DISCLAIMER

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Medicaid Housing Assistance Waiver
Kilpatrick | Medeiros | Politano

Pilot Program Analysis

The Medicaid housing pilot program, effective since December 2019, aims to provide housing assistance to unhoused or at-risk of being unhoused Medicaid recipients. It offers transitional housing, support services, and counseling to improve health outcomes. Eligibility requirements include being 21 years old or older and having a severe mental illness, substance use disorder, or both. The program operates in Florida Regions 5 and 7, which account for 20% of Florida's unhoused population.

Our Approach

We conducted a cost-benefit analysis to analyze the impact and effectiveness of the program. This cost-benefit analysis considered costs for emergency departments, hospitalizations, and criminal justice systems. The analysis was broken down into a Medicaid benefit scenario and an overall societal benefit scenario.

The Medicaid benefit was calculated by using difference in differences to find the change in ER visits and hospitalization stay over the span of 3 years. 78% of the cost of a visit to an emergency room, is the total cost paid by Medicaid, and the estimate we use within our analysis. The average cost of hospitalization incurred by Medicaid was found using the same method, but factoring in the average cost per day for inpatient care. The overall societal benefit was also conducted in the same manner, in addition to including cost of incarceration.
Findings

In the cost-benefit analysis conducted, we find that the Medicaid Housing Assistance Waiver Pilot Program, Medicaid has received a total benefit of $12.6 million. This benefit consists of the emergency room benefit and inpatient care benefit. We quantify the reduction in emergency room visits and days in inpatient care for treated individuals relative to untreated individuals. Using the reduction of visits, multiplying by the average cost of a visit to the the respective medical facility, and the number of participants is how we calculate the total benefit of each medical facility.

The total benefit from emergency room savings is approximately $6.7 million since the program has gone into effect. The total inpatient care benefit since the program has gone into effect is approximately $5.8 million.

The per person per month cost is $194.29. Since program effectiveness, there has been an estimated $11.5 million spent on 1533 individuals. The total net benefit is approximately $1.1 million. The net benefit does not include the intangible benefit (happiness, standard of living, etc.) these individuals experience post treatment. We explore community benefit and societal benefit in more detail in our report.

Benefit Snapshot

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Costs</th>
<th>Net Benefit*</th>
</tr>
</thead>
<tbody>
<tr>
<td>$12.6 million</td>
<td>$11.5 million</td>
<td>$1.1 million</td>
</tr>
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</table>

*Net benefit is based solely off of inpatient and ER calculations.

All results were determined as part of a student-lead project and without verification by the Agency for Health Care Administration.
Introduction

This report addresses the Medicaid Housing Assistance Waiver Pilot Program, which is a program designed to reduce homelessness in the state of Florida. Throughout this report, our literature review and analysis will demonstrate the program’s criteria and functionality, its budget and costs, and the benefits this program provides to Florida and to Medicaid.

For the past decade, the number of homeless persons in the United States has varied substantially. Between 2012 and 2016, the homeless population in the United States decreased, from 621,553 to 549,928. From 2016 to 2018, the population was mostly constant, with a variance of approximately 3,000 homeless people. However, since 2019, the numbers have shown a large increase with the latest statistics in 2022 reporting an approximate 582,462 homeless population in the US.¹ In 2022, the three states with the largest homeless population were California (171,521), New York (74,178), and Florida (25,959). Adding Washington (25,211) to this list accounts for more than 50% of the United States' total homeless population.²

The United States Department of Housing and Urban Development designated four different categories to classify the type and level of homelessness: “literally homeless”, imminent risk of homelessness, homeless under other federal statutes, and fleeing/attempting to flee domestic violence. Individuals are considered to be in one of these categories if they are experiencing situations such as trading sex for housing, living in someone’s house for a maximum stay of 14 days, and other related circumstances.³

Point-in-Time is the measurement method for counting homeless populations. The count is based on how many unsheltered homeless individuals there are in a single night, and the count occurs every other year. There is also a count of homeless sheltered individuals on a single night, accounting for people in transitional housing, safe-havens, and emergency shelters.⁴

³ Andrichik, “The 2022 Annual Homelessness…”, 2022
⁴ Andrichik, “The 2022 Annual Homelessness…”, 2022
Our research on programs within the state of Florida, find they are created to reduce homeless populations. These programs have a positive impact on government spending, community spending, hospital utilization, and crime. These areas are considered quantifiable, given the impact can be measured whether in dollar amount, change in visits to hospital services, or changes in crime rate. However, it is important to consider that there are also other impacts that cannot be precisely measured. For example, an increase in the level of happiness and well-being of the individuals enrolled in these programs. This report addresses only quantifiable measures and debates the previously mentioned research in further sections.

Florida’s homeless population has shown a continuous decrease over the past decade. Nonetheless, Florida has held the third-largest homeless population within the United States over the same timeframe. Florida's Medicaid Housing Assistance Waiver Pilot Program specifically addresses two of the four aforementioned homeless classifications: “literally homeless” and imminent risk of homelessness. The program further restricts its target population to people with severe mental illness, substance use disorder, or both. Further, it restricts to Regions 5 and 7 (Figure 1).

The analysis in this report uses a regression approach to justify a cost-benefit analysis of the Medicaid Housing Assistance Waiver Pilot Program. The analysis will account for changes in emergency room visits and inpatient care measured through length of stay (LOS). It will also account for propensity score matching. It will further explore a societal cost-benefit analysis, which is tangential to the Medicaid Housing Assistance Waiver Pilot Program.

The findings of this report account for a benefit of $1.1 million since the beginning of the program, with an additional $500 thousand quantifiable societal benefit. The report does not address subjective benefits nor the total benefit of the program since its only measures of benefit are changes in emergency room usage, inpatient care, and incarceration costs.

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5 Andrichik, “The 2022 Annual Homelessness…”, 2022
Figure 1: Region 5 (Pasco and Pinellas) and Region 7 (Brevard, Orange, Osceola, and Seminole)


Literature Review

What is Medicaid?

Medicaid is a government program that aims to provide medical coverage to persons that have a low income. Medicaid offers easier access to hospitals, physicians, laboratories, and pharmaceutical treatment options. Coverage can also extend to dental, vision, mental health, and long-term care services (depending on state government policy and regulation). The federal government sets certain guidelines and regulations. State governments then shape the program to tailor it to their specific aggregate needs. These “specific needs” can include their own eligibility criteria, benefits packages, and reimbursement rates for healthcare providers. The cost of Medicaid is shared by the federal and state governments via the Federal Medical Assistance percentage (FMAP), which is a federal government percentage match of funding. FMAP varies based on the state’s per capita income, with lower-income states receiving a higher federal matching rate.

Eligibility Requirements

One’s eligibility for Medicaid is determined based on set guidelines of criteria provided by the federal and state government. The following variables determine Medicaid eligibility:

Income: Income limits are the primary determinant of one’s Medicaid eligibility. The program considers both the individual’s income and the size of their household. States have the option to expand the Medicaid program under the Affordable Care Act (ACA) to participants up to 138% of the federal poverty level.

