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### **Methods**

This research will examine how the increased use in telehealth has increased access to medical care for Medicare and Medicaid members. Although this suggests a potential causal relationship, finding direct causality is challenging given the non-experimental structure of the study. Therefore, we will be aiming to find correlations rather than causations between several independent variables in relation to telehealth use. I will be primarily working with the *Medicare Telehealth Trends* dataset published by the Centers for Medicare & Medicaid Services, made available on Data.gov. This dataset represents patients with Medicare and/or Medicaid who reported using telehealth services during and after the pandemic. This data will be merged with publicly available data from the US Census Bureau on state specific factors that could be impacting access to telehealth.

**Data Exploration**

For initial exploration, I will be using bar plots to visualize TelehealthVisits (number of unique telehealth visits) across various demographics (ie state, rural/urban, race, sex, age, year). These variables are important to explore because demographics of individuals influence their ability to access telehealth services (Ching-Ching, 2018). I will also use histograms to explore the distributions of TelehealthVisits and EligibleServicesCount variables. TelehealthVisits refers to the number of visits that used telehealth services while EligibleServicesCount is the number of services that were identified as having potential to be done with a telehealth service. The histograms will provide an understanding of the extent to which telehealth is being utilized.

**Analytical Methods - Fixed Effect**

* I will use fixed effect analysis to see whether certain variables are having a strong impact on the number of telehealth visits. Fixed effect was the chosen method because it can be used to assess the impact of various factors on TelehealthVisits (the number of telehealth visits) and EligibleServicesCount (had potential to be using telehealth) while accounting for time-invariant characteristics (Borenstein, 2010).
* I will use state and year as my fixed effects because they are not changing with time. Some factors from the telehealth dataset that will be used to assess number of telehealth visits are Sex, Race, EnrollmentStatus (Medicare & Medicaid or Medicare Only), MedicareAccessForInsured (Aged, Disabled), and Rural/Urban
* Using a fixed effect will be a beneficial method because it will help isolate variables of influence to see how they are impacting the utilization of telehealth services.

**Merged Variables to be used as Factors in the Fixed Effect:**

* Variables from the U.S. Census Bureau that I will merge to my dataset based on the state include: number of vehicles by state, presence and types of internet subscriptions*,* annual estimates of the resident population by state, and hospitals in each state.
* Other variables that could be added but not yet found include: availability of public transportation, number of physicians in the hospitals, and wait times for appointments.
* Variables that are available on FRED that I will merge based on the year include: the unemployment rate and GDP. These will represent the economic situation of the US at that time. A poor economic state could be related to a lack of access to healthcare services.

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#### **Data Map and Fixed Effect Model Map**

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#### **Model Validation and Interpretation**

Standard Errors will be used to assess the validity of the model because they represent the uncertainty and precision (Altman, 2005). Ordinary standard errors are often unrealistic when working with real data because they assume that the errors are homoscedastic (constant variance) and are uncorrelated across observations. For this reason, I will be using the function feols (fixed effects ordinary least squares) in R which defaults to “cluster” when using fixed effects. Cluster assumes that the error terms within the same cluster are correlated. This is needed for the fixed effect model because the data within the same cluster is autocorrelated (correlated with each other).

To further validate the stability of the findings by testing different variable selections, a cumulative stepwise approach will add independent variables and fixed effects which will help evaluate their contribution to the model. To evaluate the fit of the model from the output, the R^2 will represent how well the model explains variation within each fixed-effect group (state, year, and both). A higher R^2 will suggest that the independent variables are good predictors of TelehealthVisits.

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