Factors Impacting the Use of Telehealth for Medicare and Medicaid Members in 2020-2024

**Jessica Coomber**

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Dr. Alexandre Scarcioffolo

Denison University

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**Abstract**

This research aims to understand the factors impacting the use of telehealth visits for Medicare and Medicaid members in the US during 2020-2024. The *Medicare Telehealth Trends* dataset is merged with publicly available data from the US Census Bureau and the *Transit Report Card* from Transportation for America in order to include variables that suggest economic status of an individual. Fixed effect analysis is used to assess the relationship between the variables and the number of telehealth visits per capita, while controlling for state and year. The results suggest that the number of vehicles owned and transit spending per capita are positively associated with telehealth visits. The number of physicians is also associated with more telehealth, but more hospitals is associated with fewer telehealth. Surprisingly, internet access shows a negative relationship with telehealth visits, indicating that access alone may not be the primary barrier. This research can be used to understand potential socioeconomic barriers to telehealth access to aid opportunities for targeted interventions to improve equitable access to care.

**Introduction**

Telehealth use has increased since the COVID-19 pandemic in 2020, and many believe it helps make healthcare more accessible. However, it’s unclear whether it’s reaching its potential to improve access to care for everyone in the population. This research aims to assess factors that affect whether Medicare and Medicaid members use telehealth visits, with a focus on variables that represent economic status. I expect that people with lower economic status face more barriers to the use telehealth services.

For my analysis, I first create exploratory visuals such as **Figure 1** which shows that rural areas have fewer telehealth visits than urban areas suggesting location plays a role in access to telehealth. Next, **Figure 2** represents how although there is a consistent amount of services eligible for telehealth, the actual number of telehealth visits has slightly declined since 2020. There is potential for greater utilization of telehealth to provide healthcare services.

For deeper analysis, **Table 2** displays the results of a state and year fixed effect analysis which highlights several key factors influencing telehealth usage such as vehicle ownership, transit spending, internet access, number of hospitals, number of providers, and poverty level. A surprising finding from the model is that internet access has a negative relationship to telehealth visits, suggesting that access to internet does not mean that there is telehealth use. If access to internet is not the factor preventing telehealth use, then addressing other barriers will help increase telehealth implementation and improve access to care.

**Table 2** reflects several other key results such as that vehicle ownership is associated with higher telehealth visits, likely reflecting higher economic status. Higher transit spending showed more telehealth visits due to transportation access and mostly urban status. More hospitals is associated with fewer telehealth visits while more providers is associated with more telehealth visits. Lastly, poverty level is negatively associated with telehealth visits, but this relationship became insignificant when accounting for state and year differences likely due to the complex relationship between economic and geographic factors. A potential limitation of the results is that there is not one variable to represent the economic status of the individuals so inferences will have to be made based on other variables.

**Literature Review**

Existing research on the use of telehealth highlights its potential to expand access to medical care. In order to understand its impact, it is important to clarify what types of services telehealth refers to. The term telehealth is mistakenly thought of as only including video calls, but it also includes phone consultations, secure messaging, remote monitoring of health through wearable devices (Wosik, 2020). The adoption of telehealth increased during the COVID-19 pandemic and it has become more mainstream in recent years (Wosik, 2020 ; Gajarawala and Pelkowski, 2021). Even with the increased adoption of telehealth in the US, concerns remain around whether there is actually an improvement for lower income populations who might not have access to the internet or technology and they might not have the same comfort using technology (Douthit, 2015). My research supports Douthit’s perspective questioning whether it is truly bridging gaps in healthcare access or if it is increasing existing disparities. This literature review explores themes such as access to healthcare, access to telehealth and its utilization trends, and healthcare costs. Understanding these factors is important in understanding how to reach telehealth's potential to improve the equality of healthcare access and overall population health.

