre- and post-expansion outcome means, focusing on:

* Substance use disorders (SUDs)
* Drug and opioid use disorders
* Diabetes and kidney-related diseases
* Alzheimer’s disease
* Uterine cancer

**Analytical Methods:**

* **Difference-in-Differences (DiD):** Baseline model estimating the treatment effect of Medicaid expansion using treat\_group × post interactions.
* **Fixed Effects Models:**
  + **State FE:** Controls for time-invariant, state-specific differences.
  + **Year FE:** Adjusts for national-level time shocks and secular trends.
* **Significance:** p-value < 0.05. Results presented with 95% confidence intervals.

**4. Deliverables Summary**

**A. Final Presentation Deck**

* ***Capstone Duke Health.pdf* – Final presentation version delivered April 26**
* **Includes:**
  + **Background & motivation**
  + **EDA & demographic trends**
  + **DiD and Fixed Effect results**
  + **Key findings and recommendations**

**B. Statistical Modeling Outputs**

* **R code and estimates for:**
  + **Disease selection via t-tests**
  + **DiD models (Early, Mid, Late vs. Never)**
  + **Fixed Effects models (State & Year)**
* **Disease- and measure-specific plots with significance highlighting**

**C. R Code**

* **Fully documented and annotated scripts**
* **Organized by function: cleaning, t-tests, visualization, modeling**
* **Easy-to-follow structure for reproducibility**

**D. Final Deliverables Guide**

* **Word document summarizing all files, their purpose, and guidance on how to navigate the outputs**

**E. Data Cleaning Guide**

* **Describes how the raw GBD files were merged, cleaned, and structured**
* **Includes details on formatting, filtering, and disease selection logic**

**F. Original Dataset – GBD Download**

* **16 raw CSV files downloaded from the IHME GBD website**
* **Provided to ensure full transparency and reproducibility**

**5. Key Findings**

**Early Expansion vs. Never:**

* Significant reductions in deaths and DALYs for chronic kidney disease due to hypertension
* Decline in opioid and substance use disorder prevalence and incidence.
* Strongest and most consistent improvements observed under **year fixed effects.**

**Mid Expansion vs. Never:**

* Mixed results; some increases in deaths for opioid-related conditions
* Significant declines emerged only when controlling for national time trends via **year fixed effects.**

**Late Expansion vs. Never:**

* Few significant effects due to limited post-expansion timeframe.
* Year fixed effects revealed negative treatment effects in DALYs and deaths, though incidence remained unchanged.

**Modeling Insight:**

* **State FE** often showed positive effects, likely due to increased diagnosis post-expansion.
* **Year FE** consistently revealed **negative and significant effects**, supporting the conclusion that Medicaid expansion led to better health outcomes when national trends were properly controlled for.

**6. Limitations**

* **Short follow-up period** for Late expansion states (2017–2019)
* **Possible endogeneity** between prevalence and mortality
* **State-level aggregation** limits granularity
* **Uncontrolled confounders**: race, socioeconomic status, rural access, healthcare infrastructure
* **Parallel trends assumption** may not fully hold in some groups

**7. Recommendations for Future Research**

* Extend analysis to **2020–2024 data** to assess long-term outcomes post-expansion
* Use **Instrumental Variables (IV)** or **Synthetic Control Methods** for stronger causal identification
* Explore **subpopulation heterogeneity** (e.g., race, income level, rural vs. urban)
* Link health outcomes with **Medicaid cost and provider-level data** to study ROI
* Investigate expansion effects on **hospital stability, physician supply, and behavioral health service capacity**

**8. Conclusion**

The analysis provides robust evidence that **Medicaid expansion improves health outcomes**, particularly when controlling for national trends. **Year fixed effects models** reveal consistent and significant reductions in disease burden, especially in Early expansion states. These findings emphasize the policy’s value in promoting early detection, preventive care, and equitable access—critical components for long-term health system improvement.