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**Circumstance:** There are circumstance eligibility criteria for recipients. Examples of circumstances are being a child, pregnant, elderly, or having a disability. A child’s eligibility for Medicaid is determined by their household’s total annual income and the child’s age. Pregnant women are also eligible for Medicaid during their pregnancy as well as post-partum, given that they demonstrate a limited income; however, it is important to note that their income limits are generally higher than the average applicant’s. This same clause applies to those who fall under the disabled and elderly category, as defined under the Social Security Administration. This higher income limit is to consider the financial burden individuals may face due to their disability or age. The elderly circumstance involves those typically aged 65 and above, including additional criteria such as citizenship, medical necessity, and long-term care needs.⁹

**Pilot Overview**

The Medicaid Housing Assistance Waiver Pilot program was debated from 2016 until its approval in April 2019, and went into effect on December 1st of the same year. The program is set to continue until 2025. The purpose of the pilot program is to provide housing assistance for Medicaid users that are suffering from homelessness or are at risk of being homeless, along with having a substance abuse disorder (SUD), severe mental illness (SMI), or both. The primary goals of the program are housing stability and improvement of health outcomes amongst participants.¹⁰ The program achieves these goals through the following primary services:

- **Transitional Housing Services:**
  - Domicile search assistance
  - Rent resources
- **Tenancy Sustaining Services:**
  - Landlord conflict mediation and resolution
- **Mobile Crisis Management:**
  - Crisis de-escalation services

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• Self-help and Peer Support:
  o Counseling and community living skills
• Incidental Coverage
  o One-time payment(s) towards deposits, utilities, etc.

The targeted areas of the program are Regions 5 and 7, which include the following counties: Pasco, Pinellas, Brevard, Osceola, Orange, and Seminole. These two regions account for 20% of Florida’s total unhoused population. To mitigate this situation, the program offers 4,000 slots annually, with an even distribution amongst the selected counties (Figure 2).

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**Figure 2: Participating Regions and Respective Counties**

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**Pilot Program Eligibility**

To be eligible for the Medicaid Housing Assistance Waiver pilot program, a recipient must be enrolled in Medicaid, 21 years of age or older, homeless or at risk of homeless with a serious mental illness (SMI) and/or a substance use disorder (SUD). A severe mental illness is defined as a general descriptor for one or a combination of multiple diagnostic categories. A substance use disorder is defined as a general descriptor for the recurrent use of alcohol and/or drugs that causes clinically significant impairment. The definition of being at risk of being unhoused is an individual with a maximum income of 30% of the median income, with not enough means to support oneself, and with other criteria such as living in someone else’s household, as defined by (24 CFR § 578.3). Given the level of difficulty to establish whether an individual is at risk of being unhoused, the assumption of this analysis is that every participant is already unhoused.\(^\text{12}\)

**Costs**

Beginning in December 2019, the Medicaid Housing Pilot program is set to run until 2025. Upon the program’s approval, Congress appropriated an annual budget of $10 million. This section outlines the program’s total cost, including monthly expenses per person, in addition to administrative costs. Based on the $10 million budget, the program's total cost can be estimated by multiplying the annual budget by the number of years of operation. Applying this estimated budget to the 6-year timeframe results in a projected total cost of $60 million. The timeframe for this report is 2019 to 2022. Hence, the total appropriated budget addressed in this report is $40 million compared to the estimated $60 million total budget.

The pilot program pays $194.29 per person per month, with a quarterly payment frequency to insurance plans participating in the program.\(^\text{13}\) This monthly cost includes all the services provided to the individuals enrolled in the program. Assuming the program operates at its full capacity of serving 4,000 people annually, the annual per capita cost can be calculated by multiplying the monthly cost by 12, resulting in an annual per capita cost of $2,331.48.

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\(^{13}\) AHCA. Statewide Medicaid Managed Care Housing Assistance Pilot Plan, 2019. https://ahca.myflorida.com/content/download/5992/file/Housing_Application-Commitment.pdf.
Multiplying this amount by the maximum number of individuals that can be served annually presents a maximum total annual cost of $9,325,920.

In addition to the expenses associated with enrollees, the pilot program incurs administrative costs related to participant and program upkeep, which may include case management and legal costs. Although specific figures regarding these costs are not provided, it is essential to account for them to obtain a comprehensive understanding of the program's financial implications. It is assumed that the total cost of these administrative services would be the difference between the allocated budget and the total cost of enrollees, resulting in $674,080, or an annual fee of $168.52 per enrollee.

Although the appropriated budget for the program is $10 million annually, the actual cost of the program depends on the number of individuals enrolled. For the purposes of this report, the number of enrollees assessed is 1533 people, due to the program not operating at its capacity. Therefore, the actual cost of the program is calculated based on 3 fiscal years [(2019-2020), (2020-2021) and (2021-2022)]. The cost equation is as follows:

\[
(\text{Per capita annual costs} \times \text{number of enrollees} \times \text{fiscal years}) + (\text{annual fee} \times \text{number of enrollees} \times \text{fiscal years}) = \text{cost}
\]

The cost calculation is as follows:

\[
(2,331.48 \times 1533 \times 3) + (168.52 \times 1533 \times 3) = 10,722,476.52 + 775,023.48 = $11,497,500.00
\]

**Current Housing Programs**

Section 8 is a government housing project initiative to address affordable housing. The Section 8 program is designed to assist low-income individuals and families in affording housing through rental subsidies and related aid initiatives. The program is federally funded and administered by the U.S. Department of Housing and Urban Development (HUD). The program operates through the issuance of Housing Choice Vouchers (HCV), informally known as Section 8 vouchers.

To qualify for the Section 8 program, applicants must meet certain eligibility criteria. Some of these qualification criteria include factors such as income limits, citizenship status, or
eligible immigrant status. For Florida in particular, there is a maximum income limit of 50% of the local median income. The amount of assistance provided varies depending on factors such as income, family size, and local housing costs. Primarily, participants are responsible for finding suitable housing within the private rental market that meets program requirements. These housing facilities must meet health and safety standards. In addition, they are also expected to adhere to program rules and regulations, including recipients paying their portion of rent on time and maintaining compliance with lease agreements.

The pilot program is designed for people with SMI and/or SUD, regardless of their involvement or incarceration for drug-related offenses. In contrast, Section 8 can deny people looking to participate based on convictions that are substance-related and usually has a waitlist. The pilot program currently has assistance allocations and would be able to assist its target demographics in a more efficient manner.14

**Previous Studies**

**Central Florida Study**

The Creative Housing Solutions for the Central Florida Commission on Homelessness conducted a study on the costs associated with chronic homelessness in society. There were 107 chronically homeless participants in the study, all from central Florida. The study utilized various expenses relating to these individuals, such as incarceration costs, medical treatment, and emergency room (ER) intakes.

Central Florida accounted for a population of about 1,577 chronically homeless individuals across three counties in 2014. These individuals' costs on publicly available systems of care sum to an estimated annual expenditure of nearly $50 million. The study found that Florida residents pay an average of $31,065 per chronically homeless person in public expenses annually. The study emphasized that most chronically homeless individuals have physical or mental disabilities, making them require more support services.

The study proposes a cost-effective alternative for managing these expenses, such as providing permanent housing and supportive services to homeless individuals. This approach

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would cost taxpayers $10,051 per person. Services included in this approach are job training and healthcare. The cost of the approach is 68% less than the public expenditure at the time of this study. This alternative could result in Central Florida saving about $350 million from 2014 to 2024.

