[Title: Impact of Provider Characteristics on Mental Health Care Services Rates]

I. Introduction

Mental health care services have often been described by patients as expensive, difficult, and discouraging (Kanagaraj, 2020). The rates of mental health care vary widely among Medicaid enrollees based on where they live in the United States (McConnell et al., 2023). Understanding how provider characteristics can affect these differences is helpful for policy development aimed at national health care improvement. This paper investigates how provider characteristics affect Medicare reimbursement rates for mental health services across different zip codes, focusing on urban versus rural disparities and the influence of provider gender and entity type (individual vs. organization), using Medicare provider utilization and payment data.

II. Methodology

The data analysis focuses on the upper 75th percentile of mental health care services by average charges, as most mental health services show similar average amounts across zip codes. To conduct the analysis, zip codes are grouped by average adjusted income, divided into 20 groups where Group 1 has the lowest income and Group 20 has the highest income. Additionally, the Rural-Urban Commuting Area (RUCA) indicators are used, ranging from 1 (Metropolitan area) to 10 (rural area). The average Medicare reimbursement rates are then mapped across these income groups, identifying urban and rural patterns. Additionally, comparative analyses are performed to visualize differences in reimbursement rates between male and female providers, and individual versus organizational providers. Multiple linear regression analyses are conducted to assess the impact of the provider's area, gender, and entity type on the average rates. Since health care charges are highly skewed, log values of the average charges are used as the dependent variable.

III. Research Question

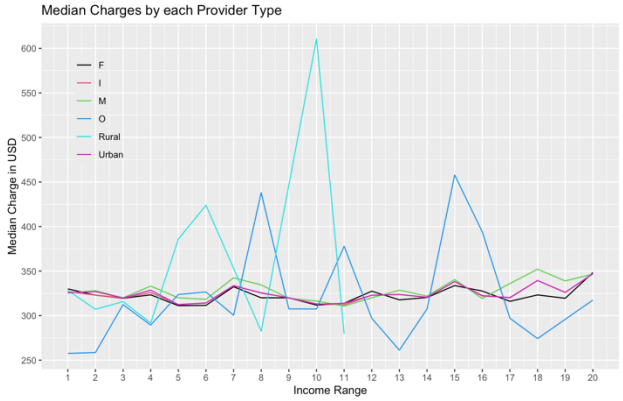
The primary research question of this paper is that how do provider characteristics, such as area, gender and entity type, influence Medicare reimbursement rates for mental health care services across different zip codes. The specific questions are:

1. Do Medicare reimbursement rates for mental health care vary between urban and rural areas in different zip codes?
2. Are there differences in Medicare reimbursement rates for mental health care services between male and female providers, and do these differences vary by zip code?
3. How do Medicare reimbursement rates for mental health care providers differ between individuals and organizations, and do these differences change across zip codes?

IV. Results

The analysis shows that high-income zip code areas (Income Ranges 18-20) typically have higher charges for mental health care, as expected. However, the difference between high-income and low-income zip code areas is not significant, even for the upper 75th percentile of

mental health care services. Although the R-squared values for the regression models are very low, the coefficients of all predictors have low p-values, indicating their explanatory power for the average charges. Higher average charges are found in more metropolitan and higher-income areas. Male providers tend to have higher average charges than female providers for highest-cost mental health care services. Additionally, the sample sizes for rural areas and organizations are not large enough to demonstrate their influence.



log(Average Charge) Regression Results

term	estimate	std.error	statistic	p.value
(Intercept)	5.859	0.007	815.678	0.000
genderM	1.196×10^{-2}	0.005	2.443	0.015
ruca	-6.997×10^{-3}	0.002	−3.504	0.000
Income_Range	1.682×10^{-3}	0.001	2.626	0.009
num_bene	-1.078×10^{-4}	0.000	−6.543	0.000
adjust_income	6.271×10^{-8}	0.000	4.989	0.000
unemployment_comp	2.193×10^{-6}	0.000	10.243	0.000
child_credit	-1.995×10^{-5}	0.000	−8.761	0.000

R-squared: 0.016
Adj. R-squared: 0.015
F-statistic: 40.739
P-value: 2.632848e-57

* Control variables included in the analysis are number of beneficiaries(num_bene), adjust income, unemployment compensation, and child tax credit(child_credit).

