Medicaid Managed Care and Emergency Department Utilization: A North Carolina Analysis

Temitope Ayokunmi Ojo

Professor M. Kate Bundorf, PhD, Faculty Advisor

Professor Grace Kim, PhD, Seminar Advisor

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Abstract

In July 2021, North Carolina Medicaid switched from a traditional fee-for-service model to a Medicaid managed care (MMC) network. This thesis explores the effect of this policy change on Emergency Department (ED) utilization for Medicaid beneficiaries in North Carolina. A linear difference-in-difference model was used to estimate the change in ED visits between the treatment group, Medicaid beneficiaries, and two control groups, non-Medicaid 19–64-year-olds and 65+ NC residents. The results indicate a statistically significant decline in ED visits, about 11% decline from pre-policy visit rates, for Medicaid beneficiaries after the mandatory switch to managed care. The reduction in visits was most persistent for those related to chronic condition treatment. Furthermore, we find evidence consistent with both medical care disruption and better management of health as drivers of the decline in ED visits. Determining the cause of these patterns should be explored by deeper analyses of trends in other healthcare delivery avenues (i.e. PCP appointments or hospital admissions) post-policy implementation.

JEL Classification: I11, I13, I18

Keywords: Medicaid, Insurance, Emergency Department

Introduction

Since the origin of Medicaid insurance in 1964, the fee-for-service model has been the traditional mode of healthcare payment and delivery. Beneficiaries could go to any medical facility (that accepted Medicaid insurance) to receive care. Under this model, physicians would be highly incentivized to provide as many medical services as possible, charging the Medicaid program for reimbursement, as the more services they provided, the more they would be paid with their up-charged prices. This structure created a system where patients were receiving unnecessary medical tests and treatments (Shrank and Rogstad, 2019). Furthermore, the traditional mode did not support consistent healthcare for a myriad of reasons: lack of providers that accepted Medicaid, churning in enrollment/disenrollment of insurance, or piecewise care – i.e beneficiaries receiving care from a variety of PCPs that do not know patient history and thus provide repeated/inefficient care to patient. Traditional fee-for-service lacks regulation in medical services charged to patients ultimately producing exorbitant healthcare spending, contributing to roughly 20% of all healthcare spending in the United States (Burns et al, 2025). With the goal of reducing medical spending and creating more effective management of health for Medicaid beneficiaries arose the managed care platform.

Managed Care was first piloted in California in 1968 to test alternative healthcare delivery models that would decrease spending. It then became permanent through the 1971 Medi-Cal Reform Act that promoted coordinated care by PCPs to provide Medicaid beneficiaries with the appropriate and personalized care they need to manage their health conditions. As of July 2024, 42 states (including DC) have implemented some version of a managed care program in their Medicaid insurance (Hinton and Raphael, 2025). North Carolina recently shifted from the traditional Medicaid model to the managed care network of providers on July 1, 2021, and is a particularly interesting state to study as the state has a well-rounded geography, with 40% of

the population living in a rural area. Thus, NC creates a special opportunity to study geographic patterns in population health. Furthermore, North Carolina recently expanded their Medicaid platform in December 2023 by expanding the eligibility for the program; therefore, the results on Managed Care affecting healthcare utilization will inform policymakers on the effects of healthcare expansion in the state, particularly for the low-income/medically vulnerable population that qualifies for Medicaid.

The recent Medicaid Managed Care (MMC) requirement for North Carolina requires beneficiaries to select healthcare plans that place them in a network of providers (physicians) registered in the Medicaid program that will disseminate their health care services. Beneficiaries are limited to medical care within their network of providers, restraining their provider selection. The incorporation of Managed Care will ideally decrease state healthcare costs while better meeting the demand of health services for Medicaid beneficiaries. However, literature debates the effect of managed care on healthcare utilization. Therefore, this thesis will explore how the mandatory shift to MMC affected Emergency Department (ED) utilization for North Carolina beneficiaries. A deeper analysis will be conducted on whether ED visits differed by location (urban vs. rural geographies) in North Carolina. The official research question is "*How do Emergency Department visits differ for Medicaid beneficiaries in North Carolina after the switch from a traditional fee-for-service model to mandatory managed care network? Does this effect, if any, differ based on geography (urban vs. rural NC areas) or ED visit diagnosis (specifically chronic conditions)?*" Through this question, we will look at the interaction between total ED visits in North Carolina for people in different age groups and insurance status. Additionally, with an overwhelming majority of adults visiting the ED containing at least one chronic

condition, the relationship between ED visits for adults with chronic conditions will also be addressed.

Rural health is an important avenue to observe the effect of MMC, as healthcare access, outcomes, and overall health is worse in rural communities compared to urban areas. There are reports of higher ICU admissions for pregnant women in rural areas (Harrington et al, 2023) and higher burden of preventable conditions for rural residents (Richman, Pearson, Stanifer, 2019). This disparity is present for a variety of reasons: poorer healthcare education in rural communities, affordability of healthcare services, and quality of healthcare services (CDC, 2024 and RHI, 2025). Access to healthcare facilities in rural areas is an alarming area of concern as 1% of ICU beds are in rural areas, while 14% of the population resides in these communities (Halpern et al, 2019). Furthermore, the insurance status of rural counties is an issue that compounds poor health as there are higher rates of uninsured residents in rural counties compared to their urban counterparts. A 2017 study by the US Census Bureau showed 12.3% of rural residents uninsured compared to a rate of 10.1% for urban residents. Lack of healthcare insurance leads to an unwillingness to seek medical treatment due to the out-of-pocket costs it would require, further exacerbating rural health. Therefore, these issues make rural health, especially in comparison to urban health, a necessary area for further study.

Literature Review

i. Theory on the effect of Medicaid Managed Care on Healthcare Utilization

Managed care gives beneficiaries a selection of physicians to receive medical treatments that is covered by Medicaid insurance. The key distinction between the traditional fee-for-service model and MMC is managed care shifts responsibility for managing care from the government to a private plan paid by capitation. Medicaid pays a managed care organization (MCO) a set price

per month per beneficiary. The MCO then pays physicians (within the network) for the healthcare service provided. This sequence creates incentives for MCOs to control utilization because the less healthcare they pay on behalf of the beneficiary to the provider, the more profit they bring home as a company. With this structure, managed care controls healthcare use through utilization review and contracts with physicians who disseminate care parsimoniously. Under utilization review, MCOs analyze what medical treatments providers are suggesting with a closer discernment on which treatments are truly necessary to protect their profits. In a similar light of limiting health costs, MCOs would contract physicians who are frugal with the medical care they prescribe to their patients. With this methodology, physicians are not giving beneficiaries every medical service under the sun but rather more conservative in the volume and costs of treatment recommended. Under these two mechanisms, by the hands of MCOs, managed care appears to decrease general healthcare utilization.

Extending beyond the actions of the MCO, within the physician choices lie two additional channels in which the switch to managed care alters health care use. The first is under the assumption that physicians provide care more effectively through better primary care. Improved primary care avoids high-cost care as the health conditions of the beneficiary are managed before they worsen. Better management of health by the provider decreases healthcare utilization because the effectiveness of each treatment is higher, curbing the worsening of the health condition and thus decreasing the need for other expensive, supplemental services. On the contrary, providers could also skimp on medical care, providing fewer services to beneficiaries to limit medical costs. Through this channel, the decrease in services is not productive, but instead reinforces ineffective treatment. With poor treatment arises exacerbated health conditions

that build-up and result in emergent care. Thus, healthcare utilization increases to resolve the beneficiaries' aggravated health issues.