The findings align with previous research demonstrating the cost of not addressing chronic homelessness. Examples from other regions, such as Charlotte, NC, and southeast Colorado, show that providing housing for homeless individuals leads to significant cost savings for taxpayers. In Osceola County, Florida, researchers discovered that taxpayers spent over $5 million in incarceration expenses over a decade to repeatedly jail 37 chronically homeless individuals.15

**Jacksonville Study**

A 2018 study out of Jacksonville Florida, conducted by the Ability Housing group, assessed the efficacy of providing permanent supportive housing to unhoused individuals and high utilizers of crisis services. The study observed a single group before and after permanent supportive housing. It examined two time periods, two years pre-housing and two years post-housing. The geographic location of this study was the counties of Duval, Miami-Dade, and Pinellas. Each of these counties allocated a select amount of funding from the Florida Housing Finance Corporation to construct a permanent supportive housing community. After construction, a subsequent analysis of the utilization of public systems of care before and after the implementation of the community was conducted.

All pilot program participants were unhoused individuals or had factors contributing to chronic housing instability, including high use of emergency rooms, hospitals, shelters, jails and prisons, and psychiatric facilities. This study included aspects related to quality of life, mental health, and wellness for participants to determine relationship changes in housing stability. The demographics of the treatment group reflected the general demographics of a Floridian homeless population, with a majority of the sample being 30 to 64 years of age, African American, and Male. Of all the initial participants, a 90% housing stability rate was achieved over the course of a 2-year period. Participants saw an average increase in income of approximately 66% after

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moving into housing, with a 56% increase in health insurance participation. Criminal Justice departments saw an average 72% decrease in incarceration and holding costs, as well as an average 65% reduction in arrest and booking costs. Total savings from these departments came to an estimated $137,792. Healthcare systems reported an average 59% reduction in inpatient costs, a 43% reduction in emergency department costs, and an overall 58% reduction in hospitalization costs. Total savings from these aspects summed to approximately $3,717,384.16

Miami-Dade Study

Being home to nearly 2.7 million individuals, Miami-Dade County is one of the most densely populated counties in Florida. With this dense population comes a large income disparity, with nearly 18% living at or below the poverty line. This portion of the community exhausts publicly available systems of care exponentially more than their counterparts, with over 70% of their unhoused population living with a chronic mental illness, substance abuse problem, or both. This creates a demand for higher use of law enforcement, hospitals, etc. A pilot study in 2014, done by the Carrfour group in Miami-Dade County, analyzed the costs and benefits of housing for the high-user population of these public systems of care that were chronically unhoused. Funded by the Florida Housing Finance Corporation, a permanent supportive housing community was constructed to assess the costs and benefits.

The study observed a single group before and after permanent supportive housing. Of all the initial participants, an approximate 78% housing stability rate was achieved over the course of the study period. Due to the county’s large Hispanic population, the demographics of the study group were atypical of a traditional unhoused population. Participants were 79.5% male and 59.1% Hispanic. The average age of the participants was approximately 52. In terms of health, the study found a 65.1% reduction in costs for physically related afflictions and a 67% reduction in costs associated with mental health issues. In addition, shelter costs were reduced by approximately 20.7%. Overall, the study suggested a $27,292 per-capita annual savings with a minimum $927,925 annual savings for the community, given permanent supportive housing was to be constructed within the Miami-Dade geographic area.17

**Demographics**

Demographic data was analyzed between the reference group and the pilot participants, focusing on four racial/ethnic categories: White, Not Determined/Other, African American, and Hispanic. The Not Determined/Other category includes Asian, American Indian, Alaskan Native, Native Hawaiian, other Pacific Islander, and unidentified racial categories. The analysis includes information on gender distribution, average age, and a percentage breakdown within each category, providing insights into the demographic composition as well as any differences between the general population and the pilot enrollees.

Our reference group contains 3479 unique homeless individuals, with the majority not having data in every year from 2017-2022. There are 384 unique individuals that have data for every year within the reference group. For the purposes of our analysis, we will proceed with the original 3479 unique individuals.

**County Distribution**

The reference group was distributed amongst counties as follows: 394 in Brevard (11%), 1013 in Orange (29%), 202 in Osceola (6%), 355 in Pasco (10%), 1326 in Pinellas (38%), 208 in Seminole (6%), and in an unlisted county (0%).

The treatment group was distributed amongst counties as follows: 187 in Brevard (12%), 428 in Orange (28%), 86 in Osceola (6%), 97 in Pasco (6%), 464 in Pinellas (30%), 123 in Seminole (8%), and 148 in an unlisted county (10%). See Table 1 for a graphic representation of these findings.
Racial Distribution

The reference group consists of 40% White (1,387), 35% Not Determined/Other (1,235), 18% African American (639), and 6% Hispanic (218) individuals. There were 609 white, 299 African American, 109 Hispanic, and 368 Not Determined/Other females. There are 778 white, 340 African American, 109 Hispanic, and 867 Not Determined/Other males.

The pilot group consists of 36.5% Not Determined/Other (581), 29.2% White (448), 23.15%, African American (355), and 9% Hispanic (137). There are 272 White, 246 African American, 102 Hispanic, and 262 Not determined/Other females. There are 176 White, 109 African American, 35 Hispanic, and 328 Not determined/Other males. This distribution is shown in Table 2.

Gender Distribution

Females comprise 40% of the reference group, with males comprising the remaining 60%. Females comprise 58% of the pilot group, with males comprising the remaining 42%. This comparison is graphically shown in Table 3.

Table 1: Distribution of Participants by County

<table>
<thead>
<tr>
<th>County</th>
<th>Reference</th>
<th>Treatment</th>
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<tbody>
<tr>
<td>Brevard</td>
<td>11%</td>
<td>12%</td>
</tr>
<tr>
<td>Orange</td>
<td>29%</td>
<td>28%</td>
</tr>
<tr>
<td>Osceola</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>Pasco</td>
<td>10%</td>
<td>6%</td>
</tr>
<tr>
<td>Pinellas</td>
<td>38%</td>
<td>30%</td>
</tr>
<tr>
<td>Seminole</td>
<td>6%</td>
<td>8%</td>
</tr>
<tr>
<td>Unknown</td>
<td>0%</td>
<td>0%</td>
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Table 2: Comparison of Gender Distribution by Race

Table 3: Comparison of Gender Distribution by Pilot Group
Table 2: Distribution of Participants by Race/Ethnicity

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
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<th>Treatment</th>
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<tbody>
<tr>
<td>Black/African American</td>
<td>18%</td>
<td>23%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>6%</td>
<td>9%</td>
</tr>
<tr>
<td>White</td>
<td>40%</td>
<td>29%</td>
</tr>
<tr>
<td>Not determined/Other</td>
<td>35%</td>
<td>38%</td>
</tr>
</tbody>
</table>

Table 3: Distribution of Sex by Group

<table>
<thead>
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<th>Treatment</th>
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<tbody>
<tr>
<td>Male</td>
<td>60%</td>
<td>42%</td>
</tr>
<tr>
<td>Female</td>
<td>58%</td>
<td>40%</td>
</tr>
</tbody>
</table>
**Age Distribution**

The reference group's overall average age is 43 years, with the female average age being 39 years old and the male average age being 46 years old. The treatment group's overall average age is 47 years, with the female average age being 44 years old and the male average age being 51 years old.