1) Comparison between urban and rural (Appendix-1)

The median average charge for mental health care is very similar between urban and rural areas. However, the highest charges are concentrated in metropolitan areas (RUCA 1-3). It is also evident that most high-income zip codes, which are above the 50th income percentile, are concentrated in urban areas (RUCA 1-6).

2) Comparison between male and female provider (Appendix-2)

Even for the high-charge mental therapy services, there is no significant difference between male and female providers. However, male providers have a higher proportion of therapies with the highest charges.

3) Comparison between Individual and Organization (Appendix-3)

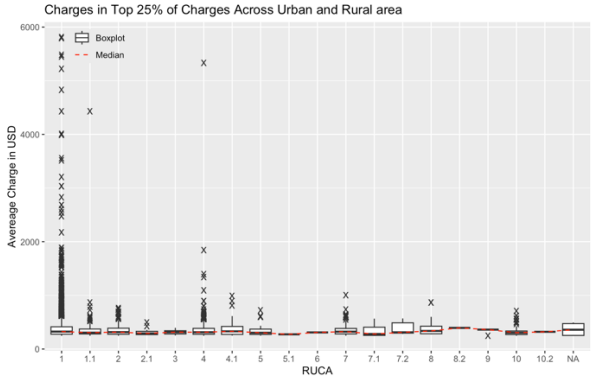
Individual mental health care providers are distributed evenly across various income level areas and are more prevalent than organizational providers, even in high-income areas. In contrast, organizational providers are very rare relative to individual providers.
Organizational providers primarily offer mental health treatments involving medication, which do not generally have particularly high charges.

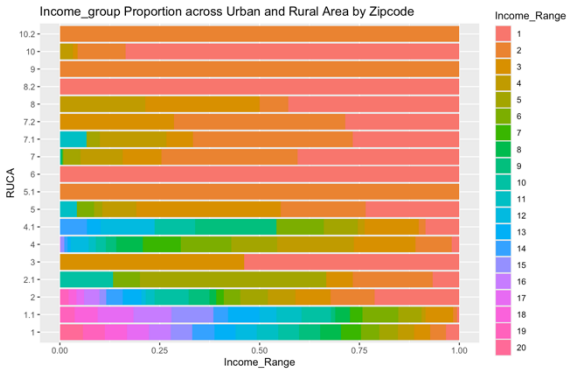
V. Conclusion

This study examines how provider characteristics, such as gender and location, along with the type of provider, influence Medicare reimbursement rates for mental health services. Although the differences are not substantial across various income levels, further exploration of mental health care charges and other provider characteristics may offer more valuable insights into the factors affecting the average costs of mental health care services.