A final mechanism that affects healthcare utilization is the disruption of health care by hands of the mandatory shift to MMC. With the major policy change, beneficiaries are unsure about their insurance status and thus halt utilization of medical treatment, decreasing overall utilization rates. This disruption is temporary, as Medicaid beneficiaries understand their insurance status and continue use of medical services. However, there is still a negative interim effect on utilization due to the new managed care policy.

ii. Emergency Department and Chronic Conditions

The research question of this thesis entails Emergency Department visits for chronic conditions. About 27% of adults in the US suffer from multiple chronic conditions hence its relevance in the assessment of community health (Zhang et al, 2020). Many research articles utilize the International Classification of Diseases, Ninth or Tenth Revision (ICD-9 or ICD-10) to identify the reason for the ED visit. This classification system provides a universal code that organizes certain health conditions across hospital systems. I will utilize the ICD-10 for two reasons: the first being it is the most recent classification system and thus will be utilized by all recent health records. The second reason is its overwhelming popularity in health policy and economic journals. In my study, I will define chronic conditions based on the Chronic Condition Indicator Refined (CCIR). Again, the CCIR is defined by the ICD-10, including hundreds of chronic conditions like malignant cancer, diabetes, and hypertension. Other articles also identify chronic diseases like heart disease, stroke, cancer, arthritis, and hypertension (which can be bucketed into heart disease) cross listing them as top causes of disability in the US (Hacker, 2024

and CDC, 2024). This thesis will maintain the larger classification of chronic conditions as outlined by the CCIR.

Emergency Department visits are a common source of healthcare services in both rural and urban communities. They are more accessible with longer hours of operation and a guaranteed source of healthcare for those uneducated on other healthcare facilities available. Regarding proximity, about 71% of residents in the US live within 30 minutes of an ED, with about 98% living within 60 minutes of a facility (Carr, Metlay, Camargo 2009). The ease of accessing the ED correlates to broader research showing rural residents utilizing the ED at a baseline rate higher than their urban counterparts (with larger increases in ED usage in recent years) (Greenwood-Ericksen and Kocher, 2019 and Ahn et al, 2020). Both urban and rural populations utilize Emergency Departments for healthcare services supporting their relevance in measuring chronic condition burden in these areas. Most literature analyzes chronic conditions through the volume of ED visits, rather than inpatient visits (Lim et al, 2024 and Hsuan et al, 2022). Sometimes, ED visits, inpatient admissions, and readmissions are measured in tandem with one another to measure the severity of diseases like asthma, mental health, and chronic obstructive pulmonary disease; all of which qualify as chronic conditions (AlSaad et al, 2022; Beckerleg et al 2022, Liew et al 2023). However, a few articles use inpatient admissions, for more serious chronic conditions -- kidney disease, heart failure, and genetic defects (Schrauben et al, 2020 and Becker et al 2022). A few utilize the more prevalent chronic conditions, as stated earlier, to classify inpatient readmissions (Jiang, 2024 and Simon et al, 2010).

For this thesis, the CCIR labels ED visits in the dataset with chronic conditions as the official diagnosis with a value 1 allowing for an easy comb-through to remove the irrelevant nonchronic conditions (labeled as value 0) in database. Furthermore, this thesis will look at

interactions between rural and urban health, race, Managed Care, and Medicaid insurance. No literature combines all aspects into one paper, but a few encompass some similar characteristics. In general literature on rural and urban health, they focus on the entire US population, rather than by subset (i.e. by insurance status or state). One study measures the impact of Chronic Conditions on ED visits for children on Medicaid, however they do not have an urban vs. rural analysis in the paper (Hsuan et al, 2022). Race was included in the dataset but not highlighted as a unit of comparison between children with varying chronic conditions. Another related study (whose methodology will be closely adopted in this thesis analysis) observes the effect of Medicaid (expansion vs. non-expansion) on ED visits and general hospital usage (Garthwaite et al, 2019).

Many articles use data from the Agency for Healthcare Research and Quality (AHRQ) through their Healthcare Cost and Utilization Project (HCUP) data on nationwide, and state specific hospital admissions or Emergency Department visits (Santo et al, 2022 and Powell, 2017). However, a limitation of this dataset is that it does not include federal, long-term, or psychiatric hospitals along with alcohol/chemical dependency treatment facilities and hospital units within institutions (i.e. prisons). Similar to the HCUP data set is one with ED visits through the National Center for Health Statistics (NCHS) through their National Hospital Ambulatory Medical Care Survey (NHAMCS) completed by hospitals (Greenwood-Eriksen 2019). Some studies used self-reported data from the Behavioral Risk Factor Surveillance System or National Health Interview Survey; however, it was utilized for a more qualitative study on usage/access to personal health care providers and chronic condition burdens reported on the survey (Chen et al, 2019). Another paper uses electronic health records from the Cerner Real World Data that includes over 500 US healthcare facilities in the data set (Jiang, 2024).

In measuring ED visits, a study by Dr. Jay G Berry of Boston's Children's Hospital made sure to include ED visits that resulted in ED discharge (Greenwood-Eriksen et al, 2019). Berry and his colleagues included chronic conditions that had at least 50 data sets (ED visits in this case) to ensure each chronic condition measured had enough observations to be statistically significant. ED visit rates were calculated as number of ED visits per 1,000 enrollee years. Enrollee years is specific to each chronic conditions identified and compared (i.e. total number of ED visits for asthma divided by x number of enrollees who have Asthma). For this thesis, the Medicaid enrollment data is by month, therefore controlling for people who are enrolled and disenrolled at a monthly frequency, thus eliminating the need to track enrollee years.

iii. Rural Health vs. Urban Health

An overwhelming volume of literature supports the poorer health of rural communities in comparison to their urban counterparts. People living in rural areas are five times more likely to die from the top 5 causes of death in the US: heart disease, cancer, unintentional injuries, chronic lower respiratory diseases, and stroke. In 2022, 44,000 deaths of rural residents from these 5 causes were preventable (CDC, 2024). Rural communities suffer from chronic conditions at a 4% higher rate than urban communities, with high cholesterol and high blood pressure the top two chronic diseases faced (RHI, 2022 and 2024). Other comorbidities overburdening rural health are higher risk of pregnancy-related mortality and complications, higher rates of HPV, and worse mental health (encompassing higher suicide rates) (Harrington et al, 2023; RHI, 2024; Ivey-Stephenson et al, 2023; Nicholson, 2008). A 2021 data brief by the National Center for Health Statistics (NCHS) reported an age-adjusted death rate 7% higher in rural areas than that of urban areas (Martin and Spencer, 2021). This blistering report alongside the comorbidity burden of chronic conditions highlights the status of health in rural areas, supporting an initial

hypothesis that people in rural areas will have more Emergency Department visits than their urban counterparts because they are sicker.

With a consensus on poorer health in rural communities, one begins to look at the root cause: healthcare access, encompassing proximity to healthcare facilities, the average cost of healthcare services, availability of primary care providers, and insurance status. Rural residents travel an average of 10.5 to the nearest hospital, twice that of urban residents at 5.6 miles (Lam, 2018). The distance is further exaggerated as hospitals close at higher rates in rural communities, making residents travel that much farther to the next healthcare facility. 100 (or 4% of) rural hospitals have closed in the past decade with 30% at risk of closing in the upcoming decade. Regarding the actual healthcare services available, urban healthcare comprises more specialized services and higher ratio of physician per 100,000 residents with better trained physicians (Zhang et al, 2020 and Soman, 2024). These statistics support both more accessible and higher quality of healthcare in urban areas in comparison to rural areas.

Theoretical Framework

i. General Emergency Department visit trends

Before the mandatory shift to MMC, ED visits should be relatively stable, however, the Covid-19 pandemic creates a stark decline in ED utilization as people are too afraid to go to medical sites, risking infection, or capacity in medical facilities is strictly limited to Covid-19 cases. There should be a recovery in utilization after this fall however it will create a new homeostasis in ED visit rates post-Covid that is lower than pre-Covid numbers.

In this new era of medical care post-Covid, ED visits will decline after the mandatory shift to Medicaid Managed Care on account of two relevant theories. The former theory relies on better management of enrollees' health through the MMC network of providers. The system offers

more consistent medical care through assignment of a primary care physician that coordinates medical treatments on behalf of the enrollee. With a stable PCP, the enrollee's care is more effectively managed because the continuity of care from the same provider ensures medically appropriate and thus, cost-effective care. As a result, ED visits would decrease as the health conditions of enrollees are properly regulated, preventing escalation of disease that would warrant a visit to the ED.