**Overview**

Variations were observed in the distribution of these groups, both in terms of overall percentages, gender distribution, and average age. The pilot sample shows higher proportions of African Americans and Hispanics compared to the reference group, the pilot also shows that the not determined/other population is higher compared to the reference group, in which the white population is the higher percentage. We explore a propensity-matching analysis to address these differences between groups.
Methodology

Data Received

We received a comprehensive data file from the Florida Agency of Healthcare Administration. Within this datafile, it contained eight tabs named: Pilot Raw Data, Pilot Raw Data Codebook, Reference Group Raw Data, Reference Group Raw Data Codebook, Simplified Pilot Data, Simplified Pilot Codebook, Simplified Reference Data, and Simplified Reference Codebook. The simplified data tabs information is linked to the raw data information. For our primary analyses, we used simplified data tabs for our pilot and reference groups.

Within the Simplified Pilot Data tab, the variables we primarily used are RandomID, age, sex, race, county name, recipient region, date enrolled, total ER visits before enrollment, total ER visits after enrollment, maximum length of stay (LOS) before enrollment, and maximum LOS after enrollment. We used the variables year, RandomID, age, race, sex, county name, district, number of ER visits, and maximum length of stay for the simplified reference data file. Within the simplified reference dataset, the tab had yearly observations for a person's number of ER visits and maximum LOS, whereas the treatment group dataset only had before-enrollment and after-enrollment observations. Assumptions regarding this dataset are located in Appendix A. All data cleaning and manipulation was done using Microsoft Excel. Cleaning procedures include removing observations where LOS and ER visits exceed 1000, as this is highly unlikely to occur.

Medicaid Spending

To measure the effectiveness of the Medicaid Housing Assistance Waiver Pilot Program, we will be conducting a cost-benefit analysis using two scenarios. The primary objective is to determine if Medicaid’s savings outweigh the $11.5 million total cost of the pilot program. To measure this, we will be examining the change in emergency room visits and the change in days in inpatient care for the treatment group. These changes will be used to estimate a treatment effect.

The treatment group is defined as individuals on Medicaid who are homeless, at risk of being homeless, that suffer from a severe mental illness (SMI) and/or a substance use disorder.
(SUD) that are enrolled in the Medicaid Housing Assistance Waiver Pilot Program. Enrollees must meet all the requirements mentioned in the program eligibility section of this report.

The reference group is defined as those who are homeless or at risk of being homeless. In addition, the reference group must also meet the following criteria:

- Reside in Regions 5 or 7 in the State of Florida.
- Fit in at least one of the following Z-codes: Z59.0, Z59.811, Z76.4, Z59.00, Z59.01, Z59.02, Z59.812.
- Are present in the data between the years 2017 and 2022.

A Z-code is defined as a diagnostic code for observation selection.\(^\text{18}\)

There are 3,712 unique individuals within the reference group. These individuals are not present in all 6 years (2017-2022), but rather present in the 6-year timeframe at least once. Within the reference group, observations were removed from the group if the individual did not have a year associated with their observation, and if their length of stay exceeded 100,000 days. Thus, our reference group was reduced to 3,479 unique individuals.

To further examine the reduction in visits and days in inpatient care, our analysis uses a difference-in-differences approach (see assumptions in Appendix A).\(^\text{19}\) This will allow us to identify the effect of the program and isolate it from the effect over time. We will also be able to observe how beneficial it is for Medicaid to provide housing assistance to these individuals and quantify the annual reduction in visits and length of stay for medical facilities. Adjusting for cost of living, and consumer price index (see Appendix C) we can calculate the annual savings since program uptake, then multiply it by the difference-in-differences estimator and the number of enrollees in the program.

We predict two variables of interest, the number of emergency room visits and the number of days in inpatient care. Therefore, conducting a negative binomial regression would be appropriate to account for the high amount of variation and low average within the dataset.

Additional justification for the use of this model is the dispersion and nature of the data; many


values within the data lying close to 0, thus creating a right skew, making a count data model more appropriate than other modeling techniques.

**Emergency Room**

The conceptual linear regression model below predicts the number of emergency room visits a participant has on an annual basis:

\[
ERvisits = treatyear + treatgroup + treatyear\*treatgroup + age + race + sex
\]

Where variables are defined as:

- \(ERvisits\): The number of emergency room visits
- \(treatyear\): Equals 1 if the year is 2020, 2021, or 2022
- \(treatgroup\): Equals 1 if the is enrolled in the Medicaid Housing Assistance Waiver Pilot Program
- \(treatyear\*treatgroup\): Equals 1 if the individual is in the treatment group and is in the year 2020, 2021, or 2022
- \(age\): Age in years
- \(race\): Categorical variable for race/ethnicity
- \(sex\): Sex/gender

The primary variable of interest in this analysis is the \(treatyear\*treatgroup\) variable. The coefficient on this variable is the difference in differences estimate. This is interpreted as the reduction in the number of visits an enrollee in the program is expected to have annually as a result of being enrolled in the program.

To find the total emergency room benefit, we use the difference-in-differences estimate and multiply it by the number of years, the number of enrollees in the program, and by the average cost of a visit to the emergency room. The conceptual equation for ER benefit is below:

\[
BenefitER = \text{NumofYears} \times \text{Enrollees} \times \text{Ercostofvisit} \times \text{DIDEstimateER} \times 0.78\%
\]
Since the data provided did not contain spending figures, we used prior literature to determine the average amount of ER spending that a homeless person incurs per visit (see Appendix C). Based on the Center on Budget and Policy Priorities, adults on Medicaid cost about 22% less than if they were covered by private insurance.\textsuperscript{20} We would need to multiply the equation by 78% to account for this. The equation to find the adjusted average cost per ER visit to Medicaid is as follows.

\[ \text{Avg Medicaid ER visit cost} = \text{Average ER visit cost} \times 78\% \]

**Inpatient Care**

To predict the length of stay, we use a similar specification as above, but replace the number of ER visits with the length of stay (LOS), where LOS is the length of stay of the observation.

\[ \text{LOS} = \text{treatyear} + \text{treatgroup} + \text{treatyear} \times \text{treatgroup} + \text{age} + \text{race} + \text{sex} \]

The coefficient that explains the benefit of the program is on the variable \text{treatyear} \times \text{treatgroup}. This coefficient is isolated from the time effect, directly explaining the causal relationship of the program with the length of stay.

To find the observed benefit from inpatient care, we use the same equation as the ER benefit calculation but use the DID estimate for LOS.

\[ \text{BenefitLOS} = \text{NumofYears} \times \text{Enrollees} \times \text{Ercostofvisit} \times \text{DIDEstimateLOS} \times 0.78\% \]

With both benefits for ER and inpatient care calculated, we sum them up to find a quantified benefit of the program (based solely on ER and inpatient care). The equation for the quantified benefit is below.

BenefitER + BenefitLOS = Quantified_Benefit

The total benefit is forgone spending that Medicaid did not have to pay as a result of the program going into effect. We subtract the total costs of the program to observe the net benefit of the program. The equation for this calculation is below.

QuantifiedBenefit - TotalCosts = NetBenefit

The dependent variable is defined as the net benefit to Medicaid, considering only the emergency room and inpatient care savings. As the equation shows, this net benefit is the savings Medicaid receives, less the costs of the program. We expand on this net benefit more in our societal benefit section. Appendix D addresses endogeneity.
**Findings**

The goal of this analysis is to find if Medicaid has received a return on its investment from the program. We will be using emergency room and inpatient care benefits as measures to quantify this. “Before” is defined as the year 2017 until December 2019. “After” is defined as January 2020 until December of 2022. This is a cost-benefit analysis, with costs equaling the cost of the program, and the benefit being the savings in visits to the emergency room and inpatient care.