Singh et al., (2018) identifies that some of the ongoing barriers of healthcare access come from social determinants of health, which include community factors such as socioeconomic status and geographic location. The use of telehealth services to provide healthcare access remotely has evolved significantly in recent years, particularly during the COVID-19 pandemic when there was a need for a fast adoption and integration of telehealth into healthcare systems (Wosik, 2020 ; Gajarawala and Pelkowski, 2021).

Tuckson (2017) highlights telehealth's progress in expanding care access, addressing provider shortages, and increasing convenience. On the other hand, Douthit et al. (2015) suggests that rural populations, low-income communities, and elderly individuals often face difficulties in utilizing telehealth services because of low technological comfort and unreliable internet access. A key factor contributing to these barriers in access to telehealth is that about 1/4 of American households in rural areas are lacking internet access, making virtual healthcare inaccessible to many who need it the most (Lythreatis et al., 2022 ; Douthit et al., 2015). Although it may seem like telehealth can be used to connect rural hospitals with specialists, increase access care for underserved communities, and make the healthcare system more efficient, it is important to assess whether this is actually the case given the barriers socioeconomically disadvantaged populations may still face to access telehealth (Wosik, 2020).

The increased use of telehealth is seen in an analysis of private insurance data, which shows that telehealth visits increased from 0.3% of total healthcare contacts in 2019 to 23.6% in 2020 (Weiner, 2021). These privately insured individuals may be wealthier and represent a more privileged portion of the US population who was more easily adaptive to new technologies. It is also possible that this new utilization may increase overall health care spending even though there are lower costs per telehealth visit for patients because it may reach a previously unmet demand by individuals who would not have seeked any care if it were only offered in person (Ashwood et al., 2017).

To understand the impact on cost, Ashwood explores the financial implications of telehealth, particularly its impact on healthcare spending and the diverse approaches to insurance reimbursement. The increased utilization of telehealth does not necessarily correlate with reduced healthcare spending (Ashwood et al., 2017). Telehealth visits often serve as an additional point of care rather than a direct replacement for in-person visits, potentially leading to higher cumulative healthcare costs.

For example, Weiner (2021) finds that people who used telehealth had higher overall medical costs. However, this correlation does not necessarily mean that telehealth is more expensive. It could mean that those people could have already been dealing with more health problems and are therefore using telehealth more frequently. Individuals with high medical needs may not prefer in person appointments because they require time off from work and have additional travel costs (Ashwood et al., 2017). These cost-related challenges could be reduced for certain types of appointments like routine check ups and follow ups that would only cost $40-50 as a telehealth visit (Ashwood et al., 2017).

Another financial challenge in regards to telehealth is that the reimbursement policies vary significantly between insurers, with Medicare and Medicaid offering limited coverage compared to private insurers (Gajarawala and Pelkowski, 2021). The lack of standardized billing practices makes it complicated to assess the cost-effectiveness of telehealth. Medicaid programs in certain states have embraced telehealth expansion, others are still more restrictive, creating disparities in access to care based on geographic location (Tuckson et al., 2017).

**Data**

The dataset used in this research is the *Medicare Telehealth Trends* from the U.S. Department of Health & Human Services which is publicly available through Data.gov, a platform that provides open government data permitting use for research. The variable names are renamed from the names in the original dataset for easier interpretation. Variable definitions are found in the *Medicare Telehealth Trends Data Dictionary.* This dataset includes the demographic information about Medicare and/or Medicaid members and whether they reported using telehealth services during and after the pandemic. The observations in this dataset are anonymous and I will not be handling specific personal health information.

The *Medicare Telehealth Trends* dataset includes their demographic variables (i.e. race, sex, state), the number of telehealth visits and the number of visits that were eligible to have been telehealth. The number of telehealth visits will be used as the variable of interest as I am trying to explain the use of telehealth. A potential limitation of this study that could affect the interpretation of the results is that the data includes years 2020-2024 but does not include information about telehealth usage before 2020. Without data from before 2020, it is difficult to determine whether the results differ from earlier years due to the COVID-19 pandemic. Therefore, without the inclusion of data from a larger period, analysis was not done based on year.