VI. Appendix

1) Comparison Plots between urban and rural

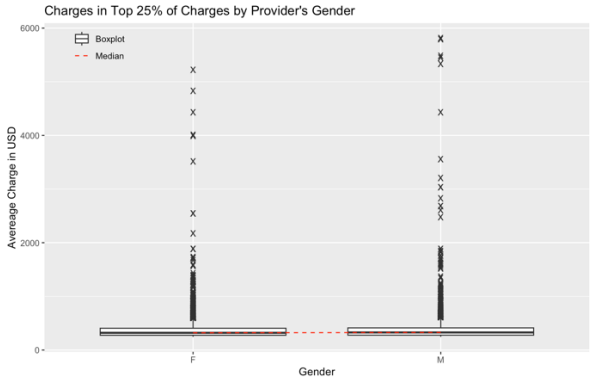


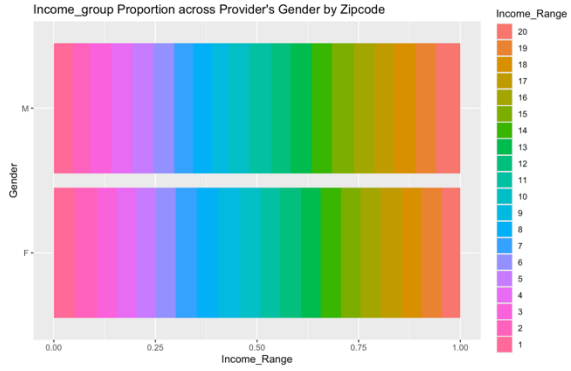


* [RUCA] 1~3: Metro politan, 4~6: Micropolitan, 7~10: small town and Rural area

** [Income_Range] Each number from 1(the lowest) to 20(the highest) covers a 5% range of the income distribution.

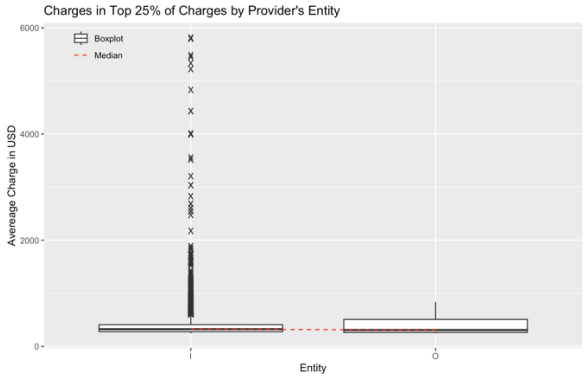
2) Comparison Plots between male and female provider

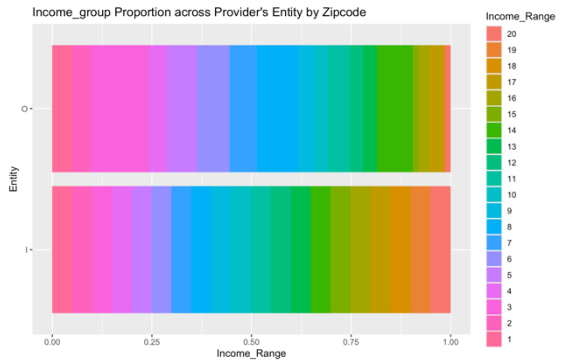




* [Gender] F: Female Provider, M: Male Provider

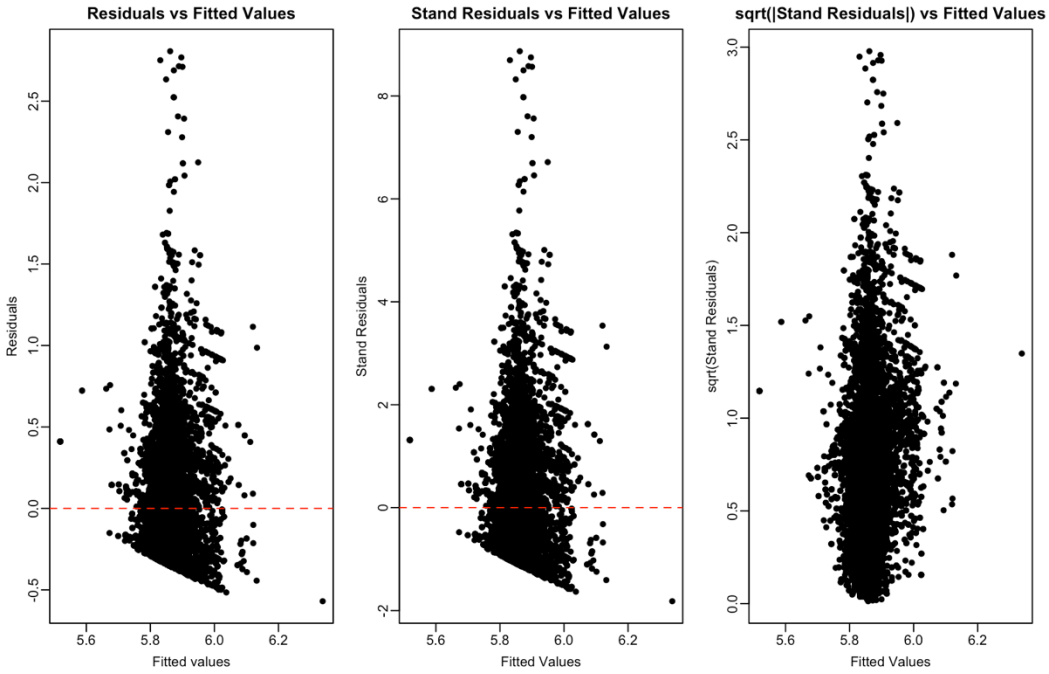
3) Comparison Plots between Individual and Organization