The data provided showed 1,533 people enrolled in the program since December 2019. We recognize individuals are enrolled on a rolling basis, and 666 of the 1,533 enrollees were enrolled in 2019 or 2020. We use all 1,533 participants and assume that they have all been enrolled in the program since December 2019, providing them with three years of treatment (2020, 2021, and 2022) and 3 years of pre-treatment (2017, 2018, and 2019).

**Emergency Room Benefit**

To predict the difference-in-differences (DID) estimator for emergency room visits, we ran a negative binomial regression and formulated our numerical results. The average cost per ER visit was found using figures obtained from the literature (see Appendix C).

We estimated the negative binomial regression to predict the expected number of visits to the ER an individual may have as follows:

\[
Num_{er} = -0.27(treatment\_year) + -0.485(treatmentgroup) + -0.778(DID) + covaritates
\]

The covariates within this regression are included within our methodology, and their respective coefficients are within Appendix E. The coefficient of interest is on the DID variable. The DID variable is equal to 1 if someone is in the treatment group and the year is 2020, 2021, or 2022. The interpretation of the coefficient is the reduction in the annual number of visits that are caused by participation in the program. The coefficient on the DID variable is the reduction of visits annually. An example of this impact is that per 100 people, we expect the program to directly reduce the number of visits that group holds by 77 total visits annually.
Based on the reduced number of visits, we can calculate the total ER savings by multiplying the DID coefficient by the number of participants, the average cost to Medicaid from a visit to the ER and multiplying by three years to adjust for the three years that the program has been in effect.

Through our research, we found that on average, a visit to the ER is approximately $2,407 (see Appendix C). We multiply this average ER cost by 78%. The equation for the average cost to Medicaid for a visit to the emergency room is below.

\[ 2,407 \times 0.78 = 1,878 \]

We find the total cost to Medicaid for a visit to the emergency room to be approximately $1,878. Now that the visits caused by the program, the average cost to Medicaid for a visit to the emergency room, the number of participants, and the number of years the program has been in effect have all been obtained, we can calculate the emergency room benefit. We multiply these variables together to find the total savings Medicaid has received since the program has gone into effect. The equation for this benefit is below.

\[ 0.778 \times 1,533 \times 1,878 \times 3 = 6,719,525 \]

We find the total benefit of emergency room visits to be approximately $6.7 million. This benefit is from the conception of the program and is not an annual benefit. To find the annual benefit we would divide the $6.7 million by three, as shown below.

\[ 0.778 \times 1,533 \times 1,878 = 2,239,841 \]

The $2,239,841 is the annual total benefit for emergency room visits.

**Inpatient Care Benefit**

To predict the difference-in-differences estimator for days in inpatient care, we used the previous methodology and ran a negative binomial regression. The cost per day in inpatient care
was found by averaging figures obtained from the literature (see Appendix C). The negative binomial regression output is as follows:

\[ \text{Num}_er = -0.17(treatment\_year) -0.29(treatment\_group) -0.876(DID) + \text{covaritates} \]

Like the previous regression, the variable definitions are included within our methodology and the output is within Appendix D. The interpretation of the DID estimator is the reduction in the annual number of days in inpatient care that are directly caused by the program (see Appendix D). This reduction of days in inpatient care will be used when calculating the measured benefit Medicaid receives. The interpretation of this variable is the number of days per year that a homeless person in the treatment group did not partake as a direct result of the program going into effect. An example of the impact of this estimate is that per 100 people, we expect the program to reduce the length of stay that group has by 87 total days annually.

Since these are annual days spent that never occurred (per person), we can calculate the total savings since the program has gone into effect by multiplying the DID estimate by the number of participants, the average cost to Medicaid for a day in inpatient care, and by three years to adjust for the three years that the program has been in effect.

We found that, on average, a day in inpatient care is approximately $1870.57 (see Appendix C). To adjust this figure to be the average cost to Medicaid for a day in inpatient care, we multiply this average cost per day by 78%. The equation for the average cost to Medicaid for a day in inpatient care is below.

\[ $1,870.57 \times 0.78 = $1,459 \]

We find the total cost to Medicaid for a day in inpatient care is $1,459. We can calculate the inpatient care benefit by multiplying the change in days caused by the program, the average cost to Medicaid for a day in inpatient care, the number of participants, and the number of years the program has been in effect to find the total savings for inpatient care Medicaid has received since the program has gone into effect. The equation for this benefit is below.

\[ 0.876 \times 1,533 \times $1,459 \times 3 = $5,877,908 \]
We find the total benefit of inpatient care to be approximately $5.8 million. This benefit is since the program has gone into effect and is not an annual benefit. To find the annual benefit we divide the figure by three.

\[0.876 \times 1,533 \times \$1,459 = \$1,959,302\]

The $1,959,302 is the annual total benefit for days in inpatient care. However, our primary focus will be on the $5.8 million benefit since program effectiveness. This will allow us to calculate overall savings, thus providing the building blocks for overall program benefit calculation.

**Net Benefit**

To observe efficacy, we compared the total Medicaid savings to the total Medicaid spending on the program. To calculate the total quantified benefit of the pilot program that Medicaid receives, we add the emergency room benefit to the inpatient care benefit.

\[\$5,877,908 + \$6,719,525 = \$12,597,433\]

Table 5 visualizes how many millions of dollars were saved by each facility.
As mentioned in the cost section, we found a total cost of $11,497,500 for the pilot program. To find the net benefit of the program, we subtract the total costs from the amount of money saved.

$$\$12,597,433 - \$11,497,500 = \$1,099,933$$

We find the net benefit of the program to be $1,099,933 (approximately $1.1 million). This net benefit only considers the savings from ER visits and inpatient care. A graphical comparison of the quantified benefit, the cost, and the net benefit is within Table 6.

Table 6: Cost and Benefits
Propensity Score Matching

When estimating the impact of a policy, program, or any other type of intervention, one of the most effective ways is to compare a control group and a treatment group using a propensity score matching (PSM) approach. This comparison captures the impact of said intervention by measuring the dependent variable before and after the implementation of the intervention. There is some difficulty in estimating a precise impact, as there is a possibility of very high variance among the two groups.

PSM use is fundamental for the creation of a more comparable control group. It works as a facilitator for amending the current control group to present characteristics that are similar and within the same range as the treatment group. This data manipulation allows for a restriction of the data sample that reflects the impact of the intervention while accounting for the differences of a randomized group.21

The treatment and control groups of the pilot program, although comparable, still had differences regarding the demographic composition of each group. Therefore, the use of propensity score matching enhanced the comparability of these groups. Running the linear regression model to generate propensity scores established a range of p-scores in the treatment group between 0.0792496 and 0.7911895. This range was used to match the control group by dropping any observation with a p-score lower than the 1% level of the treatment group’s p-scores. The cutoff P-score is approximately 0.2. Table 7 displays P-scores for treatment and control.