The *Medicare Telehealth Trends* data is merged with publicly available annual data from the US Census Bureau on state specific factors that could be impacting access to telehealth. The US Census Bureau data includes population sizes as well as various variables relating to vehicle access, internet access, and poverty rate. These variables are chosen because I hypothesize that the owning vehicles and having internet access vary based on the individual's economic level and therefore impact the ability to access medical care and telehealth services. Since this dataset includes Medicare and Medicaid populations, poverty rate is an important variable to control for in the model as these populations are likely more at risk. The vehicle and internet variables are converted to be representing per capita for easier interpretability.

The *Medicare Telehealth Trends* data is also merged with the *Transit Report Card* from Transportation for America to capture individuals who depend on public transportation in each state. The Transit Spending Per Capita variable is chosen to represent public transportation use of individuals who are likely in urban areas. Transit Spending for each state is adjusted to per capita to fairly compare states of varying sizes.

**Methods**

For initial exploration, I use bar plots to visualize TelehealthVisits (number of unique telehealth visits) across demographics categories (rural/urban, race, and year). These variables are important in understanding the dataset because demographics of individuals influence their ability to access telehealth services (Ching-Ching, 2018). Next, I use a fixed effect analysis to assess the association between various variables and the number of telehealth visits while controlling for state and year. Fixed effect models control for time invariant variables and in this case controls for differences between states and years. Fixed effect is a beneficial method because it helps isolate variables of influence to see how they are impacting the utilization of telehealth services.

6 variables are chosen for the multivariable fixed effect model including: the number of vehicles owned, transit spending per capita, having internet access, number of hospitals, number of physicians, and poverty rate. To evaluate the fit of the model, the R^2 represents how well the model explains variation within each fixed-effect group (no fixed effect, state fixed effect, and both state and year fixed effect). A higher R^2 suggests that the independent variables are good predictors of telehealth visits.

**Table 1: Fixed Effect Model Variables**

|  |  |
| --- | --- |
| **Variable** | **Relevance** |
| Number of Telehealth Visits | Dependent Variable |
| Number of Vehicles Owned | Factor that could reflect financial status of individuals who own a vehicle |
| Transit Spending per Capita | Factor that could represent access to public transportation, likely urban location. |
| Internet Access | Internet of any type is important factor to include when assessing telehealth utilization. |
| Number of Hospitals | Factor that could impact healthcare appointment availability. |
| Number of Physicians | Factor that reflects availability of healthcare professionals to provide appointments, such as telehealth. |
| Poverty Rate | Factor that reflects individuals with lower economic status and higher risk for potential barriers to telehealth services. |
| State | The fixed effect to control for differences across states |
| Year | The fixed effect to control for differences across years. |

**Model Validation**

Standard Errors are used to assess the statistical significance of the coefficients of variables in 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 use 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). Feols drops variables that are perfectly collinear but if a variable has very high VIF, it might still be problematic and could lead to unstable estimates.

Variance Inflation Factor (VIF) analysis is used to test for multicollinearity, which is when independent variables are highly correlated with each other. When independent variables are highly correlated, the fixed effect model is not able to determine which variable is correlating to the outcome variable and in this case, it is capturing overlapping aspects of economic status. Correlated variables in a fixed effect model could lead to unreliable coefficient estimates and the interpretation of the impact of each variable could be incorrect.

**Ethical Considerations**

1. **Data Privacy**

The *Medicare Telehealth Trends* dataset includes demographic information such as race, sex, and age, but does not include personally identifiable information like names, SSN, or patient IDs. For this reason, it meets the HIPAA national standards in place to protect individuals' medical records and other personal health information. The data will not be used to identify individuals but rather to understand access for those demographic groups. In order to get a deeper understanding of access to telehealth by more than just demographic groups, the Telehealthdataset will be merged with publicly available data from the US Census Bureau and *Transit Report Card.*

1. **Population’s Impact on Model Interpretation**

The research findings will address access for older adults (Medicare members), low-income Medicare members (those who also have Medicaid). A potential limitation of the findings is that the dataset only includes Medicare and Medicaid members and excludes uninsured or other types of insured individuals. When interpreting the model findings, it is important to be aware that the findings should only be applied to this specific population. However, disadvantaged populations, such as those with Medicare and Medicaid, are an important population to research because they are at a higher risk of limited healthcare access because of financial, geographic, and technical constraints. Understanding populations with barriers in access to care could be helpful in understanding a population in need of increased telehealth adoption. Further research is needed to draw conclusions about individuals with other insurance plans.