The latter theory, less indicative of beneficiary health, supports a disruption of medical care for people on Medicaid. With this framework, a decline in ED visits is attributable to beneficiaries being lost within the system once they are switched to managed care. They do not know how to reach their newly accessed provider network and are not sure if the Emergency Department, their former primary source of medical care, is still covered by insurance. The sudden decrease post July 2021 is later followed by a recoil to pre-policy ED rates as beneficiaries realize their ED visits are still covered and thus choose to utilize the ED over the managed care network that is too complicated to navigate.

However, disrupted medical care can also lead to an increase in ED visits depending on the beneficiary's relationship with their PCP. If a beneficiary has an established relationship with a PCP that is not in the managed care network after the mandatory switch, medical care for the beneficiary abruptly discontinues. Their prescription runs out and they no longer have regular primary care appointments. Eventually, they must go to the Emergency Department as their health conditions are exacerbated, ultimately creating an increase in ED utilization.

ii. Urban vs. Rural Trends in Healthcare Utilization

Without regard to the policy shift, rural areas should have a higher ED rate, both generally and for chronic conditions, due to their overall poorer health and less accessibility to healthcare.

With limited healthcare facilities outside of the Emergency Department, it could be more convenient for rural residents to find an ED to receive care rather than a PCP or specialized doctor (i.e. pulmonologist). For North Carolina rural residents, the opportunity cost of finding an urgent care, doctor's office, or other healthcare facility is higher as these alternative facilities are most sparse in rural areas. Additionally, rural residents are unsure of whether these establishments accept their healthcare insurance (if insured at all).

After the Medicaid policy's expansion to managed care, I expect residents in both urban and rural geographies to shift away from the ED and toward other medical facilities (i.e. doctor's offices) to receive their medical care. These more extensive services should be more convenient for beneficiaries, offering better use of their time with shorter wait time and predictable appointment schedule (knowing the exact time and day to take off work for their appointment, and the duration of said appointment). Within this hypothesis lies the assumption of a rational, well-informed beneficiary exhibiting the substitution effect, where the MMC beneficiary substitutes away from the Emergency Department and toward their network of specialized providers to seek medical care. In this substitution lies the beneficiary's knowledge in discerning what their new health plan entails and their assigned PCP. How beneficiaries manage their new managed care plan determines the benefits they receive from the program. Thus, with a poorer understanding of the new MMC policy, rural beneficiaries don't receive the same benefits under the plan as their urban counterparts. Therefore, rural residents are more unaffected by the policy change, exhibiting a smaller decrease in ED visits compared to their urban counterparties. Even as rural residents now have access to a broader network of providers, with a lower general health literacy, they will find it more difficult to navigate the intricacies of finding a PCP or specialist under their managed care network. Instead, some rural residents would rather continue receiving

medical care in ED visits, contributing to their relatively smaller decrease in ED visits after the MMC shift than their urban counterparts. With a higher health literacy and closer proximity to various medical facilities, urban residents will utilize their expanded network of providers, substituting away from the Emergency Department for healthcare.

iii. ED visits and Chronic Conditions

Compared to their uninsured counterparts of the same age, Medicaid beneficiaries have a higher burden of chronic conditions. This burden is mechanically connected to the Medicaid qualification by disability (medical condition) that puts those with life-affecting illnesses under Medicaid insurance. Additionally, another qualification for Medicaid is of being low-income status, which strongly correlates to poorer health. Therefore, with these confounding factors, the ED rates for Medicaid beneficiaries will be higher than those of other demographic groups. However, the majority of ED visits will not be due to chronic conditions because a lot of ED visits are accidents (i.e. bicycle fall or kitchen accident) and the method of diagnosis for a visit. For example, if someone has a heart attack – which was prompted by worsening of their diabetes – the diagnosis of the ED visit could be a heart attack, instead of their chronic condition.

After the MMC shift, ED visits for chronic conditions should decrease as the new access to a network of providers gives beneficiaries an opportunity to have a PCP and thus receive recurrent, stable care for management of their chronic conditions. With continuous care from the same network of providers, beneficiaries' overall health will improve, leading to a decline in ED visits post-policy shift.

Data

This research observes ED visits from 2019-2022 with data analysis by months to ascertain how the shift to Medicaid Managed Care affected the overall number of ED visits for

Medicaid beneficiaries. It also observes whether Medicaid differentially affected ED visits for 1) chronic conditions and 2) urban and rural areas in NC. 2019 and 2020 will be utilized to observe trends prior to the shift to MMC, 2021 shows the initial shift while 2022 will give the first full year post shift.

The dataset is 2019-2022 North Carolina State Emergency Department Database (SEDD) from the Healthcare Utilization Project (HCUP) on the volume of ED visits. The data set includes 160 variables for each ED visit with the relevant ones including: CCIR, rural/urban classification, race, hospital state postal code, and primary expected payer. Because primary expected payer is included as a variable in the database, there will be enough observations to determine the Medicaid effect, especially because I am including observations from 2019-2022. The recorded ED visits came from 116 hospitals across North Carolina. Regarding total volume of Emergency Department visits, there were 4.3 million in 2019, 3.4 million in 2020, 3.7 million in 2021, and 3.9 million in 2022. The Covid-19 pandemic and its reverberating effects on hospital capacity and public trust of hospital contamination can account for the immediate decline in visits between 2019 and 2020. However, the steady increase in ED visits in 2021 and 2022 represents the slow return to normal volume. This dataset excludes hospital records within institutions, like Veterans Affairs (VA) hospitals, Indian Health Service, and psychiatric hospitals. Only hospital-owned Emergency Departments are participating in the data reporting thus, urgent care visits are not included in the database. All children, ages 17 and younger, were removed from the dataset as they are irrelevant to the policy change and not an appropriate comparison group for Medicaid beneficiaries.

Empirical Methodology

In creating a master ED visit database for 2019 – 2022, variables unnecessary to the analysis were removed leaving 17 relevant variables: age, month of admission, whether the patient died, female indicator, their official diagnosis, patient zip code, patient insurance, etc. This refined ED visit database was merged with a file from the 2022 American Community Survey that matched each zip code under an ED visit to a county. This file also contained a mapping of each county to urban or rural. Ultimately, this merge allowed each ED visit to be classified as urban or rural based on the zip code to county map for each patient. Every zip code that did not merge either from the master dataset (the refined ED visit database or the using (zip code to county map)) was because of 2 possible reasons; the first being that the patient zip code was not in NC, to which that observation was dropped because only ED visits for North Carolina residents are of interest. The second possible cause of merge error is the zip code listed for the patient crosses multiple county lines; to this extent the observations were also dropped because when completing later analyses on ED visits per capita or per 1000 people by county, this would lead to double counting the ED visits resulting in higher ED rates.

With a month, year, county unit for each ED visit, a collapse sum was conducted to condense the ED visits to a simpler dataset labeling the total number of visits per month, year, for urban and rural areas. Each observation (ED visit) in the dataset needed to have a month-year analysis because of the specifically dated July 2021 shift to MMC in NC. In order to arrive at the ED visit per thousand people rate for each month-year across 1) all of NC and 2) urban and rural geographies, independently, the total number of ED visits was divided by the total 18–64-year-old population from the 2022 American Community Survey (ACS) that had population by county. The ACS age population breakdown (18-64) is not a perfect match with the age

qualification for Medicaid (19-64) because population estimates are separated by children (17 and younger), adults (18-64), and the elderly population (65+). However, because all analyses consistently include the 18-64 population as the denominator, the integrity of the results are not compromised. Furthermore, the 18-19 age range is not a significant subset of the entire 18-64 population group.

With the ED visit per thousand for every month-year from January 2019 to December 2022, two Difference-in-Difference regressions were run. They are linear models because the trend of ED visits per thousand across time is not skewed. The treatment group is Medicaid beneficiaries while the two control groups are 1) 19–64-year-olds of other insurance status (i.e. private insurance, self-pay, or uninsured) and 2) older population (65+ years old) again with difference insurance (i.e. Medicare or private insurance). A DiD model is the most appropriate empirical methodology because it allows for direct comparison between the treatment and control groups before and after the MMC policy implementation. Furthermore, the fixed effects within the model, clustered at the county level, control for the unique patterns in ED visits for each month and year that would otherwise corrupt the model estimates.