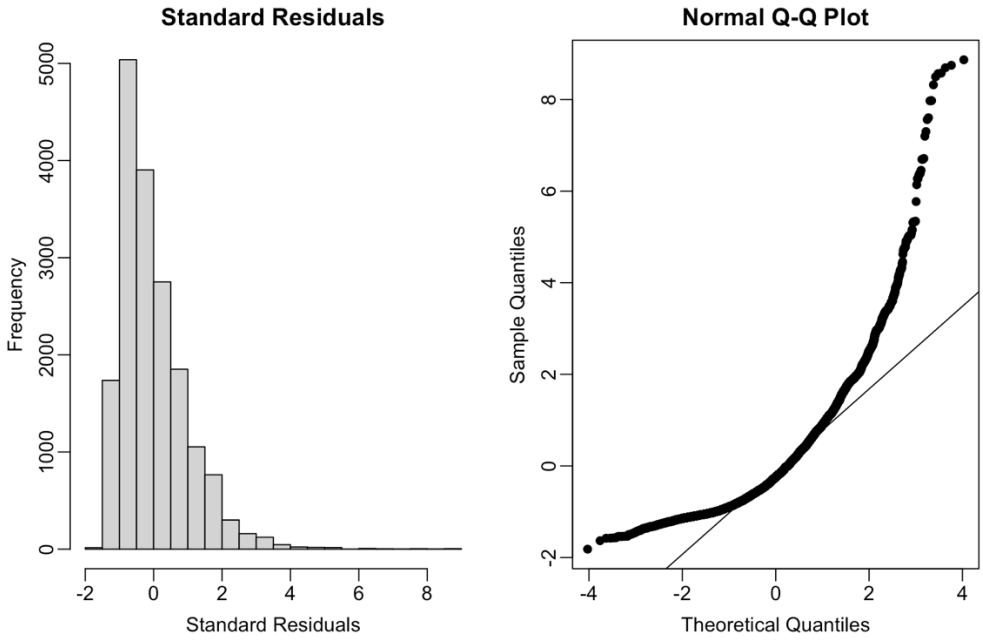


* [Entity] I: Individual Provider, O: Organization Provider

4) Regression Residual Plots for Linearity and Homoscedasticity Check



5) Regression Residual Plots for Normality Check



VII. References

1. GitHub Repository (Analysis Code) **:**
https://github.com/tedheo10/FinalProject_STATS506

2. Data Sources :

- Medicare provider utilization and payment data:
  - Medicare Physician & Other Practitioners - by Provider
  - Medicare Physician & Other Practitioners - by Provider and Service
    (Available from: https://data.cms.gov/provider-summary-by-type-of-service/medicare-physician-other-practitioners)

- Individual Income Tax Statistics - 2020 Zip Code Data
  (Available from: https://www.irs.gov/statistics/soi-tax-stats-individual-income-tax-statistics-2020-zip-code-data-soi)

3. Other Sources :

- Manoj Kanagaraj (2020). Here's Why Mental Healthcare Is So Unaffordable & How COVID-19 Might Help Change This. Harvard Medical School Center for Primary Care. https://info.primarycare.hms.harvard.edu/perspectives/articles/mental-health-unaffordable

- K. John McConnell, Kelsey Watson, Esther Choo & Jane M. Zhu (2023). Geographical Variations In Emergency Department Visits For Mental Health Conditions For Medicaid Beneficiaries. Health AffairsVol. 42, No. 2. https://doi.org/10.1377/hlthaff.2022.00796