1. **Model Potential Misinterpretation**

The use of a fixed effect model, will avoid misleading conclusions by controlling for state and year to show more accurate representation of the relationship between those disparities on telehealth access. There is a potential for misinterpretation of the findings if a lower telehealth utilization among certain populations is seen as the result of personal choices rather than structural barriers. To avoid misinterpretation, the findings of this research are framed in a way that highlights systemic barriers rather than individual responsibility. For example, if a demographic variable is seen to be associated with a decrease in telehealth utilization, a misinterpretation could be that they prefer in-person visits. In reality, they could have financial restraints and low technology access limiting their use of telehealth.

**Results**

**Figure 1: Telehealth Visits by Rural vs. Urban**

A graph showing a number of different colored squares

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**Note:** Rural/Urban status is defined using the beneficiary’s mailing ZIP code and the Rural Urban Commuting Area Crosswalk (RUCA). The RUCA crosswalk relies on commuting data from the US Census.

***Figure 1*** shows almost 12.5 telehealth visits (per capita) for urban individuals and only about 5 telehealth visits for those who are rural, which could be because of differing socioeconomic status and access to the internet. Since the per capita values for number of telehealth visits are very small, about .0001 - .0009, the sum for all individuals in urban areas is only 12.5. Singh et al., (2018) identifies that community factors, such as socioeconomic status and geographic location, are associated with ongoing barriers of healthcare access. Rural populations have a higher lack of access which is an issue with over 51 million Americans who live in rural USA (Douthit, 2015).

Another key factor contributing to these barriers in access to telehealth is the digital divide, with about 1/4 of American households in rural areas lacking internet access, making virtual healthcare inaccessible to many who need it the most (Lythreatis et al., 2022 ; Douthit et al., 2015). Even though telehealth is thought to be expanding care access, Douthit et al. (2015) suggests that certain populations like the rural, low-income communities, and elderly, have more difficulty using telehealth services because of low technological comfort and unreliable internet access. ***Figure 1*** reinforces Douthit’s concern that telehealth is not reaching its potential and rural populations are lacking.

**Figure 2: Telehealth Visits by Race**

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***Figure 2*** shows that telehealth visits are much more common among the Non-Hispanic White population. This could be because of the advantages and resources available to this demographic, suggesting a need for targeted approaches to increase utilization among other race groups. Recognizing that non-white populations have much lower number of telehealth visits can help target the allocation of resources and education programs relating to the implementation of telehealth to improve its access.

**Figure 3: Telehealth Visits by Year**

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**Figure 4: Eligible Services (With Potential for Telehealth Use) by Year**

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***Figure 3*** shows the number of telehealth visits while ***Figure 4*** shows the number of eligible services that could have been used by telehealth by year. **Figure 3** shows the number of telehealth services was the highest in 2020, likely because the pandemic forced almost all in person visits to become virtual. However, ***Figure 4*** suggests that since 2020 there has only been a small decline in the number of services that are eligible for telehealth use. There are about 150 eligible services (per capita) for each year and only fewer than 50 telehealth visits. Therefore, this research will provide insight into ways that the use of telehealth services can increase and which populations are currently lacking versus accessing those eligible services.