Relying on a DiD model estimate requires for the parallel trends assumption to hold. In this context, there must not be a trend in ED visits across Medicaid beneficiaries from before and after July 2021 within our observation period. Lack of an observable trend would support that the statistically significant trend in ED visits after the MMC policy is truly attributable to managed care policy, and not another exogenous factor. When creating the event dummies that estimate the treatment difference for each month, month and year fixed effects were dropped as they are directly correlated to the event dummies. Figure 1 shows the event dummies were created for each month in relation to the policy change, with June 2021 serving as the net 0 axis (where the

red dotted line resides) as the policy took effect on July 1, 2021. Based on the results in the figure between our Medicaid beneficiaries and other 19-64 insurance group, the period of the distance past (January 2019 – May 2020) has fundamental differences between our treatment and control group, resulting in an abnormally high coefficient estimate during the period. Additionally, Figures 5A-C show the excessive decline in ED visits during the early months of the Covid-19 pandemic for all demographics. Covid made ED visits fundamentally different during the first 5 months of 2020, further supporting the need to remove these months from our observation period. Therefore, this thesis will focus on a stricter observation period, roughly one year before and after the MMC policy: June 2020 to December 2022.[1] With this refined time period, there is no abnormal trend in ED visits prior to July 2021 and the hypothesized decline post-policy appears between each control group (see Figure 2). Thus, the parallel trends assumption holds.

Two regressions were run observing the trends in ED rates pre and post MMC policy. The first regression shows this general trend while the latter observes the interaction between rural and urban geographies possibly contributing to ED visit rate change.

The former, general regression, clustered at the county level, is as followed:

$$(1) \quad Y = \beta_0 * POST + \beta_1 * MC + \beta_2 * POST\_MC + \delta_M + \delta_Y + \varepsilon_{MYC}$$

- POST = Post indicates whether than observation is in or after July 2021, when the MMC policy was implemented
- MC = MC is an indicator variable that indicates whether that ED visit is under Medicaid or not; 1 represents Medicaid while 0 is for non-Medicaid
- POST_MC = The interaction variable between the ED visit that is after policy implementation and covered by Medicaid

- δ_M = Month Fixed Effects
- δ_Y = Year Fixed Effects
- ε_{MYC} = Error term at the month – year – county level

Another linear DiD regression incorporated a treatment variable estimating the change in ED visits across urban and rural geographies among the same treatment and control groups. It is as follows:

$$(2)\quad Y = \beta_0 * POST + \beta_1 * MC + \beta_2 * POST_{MC} + \beta_3 * LOC_{MC} + \beta_4 * LOC_{POST_{MC}} + \delta_M + \delta_Y + \varepsilon_{MYC}[1]$$

- LOC = Location is an indicator variable where 1 indicates urban areas and 0 represents rural areas
- LOC_MC = The interaction variable between location and Medicaid beneficiaries.
- LOC_POST_MC = The interaction variable between location, post MMC policy for Medicaid beneficiaries. The model estimates for this variable would support a statistically significant change in ED visits between residents in rural and urban areas

Results

I begin this section by outlining general trends in ED visits between our demographics with additional location-specific analyses.

[1] With any interaction variable in a regression, the standalone variables should be included in the regression outside of the interaction. In this case, location (aka LOC) should exist independently within the regression, however because the regression is run with clustering at the county level, location correlated with counties and was omitted in the regression. The collinearity between county and location exists because counties are consistently classified as urban or rural with no change and thus maintain correlation with one another. Therefore, location, LOC, as a standalone variable, was omitted in this regression.

i. General Trends in ED visits

Beginning with monthly ED visit rates across the demographics, we see that Medicaid beneficiaries have higher overall utilization rates, more than doubling that of the control groups (see Figures 5 A-C). All groups experience the Covid-19 pandemic decline starting in January 2020, at its lowest in February/March 2020, and persisting until June 2020. After this sharp fall, there is a return to pre-covid numbers, however only older people (65+ demographic) reach and surpass initial rates. From the policy shift in July 2021 until the end of the year, Medicaid beneficiaries are the only group to experience a decline in ED rate. At the lowest point of ED utilization post-policy in November/October 2021, both control groups are at a peak in ED rates. However, Medicaid beneficiaries and their age counterparts stabilize rates throughout 2022 while the older population is on a steadily increasing rate.

The same general trends mentioned above are exhibited when separated into rural and urban areas, however the magnitude of ED utilization across these geographies differs (see Figures 6 A-C). Rural ED visit rates are higher than urban for all demographic groups. The difference between the two geographies is roughly 10 ED visits per thousand, beginning in January 2020, across all demographics, but during Covid, the gap between urban and rural rates decreases significantly to almost overlap at the lowest point of ED utilization in February/March 2020. The fall in ED visits post-MMC policy for beneficiaries is similar between geographies as well.

ED visits for chronic conditions exhibited the same patterns as overall ED visits just on a lower magnitude, as ED visits for chronic conditions are about 17.5% of the total ED visits rate (see Figures 7A-C). Again, there was a significant drop in ED visits during early months of Covid followed by an uptick to relatively stable levels. A large difference between ED visits for

chronic conditions (Figures 7A-C) and overall ED rates (Figures 5 A-C) is that the decline in ED visits for chronic conditions was persistent for all demographic groups. However, Medicaid beneficiaries experienced the largest drop at 3 ED visits per thousand people. Yet, both control groups reach their pre-MMC ED visit rates supporting the theory that their coordinated decline in ED rates is linked to an exogenous factor unrelated to the managed care policy. Urban and rural rates for chronic conditions follow similar patterns with rural rates higher than urban (see Figures 8A-C).

ii. Difference-in-Difference Estimates

Working Age Adults with Other Types of Insurance as a Control Group

There was a statistically significant decline in ED visits between our treatment group, North Carolina Medicaid beneficiaries, compared to our control groups after the shift to Medicaid Managed Care in July 2021. Starting with the comparison between Medicaid beneficiaries and the non-Medicaid control group, Table 2 column 1 shows a statistically significant decline of 5 ED visits per thousand people after the shift to MMC, an 11% decline from June 2021 at roughly 56 ED visits per thousand. The event study shows that the decline changed during the post-policy period; it was -10 during the first 8 months and then returned to pre-policy utilization levels (Figure 2). The -5 from the DiD represents the average of the -10 ED visits per thousand in the first 8 months post-policy and the 0 effect once utilization reverts to pre-policy rates.

People 65 and Older as a Control Group

Between Medicaid beneficiaries and the older 65+ control group, a larger ED visit decline was displayed at a rate of -9, a 16% decline from June 2021 beneficiary utilization. In real terms, there were 9 less ED visits per thousand between beneficiaries' post MMC policy

compared to older people in the same time period (Table 3 column 1). Figure 2 shows this decline to be long-lasting as ED visits post-policy and for the remainder of the observation period maintain a lower rate than pre-policy utilization. The larger decline is partly attributable to the upward trend in ED visits for older people after the policy at the same time that ED visits are declining for Medicaid beneficiaries, thus creating the large ED visit difference between the groups (see Figure 5C). I must note that even though the decline in ED visits is more drastic between beneficiaries and old people – in comparison to the other 19-64 control group – the baseline difference in ED visits is higher between Medicaid beneficiaries and non-Medicaid 19-64 control group compared to their 65+ control counterparts, 35 and 31 ED visits, respectively. This pattern signals that Emergency Department utilization is more similar between Medicaid beneficiaries and 65+ North Carolinians than their own age group with alternative insurance status.

Differences for ED Visits Related to Chronic Conditions

ED visits for chronic conditions mirrors a similar pattern between the treatment and control groups, with the exception that the reduction appears to be more persistent. In Table 2 column 2, I find Medicaid beneficiaries experienced a 1.5 visit decline in ED visits post MMC shift in comparison to their 19-64 non-Medicaid counterparts. Figure 4A displays this decline but also shows that the DiD is an average of a larger effect earlier in post-policy period and smaller effect later. In this figure, the coefficient hovers around -3 in the immediate future post-policy but lessens in later time around -1. The lack of complete recovery to the 0-coefficient level represents a persistent decline in ED use for chronic conditions between Medicaid beneficiaries and their age peers.