<table>
<thead>
<tr>
<th>P- scores</th>
<th>Treatment</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>0.0792496</td>
<td>-0.2452984</td>
</tr>
<tr>
<td>Max</td>
<td>0.7911895</td>
<td>0.7911895</td>
</tr>
</tbody>
</table>

Table 7: P-Scores by Group

The line charge in Table 8 displays the propensity scores for the treatment and reference group. We visually show the dropping of all observations in the blue area. The dashed line represents the “new minimum value” for the P-scores in both the reference and treatment group. Any value below the new minimum value is dropped.

Within Table 9, we can visually see how propensity score matching impacted the closeness of the demographics between the treatment and the reference group. The propensity matched column is the propensity matched reference group, whereas the treatment group is the non-adjusted treatment group’s average age. We can see that the propensity score matching is successful in adjusting the average ages between genders to make them more comparable across groups.
After the propensity score matching, a negative binomial regression with the same specification as previously mentioned resulted in the following estimated numbers:

**Emergency Room (ER) visits:** decreased to 0.7572325 yearly (see Appendix B, Table A)

**Length of Stay (LOS):** decreased to 0.8507539 yearly (see Appendix B, Table B)

Using these estimates to find the total savings in ER and LOS, and multiplying by 3 since these are yearly impacts and the report is estimating the 3 years of the program, resulting in:

\[
\text{ER: } -0.7572325 \times 3 \times 1533 \times 1878 = 6,540,158.03 \\
\text{LOS: } -0.8507539 \times 3 \times 1533 \times 1459 = 5,708,508.47 \\
\text{Total: } 12,248,666.50
\]

Hence, the net benefit would be the difference between the total benefit (ER and LOS) and the cost of the program:

\[
12,094,437.36 - 11,497,500.00 = 751,166.50
\]
Medicaid Shared Costs

Medicaid is a program that receives funding both from the federal and state governments. The Center on Budget and Policy Priorities states that federal and state government(s) distribute the cost of Medicaid based on 60% federal and 40% state budgeting distribution. For 2021, the Keiser Family Foundation (KFF) reports Medicaid spending is 69% on the federal budget, and 31% on the state budget. Given this is the most recent information on the topic, this report will use this proportion to adjust for the State of Florida’s cost of Medicaid spending regarding ER visits and inpatient care, within the context of the pilot program.

This report calculates the benefit as approximately $1.1 million accounting for ER and inpatient care. Adjusting for the share in spending, Florida would benefit from $340 thousand in savings on Medicaid spending.

When applying the same proportions to the propensity score measurement of benefit, we find that Florida’s savings is $233 thousand.

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Societal Benefit

We conducted an alternative scenario to assess the overall benefit of the program in a communal context. To analyze the program further, it would be necessary to understand the impact of $11.5 million on the community, particularly on hospitals and incarceration facilities. Instead of focusing solely on the benefit received by Medicaid, we will examine the societal benefit. Societal benefits will be determined by calculating the combined benefits from the emergency room, inpatient care, and incarceration. The inclusion of incarceration in this scenario is based on previous literature establishing a link between homelessness and crime, which our analysis explores through a related calculation.\textsuperscript{14} The only difference between this calculation and our previous analyses is the inclusion of incarceration as a factor in potential program benefits. We are assuming that the reference group has an incarceration rate that is unchanged over time. We assume the treatment group is committing less crime because they most likely have easier access to a home (see Appendix A).

In the incarceration benefit calculation, we utilize the incarceration rate of homeless individuals and the incarceration rate of housed individuals.\textsuperscript{24} We assume that individuals who are in the pilot program will see a decrease in incarceration rates once they are housed. The National Homelessness Law Center finds that individuals who are homeless have an incarceration rate of 0.08745.\textsuperscript{25} To calculate the incarceration benefit, we use the homeless incarceration rate, the housed incarceration rate, the number of people in the pilot program, the average cost of booking per person, and the average days in an incarceration facility per person. Using the homeless incarceration rate and multiply it by the number of people, average booking cost, and average days in incarceration. Subtract this from the low-income version of the above calculation.

Unhoused
(38.4 x 111.49 x 134) = $573,682.94
(134 x 125.14) = $15,768.76
$573,682.94 + $15,768.76 = $590,451.70

Housed
(38.4 x 111.49 x 12) = $52,716.68
(12 x 125.14) = $1,527.70
$52,716.68 + $1,527.70 = $54,238.38
Net benefit = Unhoused - Housed = $536,213.32
Conclusion

The analysis of the Medicaid Housing Assistance Waiver Pilot Program has provided insight into the program’s cost-effectiveness and return on investment for the Medicaid program on the aggregate level. By considering the costs of specific public systems of care, such as emergency rooms and inpatient care services, we are able to quantify the program's impact and estimate its benefit within Medicaid.

Considering the program’s cost, which is calculated to be $3,832,500 annually, the total program cost amounts to $11,497,500 between 2019 and 2022. Subtracting the calculated benefit from the total cost, we determine a measured benefit of $1.1 million.

Besides Medicaid benefits, societal benefit was measured by taking into consideration the impact of unhoused persons on the public systems of care, and incarceration. A net benefit of $536,213.32 was found when comparing the costs associated with the incarceration of unhoused to housed persons, as well as those living at or below the poverty level.

The benefits adjusted directly to Florida’s spending are approximately $900 thousand, taking into consideration the shared costs of Medicaid, and adding the incarceration benefit to the savings related to ER visits and inpatient care.

The analysis demonstrates that the Medicaid Housing Assistance Waiver Pilot Program generates a benefit not only related to Medicaid spending but community spending as well. The program has not only resulted in cost savings by reducing emergency room visits and inpatient care amongst its target group but has also improved healthcare outcomes for them as well. In addition, the enhanced overall well-being of individuals enrolled in the program is a strong non-quantifiable benefit. These findings imply worthwhile investment in the program's continuation and expansion to further benefit Medicaid and reduce the costs of the program's target demographics on public systems of care.
Appendix A

Select assumptions were made in our analysis to control for some risks to the project that may cause inaccuracy, inconsistency, or incompleteness of conclusions drawn from it. In no particular order, these assumptions are listed below:

- The reference group used was comparable to the treatment group used. This is assumed as a measure to ensure the accuracy of the difference-in-difference portion of the analysis.
- Differences between reference and treatment group demographics are insignificant. This is assumed as a measure against variance within our results.
- The difference between reference and treatment group participants’ mental illness and substance abuse disorder rates are insignificant. This is assumed as a measure against variance within our results.
- The difference between reference and treatment groups’ spending is insignificant. This assumption is relaxed in our sensitivity analysis.
- Spending figures derived from previously conducted research are applicable and comparable to current participant numbers. This certifies the legitimacy of our averaging methods to derive ER and hospitalization values.
- All participants in the reference and treatment group want to improve their personal quality of life. This assumption is to control for endogeneity.
- Participants that are at risk of being unhoused are indistinguishable from participants that are currently unhoused in terms of cost. This ensures continuity between the reference group and treatment group participants’ fiscal impact(s).
- The difference-in-differences method adequately controls the impact of COVID-19 on data. This is assumed to mitigate the shock that the COVID-19 pandemic had on analysis outcomes.
- The maximum length of stay for each year is equivalent to the total number of days spent in inpatient care annually for participants.
• A Medicaid recipient costs 78% of what a privately insured recipient would cost to a healthcare institution. This was assumed to adjust non-Medicaid spending values to Medicaid spending values for the Medicaid analysis portion.

• All fiscal values are accurately adjusted to the geographic areas in which the analysis occurs.