**Figure 5: Telehealth Visits by Insurance Enrollment Status**

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In the *Medicare Telehealth Trends* data includes a population of Medicare and Medicaid members in the US in 2020-2024. **Figure 5** displays that the number of telehealth visits is higher for those with Medicare only, compared to those with Medicare and Medicaid. The difference between insurance enrollment status suggests that the individuals with Medicaid are facing financial barriers that the Medicare only participants are not facing. This research will focus on including economic related factors that could be increasing barriers access to telehealth in order to assess how to provide targeted improvements to telehealth implementation.

**Table 2: State and Year Fixed Effects on Various Factors impacting the Number of Telehealth Visits (Per Capita)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **No Fixed Effect** | **State Fixed Effect** | **State and Year Fixed Effect** |
| **Vehicles Owned** | **0.066\*\*** | **0.121\*\*\*** | **0.122\*\*\*** |
|  | (0.009) | (0.021) | (0.021) |
| **Transit Spending Per Capita** | **0.000\*\*\*** | **0.005\*\*\*** | **0.005\*\*\*** |
|  | (0.000) | (0.001) | (0.001) |
| **With Internet** | **-0.072\*\*\*** | **-0.108\*\*\*** | **-0.103\*\*\*** |
|  | (0.009) | (0.013) | (0.014) |
| **Number of Hospitals** | **-45.313\*\*\*** | **-1670.351\*\*\*** | **-1657.032\*\*\*** |
|  | (5.089) | (323.434) | (323.677) |
| **Number of Physicians** | **2.211\*\*\*** | **92.439\*\*\*** | **93.079\*\*\*** |
|  | (0.213) | (14.899) | (14.912) |
| **Percent Below Poverty Level** | -0.025\*\*\* | -0.022 | -0.021 |
|  | (0.003) | (0.015) | (0.015) |
| **Num.Obs.** | **19330** | **19330** | **19330** |
| **State Fixed Effects** | **No** | **Yes** | **Yes** |
| **Year Fixed Effects** | **No** | **No** | **Yes** |
| **R2** | **0.092** | **0.139** | **0.139** |

**Note:** Statistical significance for coefficients is shown by \*p < 0:10 \*\*p < 0:05 \*\*\*p < 0:01 \*\*\*\*p < 0:001. Standard Errors are included in parenthesis.

**Interpretation of Factors Relationship to Number of Telehealth Visits**

1. **R^2 Strength of Variable Relationships**

The coefficients for **Table 2** represent the estimated change in the number of telehealth visits associated with a one unit increase in each independent variable, if all other variables stayed constant. When there is no fixed effect, the R^2 is 0.092 which suggests that the number of telehealth visits is explained little by the variables in this model. Adding state fixed effect or state and year fixed effect, the R^2 is 0.139. This means the fixed effect improves the model and explains more of the variation in the number of telehealth visits due to the independent variables.

1. **Vehicles Owned.**

The number of vehicles owned has a positive relationship to the number of telehealth visits suggesting that a higher number of vehicles owned is associated with more telehealth visits. This could be because individuals who own more vehicles have better financial status and more accessibility to resources needed for telehealth. Since telehealth visits can often serve as an additional point of care, rather than a direct replacement for in-person visits, people who used telehealth had higher overall medical costs (Weiner, 2021). Therefore, individuals with a higher financial status would likely be the ones who would seek out additional care on telehealth, supplementing their in-person visits.

1. **Transit Spending**

The amount of transit spending per capita shows no relationship before controlling for fixed effects but has a slight positive relationship after controlling for the fixed effects which suggests a higher amount spent on transit is associated with a higher number of telehealth visits. This association could be because the individuals who are using public transportation are likely living in urban areas which have greater access to high speed broad band internet compared to rural areas (Ching-Ching, 2018). Since previous research has repeatedly found that urban areas also have the more consistent access to that internet access, telehealth is not equally accessible to everyone in the population. (Lythreatis et al., 2022 ; Douthit et al., 2015).