The comparison between the treatment group and 65+ control group exhibits a sustained decline – more so than the other control group – at 2.3 ED visits per thousand post-policy (see Table 3 column 2). The event study supports this decline while also creating a case that, unlike the other control group, the DiD estimate is an average of consistent reduced utilization of 2 ED visits per thousand throughout the entire post-policy period (Figure 4B).

Differences between Rural and Urban Areas

Factoring in location produced insignificant results in ED visits post July 2021. There is no difference in pattern of ED visits post shift to managed care based off urban and rural geographies in North Carolina (see Tables 4 and 5). The lack of trend by geography suggests that the opportunities and challenges created by managed care did not differ between urban and rural areas in NC.

Discussion

The regression and event study estimates can be used to support the theories explaining the decline in ED visits for Medicaid beneficiaries post MMC policy. Between North Carolina Medicaid beneficiaries and non-Medicaid 18-64 group, ED visits seemed to return to pre-policy rates after that 8 month decline time period (aka 'immediate future post-policy'). This corroborates the 'disruption to healthcare' theory as the immediate decline in ED visits is attributable to beneficiaries unsure of their insurance status and unfamiliar with navigating the managed care network of providers. The trend is shown in Figure 3 as the coefficients resume hovering around the 0-line starting in March 2022. Once they realize the continuity of their insurance status, they resume medical care at the Emergency Department.

On the contrary, the pattern between beneficiaries and the 65+ group supports the 'better management of health' theory. Figure 2, displaying these two groups, shows that ED visits did

not return to pre-policy numbers, maintaining steady between the -10 and 0 points. In the immediate future post-policy, beneficiaries maintain a permanent shift in medical care away from the Emergency Department. This is consistent with management of care away from the Emergency Department and toward primary care physicians, although it could also be consistent with managed care plans preventing access to emergency department care. The event studies for chronic conditions, see Figures 4A and 4B, also support the improved management of health post-Managed Care policy as the coefficient intervals did not bounce back (i.e. return to the 0-line) after the initial 8-month period following July 2021.

With conflicting trends in the long-lasting effect of MMC on ED visits between beneficiaries and the two control groups, the definitive cause -- disruption of care or better management of health – is still debatable. However, with a sustained decline in ED visits for chronic conditions post July 2021, it appears that managed care was more effective in management of chronic conditions than non-chronic health issues. With the exorbitant health costs of chronic conditions – roughly $3.7 trillion each year – North Carolina Managed Care appears to accomplish its goal of decreasing excess healthcare spending (through decreased emergent care) and improving general health through chronic condition management (CDC, 2024). Further research is needed to ascertain whether the decrease in ED visits is created because beneficiaries are shifting toward their managed care network of providers, or they are simply seeking less care. Health plans may use their network of providers to reduce medical care in a way that is not completely productive to the beneficiary's health. Additionally, the quality of medical care through the provider network should be studied to ensure the decreased ED visits do not correspond to poorer health, but rather more cost-effective allocation of medical care to beneficiaries.

Finally, my research suggests that neither the discrepancies in supply of facilities nor ability of the beneficiary to navigate health care led to differences in ED utilization between urban and rural areas after the policy shift. Further research should be conducted on whether the location insignificance persists between racial demographics, particularly the Black and White population in North Carolina as they are the most populous demographics in the state and are well dispersed across urban and rural geographies.

Regardless of theory, there is a statistically significant decline in ED visits for North Carolinians on Medicaid after the mandatory shift to managed care in July 2021. Literature is mixed on whether managed care interventions lead to decrease ED utilization, if any effect at all, however, some research does support a causal decline in ED use. Furthermore, the definition of managed care differs by each state and insurance plan (there are different levels of managed care even in North Carolina) but an overall aspect consistent with most managed care programs is the involvement of a permanent primary care physician in the medical decision making for Medicaid beneficiaries. With this definition, some studies do find significant declines in ED use post-managed care interventions (Powers 2000, Catalano 2005, Franco 1997).

I must note that MCOs are incentivized to control healthcare costs by reducing services because the less costs they cover, the larger the profit margin from the flat-per-beneficiary fee they receive from Medicaid. Even if decreased ED utilization is seen post-MMC, this study is limited to Emergency Department usage, lacking information about alternative healthcare utilization. Therefore, additional research will have to observe the volume of medical care outside of the Emergency Department – hospitalizations, PCP appointments, inpatient and outpatient admission – to ascertain whether a decline in ED visits is truly due to better

management of health with substitution toward less emergent, more consistent care (i.e. regular primary care).

Figures

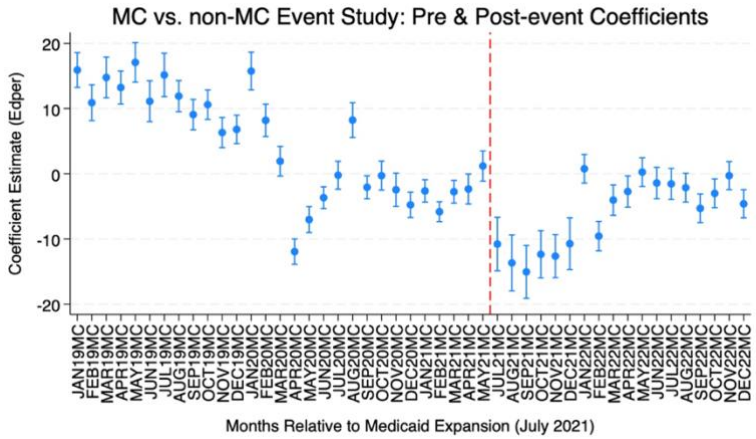

Figure 1: All ED Visits Coefficient Plot between Medicaid beneficiaries and 19-64 non-Medicaid group, January 2019 – December 2022[2]

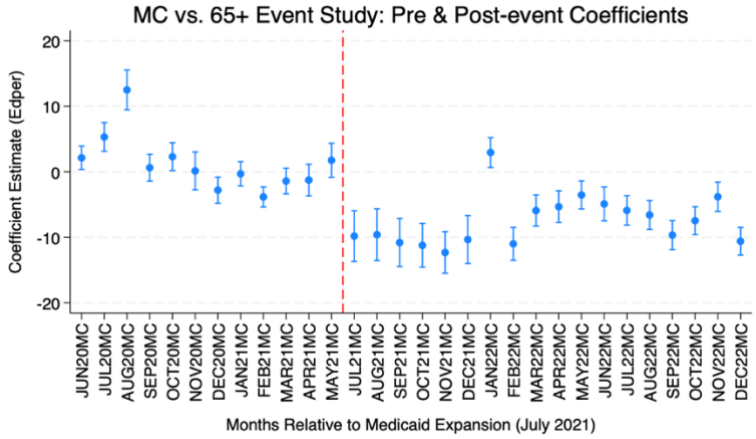

Figure 2: All ED Visits Coefficient Plot between Medicaid beneficiaries and older 65+ group during refined observation period, June 2020 – December 2022

[2] MC is an abbreviation for Medicaid

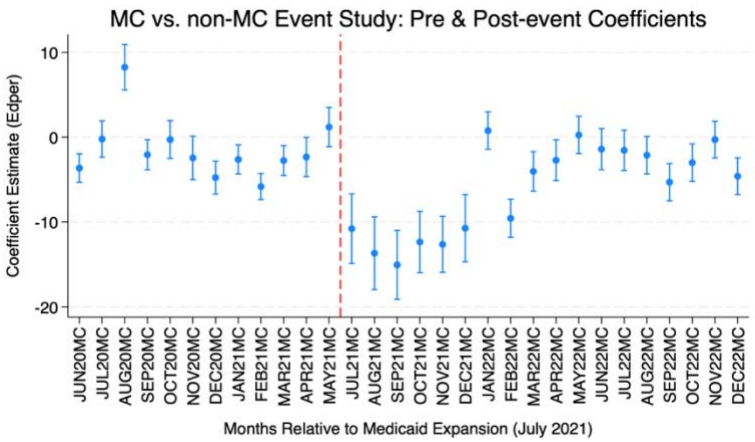

Figure 3: Refined time period for All ED Visits Coefficient Plot between Medicaid beneficiaries and 19-64 non-Medicaid group, June 2020 – December 2022