• We treat all members of both groups as though they were present in all 6 years of the program’s activity. This was done to ensure continuity and comparability for the difference-in-difference analysis.

• We assume that the reference group has an incarceration rate that is unchanged over time. This is to ensure continuity and lessen variance in calculation results.

• We assume the treatment group is committing less crime because they most likely have easier access to a home. This was assumed due to its reflection in the referenced literature.
### Appendix B

**Table A**

Fitting full model:

<table>
<thead>
<tr>
<th>Iteration</th>
<th>log likelihood</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-49095.328</td>
</tr>
<tr>
<td>1</td>
<td>-48769.751</td>
</tr>
<tr>
<td>2</td>
<td>-48748.573</td>
</tr>
<tr>
<td>3</td>
<td>-48748.532</td>
</tr>
<tr>
<td>4</td>
<td>-48748.532</td>
</tr>
</tbody>
</table>

Negative binomial regression

<table>
<thead>
<tr>
<th>Dispersion</th>
<th>Number of obs</th>
<th>LR chi2(11)</th>
<th>Prob &gt; chi2</th>
<th>Pseudo R2</th>
</tr>
</thead>
<tbody>
<tr>
<td>mean</td>
<td>19,363</td>
<td>4321.00</td>
<td>0.0000</td>
<td>0.0424</td>
</tr>
</tbody>
</table>

Log likelihood = -48748.532

| num_cr    | Coef.     | Std. Err. | z    | P>|z|  | [95% Conf. Interval] |
|-----------|-----------|-----------|------|------|----------------------|
| 1.treatment_year | -.296    | .021198   | -13.96 | 0.000 | -.3375473 to -.2544527 |
| 1.treatmentgroup | -.5102342 | .0218932 | -23.31 | 0.000 | -.5531441 to -.4673243 |
| 1.did     | -.7572325 | .0328037  | -23.08 | 0.000 | -.8215265 to -.6929384 |
| sex_enc   |           |           |      |      |                      |
| M         | .1285276  | .0173014  | 7.43 | 0.000 | .0946175 to .1624378  |
| race_enc  |           |           |      |      |                      |
| B         | .4220852  | .1635623  | 2.58 | 0.010 | .1015089 to .7426615  |
| H         | .2906049  | .1654035  | 1.76 | 0.079 | .03358 to .6147898    |
| I         | .0395449  | .2191174  | 0.18 | 0.857 | -.3899173 to .4690072 |
| N         | .5102995  | .1630486  | 3.13 | 0.002 | .19073 to .8298689    |
| O         | .0429548  | .1729887  | 0.25 | 0.804 | -.2960967 to .3820064 |
| W         | .4874997  | .1631097  | 2.99 | 0.003 | .1678105 to .8071882  |
| age_enc   |           |           |      |      |                      |
| _Cons     | 1.225545  | .165563   | 7.40 | 0.000 | .9010479 to 1.550043  |
| /lnalpha  | -.0324753 | .0124296  | -.0568369 | .0081136 |
| alpha     | .9680464  | .0120325  | .9447481 | .9919192 |

LR test of alpha=0: chibar2(01) = 6.7e+04 Prob >= chibar2 = 0.000
### Table B

Fitting full model:

Iteration 0:  log likelihood = -36138.208
Iteration 1:  log likelihood = -36088.434
Iteration 2:  log likelihood = -36086.353
Iteration 3:  log likelihood = -36086.351

Negative binomial regression

<table>
<thead>
<tr>
<th>Dispersion</th>
<th>Number of obs</th>
<th>LR chi2(11)</th>
<th>Prob &gt; chi2</th>
<th>Pseudo R2</th>
</tr>
</thead>
<tbody>
<tr>
<td>mean</td>
<td>19,363</td>
<td>839.44</td>
<td>0.0000</td>
<td>0.0115</td>
</tr>
</tbody>
</table>

| num_los            | Coef.  | Std. Err. | z    | P>|z| | [95% Conf. Interval] |
|--------------------|--------|-----------|------|------|----------------------|
| 1.treatment_year   | -.1882902 | .0473893 | -3.97 | 0.000 | -.2811716 , -.0954089 |
| 1.treatmentgroup   | .2679258  | .0476559  | 5.62  | 0.000 | .174522 , .3613297   |
| 1.did              | -.8507539 | .0694198  | -12.26| 0.000 | -.9868143 , -.7146936 |
| sex_enc            | .4321434  | .035962   | 12.02 | 0.000 | .3616591 , .5026277  |
| sex_enc M          |         |           |      |      |                      |
| race_enc           |         |           |      |      |                      |
| B                  | -.1019333 | .3395032  | -0.30 | 0.762 | -.7602914 , .5564248 |
| H                  | -.2901702 | .338095   | -0.85 | 0.393 | -.9561845 , .3758441 |
| I                  | .3494966  | .4510442  | 0.77  | 0.438 | -.5345338 , 1.233527 |
| N                  | .2317224  | .3348384  | 0.69  | 0.489 | -.4245488 , .8879937 |
| O                  | -.20167   | .3552369  | -0.57 | 0.570 | -.8979214 , .4945815 |
| W                  | .2238708  | .3347399  | 0.67  | 0.504 | -.4322074 , .879949  |
| age_enc            | .0147166  | .0014118  | 10.42 | 0.000 | .0119496 , .0174836  |
| _cons              | .2060928  | .343093   | 0.60  | 0.548 | -.4663572 , .8785427 |

| /lnalpha | 1.671044 | .0151819 | 1.641288 | 1.7008 |
| alpha    | 5.317716 | .080733  | 5.161813 | 5.478327 |

LR test of alpha=0: chibar2(01) = 1.2e+05  Prob >= chibar2 = 0.000
### Non-Propensity Score Matching Output

Iteration 0:  log likelihood = -51387.679  
Iteration 1:  log likelihood = -51074.953  
Iteration 2:  log likelihood = -51057.459  
Iteration 3:  log likelihood = -51057.432  
Iteration 4:  log likelihood = -51057.432

Negative binomial regression  
Number of obs = 20304  
LR chi2(11) =  4320.28  
Dispersion = mean  Prob > chi2 =  0.0000  
Log likelihood = -51057.432  Pseudo R2 =  0.0006

| num_er  | Coef.  | Std. Err. | z     | P>|z|  | [95% Conf. Interval] |
|---------|--------|-----------|-------|------|-----------------------|
| 1.treatment_year  | -.2742528 | .0202561  | -13.54 | 0.000 | -.313954 to -.2345517 |
| 1.treatmentgroup  | -.485199  | .0214899  | -22.58 | 0.000 | -.5273184 to -.4430797 |
| 1.did  | -.7780997 | .0321388  | -24.21 | 0.000 | -.8410507 to -.7151087 |
| sex_enc  | M  | .0824079  | .0166119 | 4.96  | 0.000 | .0488492 to .1149666 |
| race_enc  | B  | .3893373  | .1590912 | 2.45  | 0.014 | .0777242 to .7013504 |
|        | H  | .2671366  | .1605689 | 1.66  | 0.097 | -.0461136 to .5824809 |
|        | I  | .0099938  | .0218272 | 0.02  | 0.981 | -.4121399 to .4221275 |
|        | N  | -.4917784 | .158625  | 3.09  | 0.002 | .0868701 to .8026777 |
|        | O  | .0210474  | .1623715 | 0.13  | 0.894 | -.3083086 to .3513034 |
|        | W  | .4505733  | .1586444 | 2.84  | 0.005 | .1306368 to .7615098 |
| age_enc  | cons  | .0070869  | .0005819 | 12.18 | 0.000 | .0059464 to .0082274 |
|        | lalpha  | 1.116451  | .1605417 | 6.95  | 0.000 | .8017953 to 1.431107 |