1. **With Internet**

Internet access surprisingly shows a negative relationship to the number of telehealth visits. Although we would expect that having internet access would mean that the individual is using telehealth, the negative coefficient confirms that having access does not guarantee usage. The Census Bureau’s American Community Survey finds that 95% of U.S. households have at least one type of computer and 90% have a broadband internet subscription (Liu, 2024). Given this widespread access, internet access alone is not a strong predictor of telehealth adoption because there could be other barriers such as digital literacy, provider availability, or awareness of services that are preventing the use of telehealth even when internet access is present.

1. **Hospitals Count and Number of Physicians**

The relationship between the number of hospitals and the number of telehealth visits becomes much stronger changing from **-45.313\*\*\***to **-1,657.032\*\*\***, after considering for state and year. After controlling for fixed effect the coefficient represents a more isolated relationship between number of physicians and telehealth visits. This negative relationship could be because when there are more hospitals there is more availability of in person appointments to treat patients without telehealth. However, Ashwood (2017) found that individuals with high medical needs could benefit from telehealth because it requires less time off from work and less travel costs. Even with the presence of hospitals, routine checkups and follow ups have the potential to be done as a telehealth visit (Ashwood, 2017).

In comparison, the relationship between the number of physicians and the number of telehealth visits becomes a much stronger positive relationship changing from **2.211\*\*\*** to **93.079\*\*\*.** This positive increase could be because when there are more physicians there is more appointment availability overall, including telehealth visits.

1. **Percent Below Poverty Level**

The negative relationship between poverty level and telehealth visits suggests that as percent below poverty level increase, there are fewer telehealth visits. This lack of access could be due to the restricted availability of resources needed for telehealth visits for the population under the poverty level. The relationship is significant with no fixed effects and becomes insignificant after controlling for state and year fixed effects. This is likely because there are influential variations between states and over time, so much of the significant explanatory power is taken away by the fixed effects.

**Table 3: Variance Inflation Factors (VIF)**

|  |  |
| --- | --- |
| **Variable** | **VIF** |
| **Vehicles Owned** | 7.70 |
| **With Internet** | 6.55 |
| **Number of Physicians** | 2.09 |
| **Hospitals Count** | 1.75 |
| **Transit Spending Per Capita** | 1.69 |
| **Percent Below Poverty Level** | 1.66 |

**Table 3** includes the VIF score and the variables that are included in the fixed effect **Table 2**. A VIF below 5 suggests low multicollinearity which is better for a multivariate fixed effect model. The variables in **Table 3** are all relatively low supporting that the coefficients in the fixed effect are more accurate and reliable. A model was run that included additional variables, GDP and Unemployment Rate, but high VIFs over 10 were present. A VIF over 10 is more problematic and would suggest multicollinearity concerns. GDP and unemployment rate are not included in **Table 2** because they would decrease interpretability and capture overlapping aspects of economic status impact on telehealth visits.

**Discussion**

The findings from this study identify several key factors influencing telehealth usage for the population in the dataset which includes Medicare and Medicaid members in the United States from 2020 to 2024. As shown in ***Figure 1***, rural areas reported fewer telehealth visits than urban areas, highlighting potential barriers to access that vary based on location which could be targeted with policy interventions to increase the utilization of telehealth services and promote equitable access for both rural and urban areas.

***Figure 2*** and ***Figure 3*** shows that the number of services eligible for telehealth has remained stable but the actual number of telehealth visits has declined slightly since 2020. There is potential for an increase access to those eligible services with virtual options. Since the data used in this study is Medicare and Medicaid members, they represent a population who is likely lacking telehealth due to economic and technological barriers. The multivariable fixed effects model was conducted to provide insights into key factors that are improving or creating barriers to telehealth visits. The fixed effect can help isolate the relationships and can help improve understanding of which variables should be targeting in order to increase access.

The first relationship found in **Table 2** suggests that a higher number of vehicles owned is associated with more telehealth visits, likely due to the economic status of access to a vehicle. Further research could be done to support that vehicle ownership is representing economic status by considering other finance related variables and how it is impacting telehealth. Second, transit spending was found to have a slight positive correlation with telehealth visits. States with a higher transit spending likely have more urban area, which previous research has found that urban areas have higher economic status and more access to medical care (Douthit et al. 2015).