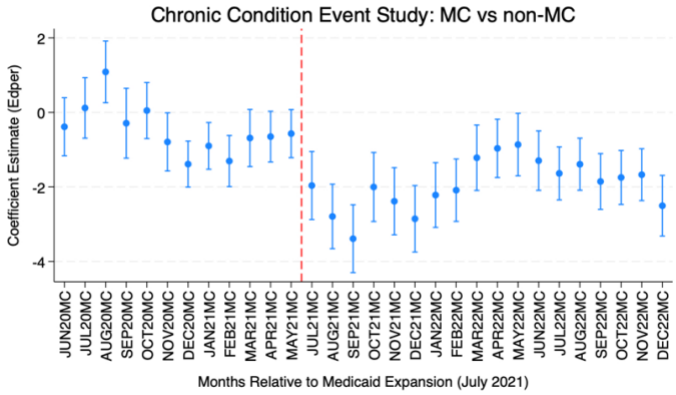

Figure 4A: Chronic Condition Coefficient Plot between Medicaid beneficiaries and 19-64 non-Medicaid group, June 2020 – December 2022

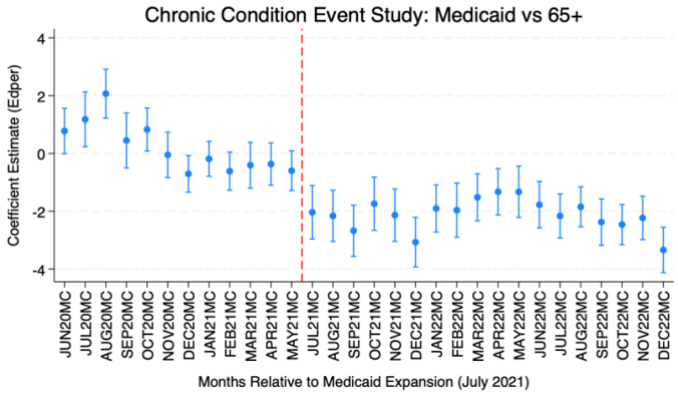

Figure 4B: Chronic Condition Coefficient Plot between Medicaid beneficiaries and 65+ group, June 2020 – December 2022

Figures 5A-C: Monthly Emergency Department Rates (per thousand people) for each demographic of interest

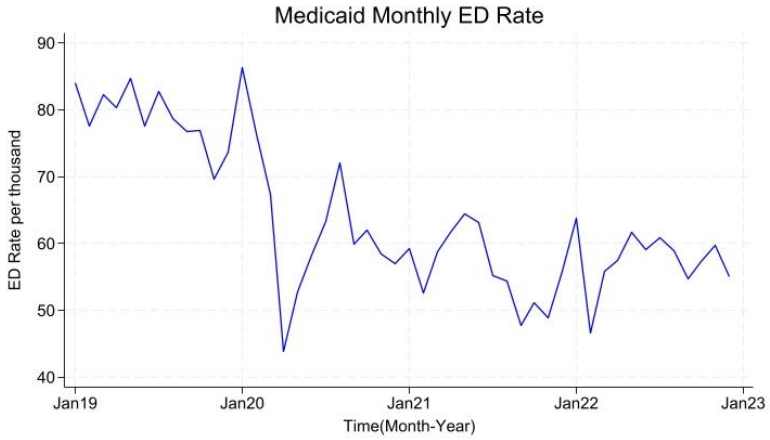

Figure 5A

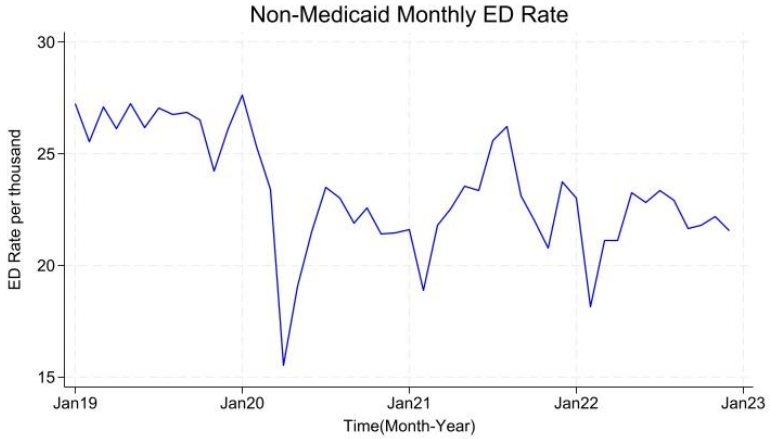

Figure 5B

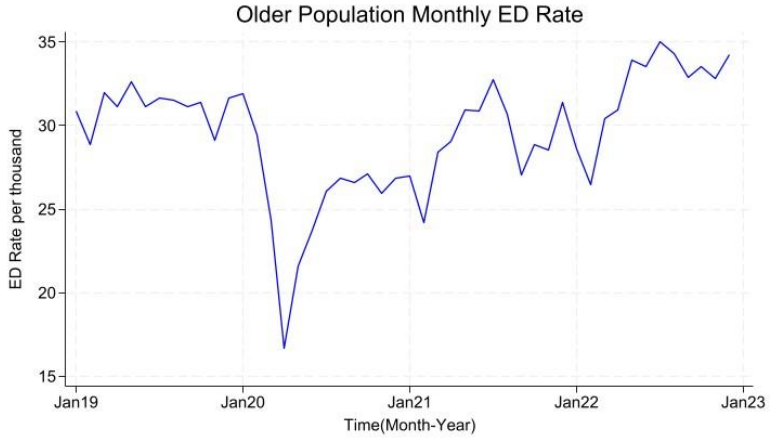

Figure 5C

Figures 6A-C: Urban & Rural Separation of Monthly ED Visit Rates (per thousand) for each demographic

