Data Wrangling Project Proposal

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I. Introduction

Women's health outcomes vary widely across states in the United States indicating differences in healthcare availability and preventative treatment[1]. Vaccination during pregnancy plays a crucial role in safeguarding the health of pregnant women and their infants.The presently recommended maternal vaccinations, which include influenza, tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap), and Coronavirus disease 2019 (COVID-19). They all have considerably decreased illness incidence and complications in these susceptible groups [2]. However, the vaccination rate during pregnancy is still lower than the expected target, especially for women with lower socioeconomic status and ethnic minority women [3]. In addition, the uninsured rates vary greatly among states across the United States which further influences access to essential healthcare services [4]. Geographic location also contributes to these differences in access to and uptake of vaccination services. Compared with urban residents, rural residents are particularly severely affected by the lack of insurance [5].Women without medical insurance face additional barriers to getting recommended preventative care. The purpose of this analysis is to investigate the link between the degree of urbanization in each state in the United States, women's insurance coverage rates, and vaccination rates for pregnant and postpartum women. We selected the recommended vaccinations for pregnant and postpartum women, including influenza and Tdap. By combining data from the Centers for Disease Control and Prevention (CDC), the National Center for Health Statistics (NCHS), and Kaiser Family Foundation (KFF), we aim to discover state-level patterns and variances that might help influence future public health initiatives to promote maternal health care and immunization equality.

II. Data Description

We will compile three state-level datasets related to women's health in the United States. The first, from the CDC's Pregnancy Vaccination dashboard [6], provides annual estimates of influenza and Tdap vaccine coverage among pregnant women, including weighted percentages, 95% confidence intervals, and sample sizes. The second, from the CDC's NCHS Urban-Rural Classification [7], includes population-weighted urbanicity scores for each state in 2013 and 2023, ranging from 1 (most urban) to 6 (most rural). We will also calculate the change in urbanicity over time. The third dataset, from the KFF [8], reports the number of insured and uninsured women (ages 19–64) by state from 2012 to 2022, categorized by insurance type. All datasets use states as the geographic unit, allowing them to be merged for joint analysis of urbanicity, insurance coverage, and maternal vaccination trends.

III. Main Study Questions and Hypotheses

Aim 1: Visualization of the Geographic Patterns of Urbanicity, Women's Insurance Coverage, and Vaccination Coverage Among Pregnant Women Across the States by Mapping

- 1.1 Identify areas with low vaccination coverage among pregnant women and assess whether these areas are more likely to cluster in states with lower insurance coverage (flu and Tdap) and/or lower urbanicity.
- 1.2 Compare the spatial clustering patterns of maternal vaccination coverage between 2013 and 2022 to assess temporal changes in geographic disparities and evaluate whether the distribution of low-coverage clusters has shifted over the decade.

Aim 2: Association Between Urbancity, Insurance Status, and Vaccination Coverage Among Pregnant Women

- 2.1: Quantify whether higher state uninsurance rates predict lower vaccination coverage (flu and Tdap) among pregnant women.
- 2.2: Assess whether more rural states are associated with lower vaccination coverage.
- 2.3: Test for an interaction between uninsurance and rurality.

IV. Expected outcomes

Our goal is to visually present the spatial patterns of urbanicity, women's insurance coverage, and maternal vaccination coverage rates, as well as to examine the relationships among these factors across U.S. states. Using a combination of Excel, Python, R, and ArcGIS, we will clean, organize, analyze, and visualize the integrated datasets. The findings will provide an evidence-based understanding of how structural and geographic factors shape maternal

vaccination disparities and will help inform targeted public health strategies to promote equitable access to preventive care for pregnant women nationwide.

Reference

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