Third, the number of hospitals showed a strong negative relationship with the number of telehealth services used, likely because of more in person access. However, previous research has suggested that telehealth visits are often used to support in person appointments so this is an area that can be targeted for increased telehealth utilization (Ashwood et al., 2017). Fourth, the number of providers has a positive correlation to telehealth visits suggesting that when there are more providers available they are also available to provide telehealth visits. For this reason, areas with provider shortages in relation to the population are at greater risk for lacking telehealth visits. Number of providers per capita should be assessed and addressed to help prevent this disparity.

Lastly, The slight negative relationship between poverty level and telehealth visits turns insignificant after controlling for fixed effects, likely because there are variations between states and over time that are removed by the fixed effects. The negative association suggests that there is a lack of access to necessary resources for the population under the poverty level.

Overall, the results show that the use of telehealth by Medicare and Medicaid members is affected by more than just whether the services are available and there are many factors such as economic status, appointment access, and technology access that all play a role.

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**GitHub Repository**: <https://github.com/Jcoomber6/DA401>

**Revised Memo**

**Overall**

* Present tense has been used throughout the paper, specifically avoiding future tense when describing the methodology in the methods section.
* The goal of the paper has been focused on understanding factors and not prediction.
* Page numbers have been added.

**Abstract**

* The mention of Variance Inflation Factor (VIF) is removed from the abstract and saved for the methods section.

**Introduction**

* The introduction was revised to clearly introduce the relevance of the topic and provide a brief overview of the paper’s structure including key findings from the figures and tables.

**Literature Review**

* Lines written as “A study by XXX (2019)...” have been changed to “XXX (2019) finds that...” so that the subject is the paper, not the author

**Methods**

* A table has been added to display the variables included in the fixed effect model to provide a visual representation to help readers easily refer back to variables.

**Model Validation**

* The explanation of standard errors was revised to define standard errors as used to assess the statistical significance of variables, not to validate the model itself.

**Ethical Considerations**

* An Ethics section is added before the results in order to include a focused section on the data privacy, population, and potential model misinterpretation.

**Results**

* Across all figures, the y axis label was revised to say “Sum of Number of Telehealth Visits (Per Capita)” to clarify that the numbers represent the sum of all the Per Capita values of all individuals in the dataset with the specific x axis category.
* The editor suggested that I ensure it is clear that the figures and the dataset represent different populations. However, all of the figures represent the same population, only medicare and medicaid members. There are no figures that include different sized groups.
* Figure 5 representing enrollment status has been added as the reviewer mentioned there were visualizations in the HTML file that weren’t present in the first draft paper. The figure in the HTML about types of internet was not included because the variable in the fixed effect is internet access of any kind.
* A color pallet was used for the figures to make them more visually appealing and have more of a sense of coherence.
* Headings, instead of bolded words within sentences, have been used to structure the interpretation of the fixed effect model
* The interpretation of the Fixed Effect has been revised with more varied explanations and structure to keep the reader more engaged. The unemployment rate or GDP variables were excluded from the model because the coefficients for the other variables from the model without unemployment rate or GDP are similar to the model where they are included. The model without them is more valid as the VIF values are lower.
* A poverty rate variable has been added to the fixed effect because of its relevance to the Medicare and Medicaid populations in this dataset.
* The reviewer suggests that adding fixed effect visualizations could help readers understand the different effects in an interesting way. These have not been included because all states are included in the fixed effect model and could make it a challenging visual to interpret. Without these visuals, the coefficients in the fixed effects table provides meaningful results.

**Discussion**

* The discussion section has been developed to include stronger connection to the research question and a concluding statement relating the main takeaways to the objective.

**Github**

* The Github page has been organized with sub folders for each dataset as well as a separate folder for the final paper and presentation. The README file has been developed to include the outputs of the analysis and more specific bullets for each datasets.