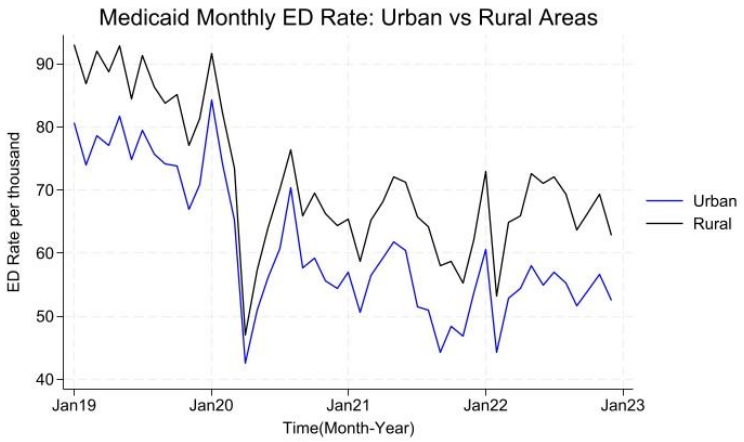

Figure 6A

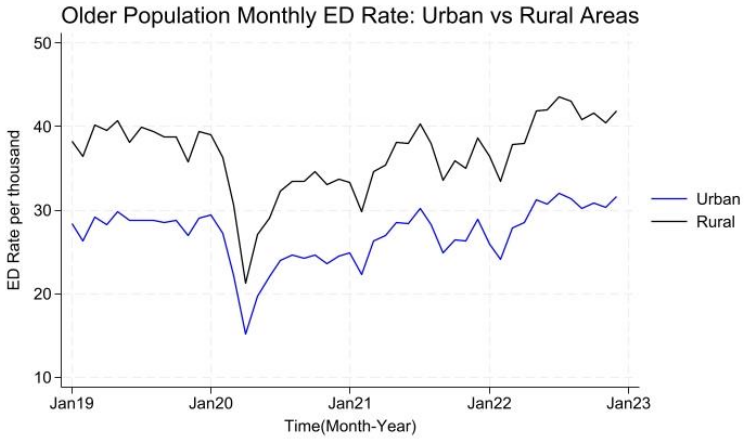

Figure 6B

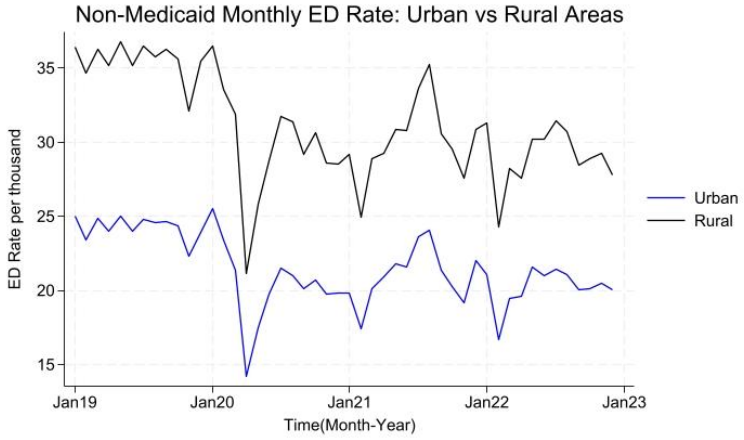

Figure 6C

Figures 7A-C: Chronic Conditions Monthly ED Rate (per thousand) for each demographic

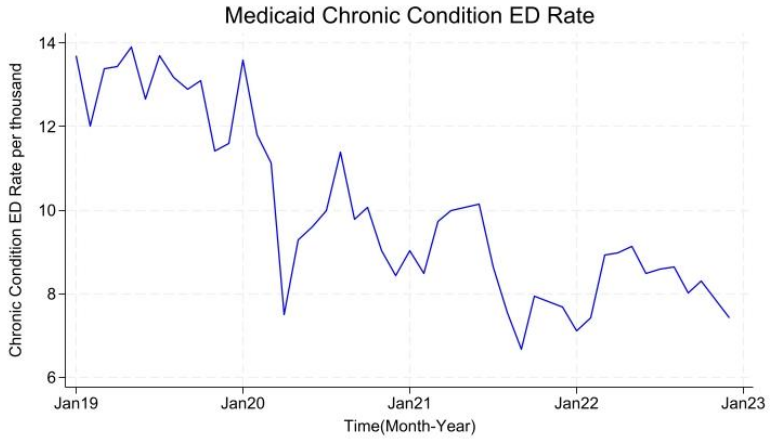

Figure 7A

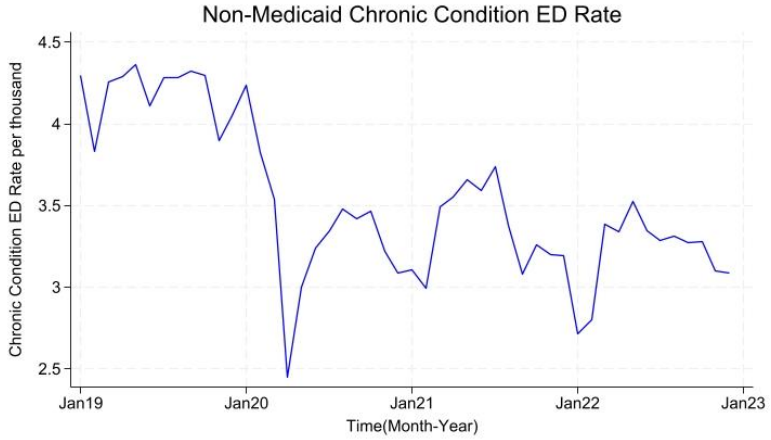

Figure 7B

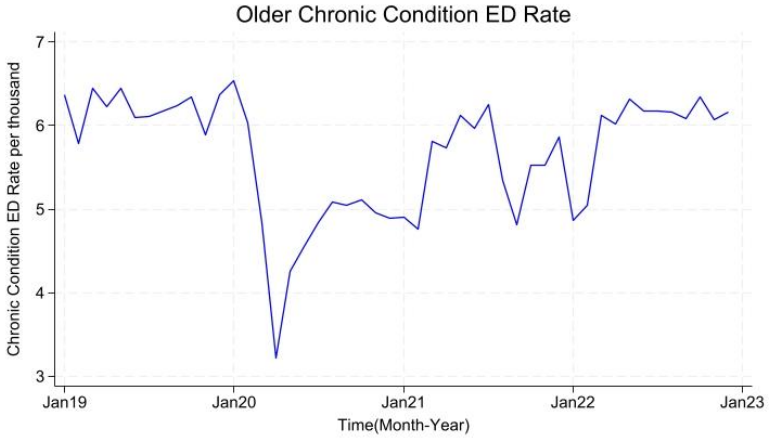

Figure 7C

Figures 8A-C: Urban & Rural Separation of Chronic Condition Monthly ED Rate (per thousand) for each demographic

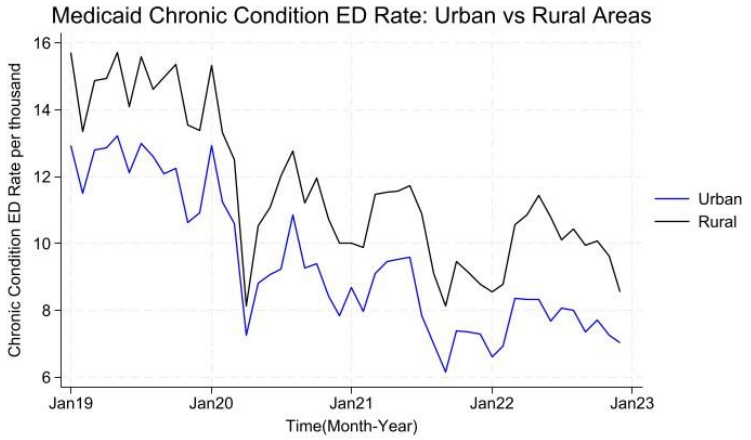

Figure 8A

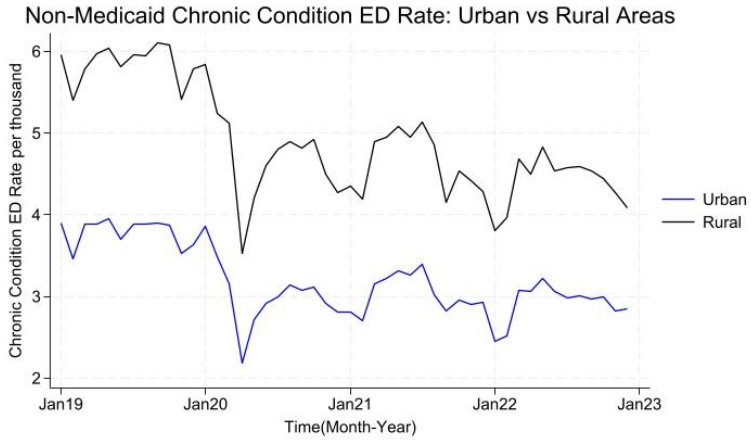

Figure 8B

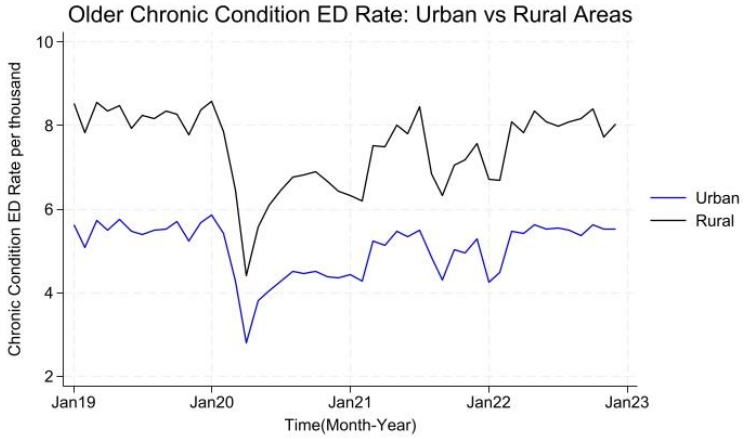

Figure 8C

Tables

Table 1: Descriptive Statistics

VARIABLES	(1) Medicaid	(2) Other (19-64)	(3) Older (65+)
ED visits per thousand			
2019	0.768	0.317	0.373
2020	0.649	0.266	0.307
2021	0.632	0.273	0.350
2022	0.656	0.263	0.387
Avg Age	39.63	40.66	75.87
Chronic Condition ED Visits (% of total visits)			
2019	0.164	0.159	0.200
2020	0.160	0.151	0.193
2021	0.154	0.147	0.191
2022	0.143	0.146	0.185
LOCATION (averages)			
Urban	0.702	0.742	0.686
Rural	0.298	0.171	0.314
RACE (% of total ED visits)			
Black			
2019	0.469	0.381	0.247
2020	0.479	0.377	0.247
2021	0.475	0.368	0.242
2022	0.474	0.361	0.245
White			
2019	0.441	0.514	0.702
2020	0.429	0.510	0.707
2021	0.422	0.514	0.712
2022	0.415	0.513	0.706
Other			
2019	0.089	0.105	0.051
2020	0.092	0.113	0.045
2021	0.103	0.118	0.046
2022	0.111	0.126	0.049

Table 2: DiD Regression Estimates between Medicaid beneficiaries and non-Medicaid population

VARIABLES	(1) Total ED visits per capita	(2) Chronic Condition ED visits per capita
POST	-1.161**	-0.378**
	(0.529)	(0.147)
MC	35.74***	6.024***
	(1.246)	(0.238)
POST_MC	-4.697***	-1.496***
	(0.977)	(0.188)
2.AMONTH	-8.849***	0.129
	(0.595)	(0.141)
3.AMONTH	-3.245***	1.165***
	(0.472)	(0.140)
4.AMONTH	-2.938***	1.096***
	(0.590)	(0.129)
5.AMONTH	1.325**	1.145***
	(0.514)	(0.141)
6.AMONTH	-0.846	0.854***
	(0.575)	(0.124)
7.AMONTH	1.153*	1.059***
	(0.614)	(0.128)
8.AMONTH	2.154***	1.014***
	(0.531)	(0.148)
9.AMONTH	-2.684***	0.468***
	(0.648)	(0.136)
10.AMONTH	-1.559**	0.869***
	(0.613)	(0.126)
11.AMONTH	-2.583***	0.466***
	(0.640)	(0.138)
12.AMONTH	-2.487***	0.0529
	(0.696)	(0.136)
2021.AYEAR	-0.396	-0.0128
	(0.495)	(0.153)
2022.AYEAR	2.586***	0.199
	(0.891)	(0.217)
Constant	27.33***	3.454***
	(0.714)	(0.142)
Observations	6,199	6,199
Number of county_id	101	101
R-squared	0.746	0.612

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3: DiD Regression Estimates between Medicaid and 65+ population

VARIABLES	(1) Total ED visits per capita	(2) Chronic Condition ED visits per capita
POST	-1.152*	-0.218
	(0.584)	(0.166)
MC	31.09***	4.011***
	(1.222)	(0.221)
POST_MC	-8.714***	-2.296***
	(0.954)	(0.186)
2.AMONTH	-7.627***	0.230
	(0.523)	(0.156)
3.AMONTH	-1.750***	1.475***
	(0.420)	(0.163)
4.AMONTH	-1.193**	1.420***
	(0.548)	(0.146)
5.AMONTH	3.257***	1.525***
	(0.524)	(0.155)
6.AMONTH	1.008*	1.205***
	(0.548)	(0.131)
7.AMONTH	3.705***	1.530***
	(0.613)	(0.139)
8.AMONTH	4.423***	1.369***
	(0.546)	(0.151)
9.AMONTH	-0.201	0.860***
	(0.622)	(0.142)
10.AMONTH	1.477**	1.363***
	(0.608)	(0.135)
11.AMONTH	0.434	0.942***
	(0.619)	(0.153)
12.AMONTH	1.032	0.663***
	(0.695)	(0.145)
2021.AYEAR	2.358***	0.520***
	(0.499)	(0.164)
2022.AYEAR	8.580***	1.173***
	(0.970)	(0.241)
Constant	28.80***	4.897***
	(0.759)	(0.160)
Observations	6,199	6,199
Number of county_id	100	100
R-squared	0.655	0.326

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4: DiD Regression Estimates factoring in location between Medicaid beneficiaries and non-Medicaid group

VARIABLES	(1) Total ED visits per capita	(2) Chronic Condition ED visits per capita
POST	-0.908	-0.417***
	(0.570)	(0.149)
MC	36.31***	6.364***
	(1.784)	(0.365)
POST_MC	-3.889**	-1.505***
	(1.482)	(0.292)
LOC_MC	-1.208	-0.732
	(2.476)	(0.461)
LOC_POST	-0.550	0.0846
	(0.461)	(0.0882)
LOC_POST_MC	-1.758	0.0180
	(1.910)	(0.367)
2.AMONTH	-8.849***	0.129
	(0.595)	(0.141)
3.AMONTH	-3.245***	1.164***
	(0.473)	(0.140)
4.AMONTH	-2.938***	1.096***
	(0.590)	(0.129)
5.AMONTH	1.325**	1.145***
	(0.514)	(0.141)
6.AMONTH	-0.846	0.854***
	(0.575)	(0.123)
7.AMONTH	1.153*	1.058***
	(0.614)	(0.128)
8.AMONTH	2.154***	1.014***
	(0.531)	(0.148)
9.AMONTH	-2.684***	0.467***
	(0.648)	(0.136)
10.AMONTH	-1.559**	0.869***
	(0.613)	(0.126)
11.AMONTH	-2.582***	0.466***
	(0.640)	(0.138)
12.AMONTH	-2.487***	0.0528
	(0.697)	(0.136)
2021.AYEAR	-0.396	-0.0132
	(0.495)	(0.153)
2022.AYEAR	2.587***	0.198
	(0.891)	(0.217)
Constant	27.32***	3.452***
	(0.714)	(0.141)
Observations	6,199	6,199
Number of county_id	101	101
R-squared	0.747	0.615

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: DiD Regression Estimates factoring in location between Medicaid beneficiaries and 65+ population

VARIABLES	(1) Total ED visits per capita	(2) Chronic Condition ED visits per capita
POST	-0.482	-0.157
	(0.632)	(0.181)
MC	30.97***	4.031***
	(1.792)	(0.343)
POST_MC	-8.320***	-2.404***
	(1.436)	(0.287)
LOC_MC	0.259	-0.0431
	(2.419)	(0.432)
LOC_POST	-1.459***	-0.134
	(0.507)	(0.137)
LOC_POST_MC	-0.854	0.235
	(1.874)	(0.363)
2.AMONTH	-7.627***	0.230
	(0.523)	(0.156)
3.AMONTH	-1.750***	1.475***
	(0.420)	(0.163)
4.AMONTH	-1.193**	1.420***
	(0.548)	(0.146)
5.AMONTH	3.257***	1.525***
	(0.524)	(0.155)
6.AMONTH	1.008*	1.205***
	(0.548)	(0.131)
7.AMONTH	3.705***	1.530***
	(0.613)	(0.139)
8.AMONTH	4.423***	1.369***
	(0.546)	(0.151)
9.AMONTH	-0.200	0.860***
	(0.622)	(0.142)
10.AMONTH	1.477**	1.363***
	(0.608)	(0.135)
11.AMONTH	0.435	0.942***
	(0.619)	(0.154)
12.AMONTH	1.032	0.663***
	(0.696)	(0.145)
2021.AYEAR	2.359***	0.520***
	(0.500)	(0.164)
2022.AYEAR	8.581***	1.173***
	(0.970)	(0.241)
Constant	28.80***	4.897***
	(0.756)	(0.160)
Observations	6,199	6,199
Number of county_id	100	100
R-squared	0.656	0.326

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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