LR test of alpha=0:  *chi2(1) = 6.9e+04  
Prob > chi2 = 0.000

---

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### Negative binomial regression

Number of obs = 20,304  
LR chi2(11) =  851.73  
Prob > chi2 =  0.0000  
Pseudo R2 =  0.0113

Dispersion = mean

| num_los         | Coef.  | Std. Err. |    z  | P>|z| | [95% Conf. Interval] |
|-----------------|--------|-----------|-------|-----|----------------------|
| 1.treatment_year| -.1724655 | .0460845 | -3.74 | 0.000 | -.2627894 to -.0821415 |
| 1.treatmentgroup| .2928938 | .0475277 | 6.16  | 0.000 | .1997412 to .3860465  |
| 1.did           | -.8760182 | .0690745 | -12.68| 0.000 | -1.011402 to -.7406348 |
| sex_enc         |        |           |       |      |                      |
| M               | .3758872 | .0354965 | 10.59 | 0.000 | .3063154 to .445459   |
| race_enc        |        |           |       |      |                      |
| B               | -.1089958 | .3341275 | -0.33 | 0.744 | -.7638736 to .545882  |
| H               | -.3200092 | .337977  | -0.95 | 0.344 | -.9824182 to .3423997 |
| I               | .3268256  | .4464799 | 0.73  | 0.464 | -.5482589 to 1.20191  |
| N               | .2419721  | .3331318 | 0.73  | 0.468 | -.4109543 to .8948984 |
| O               | -.2191192 | .3530923 | -0.62 | 0.535 | -.9111673 to .4729289 |
| W               | .2071587  | .3330257 | 0.62  | 0.534 | -.4455596 to .859877  |
| age_enc         | .01661    | .0012975 | 12.80 | 0.000 | .014067 to .019153    |
| _cons           | .1276788  | .3393016 | 0.38  | 0.707 | -.5373401 to .7926976 |

| /lnalpha        | 1.702487  | .0149465 | 1.673193 | 1.731782 |
| alpha           | 5.48758   | .0820201 | 5.329155 | 5.650714 |

LR test of alpha=0: chibar2(01) = 1.3e+05  
Prob >= chibar2 = 0.000
Appendix C

Averaging Figures and Adjustment Equations

Inpatient Care Cost (Per Day)

Definitions

- **COLI**: Current Cost of Living Index (adjusted on US index of 100)
- **CPI**: Consumer Price Index of Study Year
- **PerDayCost**: Cost of inpatient care, per day
- **TotCost**: Total cost of inpatient care
- **AvgNumDays**: Average number of days in inpatient care

Conceptual Equation

\[
PerDayCost = \frac{[(TotCost \times COLI) \times AvgNumDays]}{CPI}
\]

Literature Numbers

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<thead>
<tr>
<th></th>
<th>Revere\textsuperscript{26}</th>
<th>Park\textsuperscript{27}</th>
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<td>2006-2012</td>
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<td>Avg. Hospitalization Cost</td>
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<tr>
<td>Avg. LOS</td>
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<tr>
<td>Adj. CPI Cost</td>
<td>1790.63</td>
<td>1,950.51</td>
</tr>
</tbody>
</table>


Numerical Equations

\[ 93408.3 = 1125.301; \text{ CPI adjustment of 1790.63} \]
\[ 70364.69 = 1500.2132; \text{ CPI adjustment of 1,950.51} \]
\[ (1,950.51+1790.63)^2 = 1870.57 \text{ average cost of inpatient care per day} \]

Emergency Room Care Cost

Conceptual Equation

\[ \text{ERvisitCost} = (\text{TotCostCOLI})\text{CPI} \]

Literature Numbers

<table>
<thead>
<tr>
<th>Reference</th>
<th>Ku(^{28})</th>
<th>Shumway(^{29})</th>
<th>Oates(^{30})</th>
<th>Larimer(^{31})</th>
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<tr>
<td>Location</td>
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<td>California</td>
<td>United States</td>
<td>Washington</td>
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<td>114.9</td>
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<tr>
<td>Avg ED visit cost (unhoused)</td>
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<td>$1561</td>
<td>$1292.595</td>
<td>$1377</td>
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<tr>
<td>Adj. CPI Cost</td>
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<td>2839.284773</td>
<td>2056.24</td>
<td>2521.72726</td>
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</tbody>
</table>

Numerical Equations

Ex. (Ku, 2006):

\[ 2213.58753 = (1478102.1)\text{CPI}_{2006} \]
\[ 2213.58753 + 2839.284773 + 2056.24 + 2521.727264 = 2407.70989075 \text{ average unhoused ED visit cost} \]


Appendix D

Difference-in-differences Assumptions

Natural Selection

Due to the nature of the program, we fail a primary DID assumption: “natural selection”. People who are enrolled in the program are referred to the program by physicians, thus a selection bias is present. In addition, people who go to the hospital more often (generally treatment group enrollees as they all have SMI and/or SUD) would more likely be referred to the program. Due to this selection bias being present, it is important to note that our calculation of the net benefit may be an overestimate of the true net benefit. People who signed into the program were not exogenously assigned to the treatment group because they enrolled because they wanted to benefit from the program. Our net benefit captures the effect of the program, plus the effect of people wanting to get better. For the purposes of our report and analysis, we will still refer to this combined effect of (program effect plus the effect of people wanting to get better) as the net benefit Medicaid receives from the program.

Parallel Trends

The parallel trends assumption observes if the treatment group and the control group would have the same trends over time, in the absence of the program. When instituting this assumption, we explored the average number of days the treatment group and the average number of days the reference group spent annually in inpatient care before the program went into effect. In the graph below, we see the reference group in blue and the treatment group in red. The treatment group is a straight line.
When analyzing parallel trends, we find that through our averaging method, the parallel trends assumption is not satisfied. The reference group has yearly observations, and the treatment group has 2 observations (before and after program.) To compensate for this discrepancy, we averaged the before enrollment ER visits over the 3 years, the equation is as follows:

\[
2017\_number\_of\_ER\_visits = \frac{before\_enrollment\_total\_ER\_visits}{3}
\]

This was done the same for 2018 and 2019. For the years after enrollment, we replaced \(before\_enrollment\_total\_ER\_visits\) with \(after\_enrollment\_total\_ER\_visits\). This was the best strategy, as opposed to the inverse of making the reference group values look like treatment group values, as not everyone in the reference group was examined annually for their number of visits.

When summing the length of stay for the treatment group and the control group annually before enrollment, we find that the parallel trends assumption is satisfied. A reason for the discrepancy between this graphic and the previous chart is that in our primary analysis, we are using the average length of stay before enrollment for each year. This chart only includes unique values for the length of stay, which is not what we used within our report.
We did not proceed with this overall approach and estimation as we were advised by the Agency of Healthcare Administration that it was possible for these data points to occur and should not be omitted. We believe this to be untrue as the data contains multiple visits on the same day for the same individual, a length of stay over the same period of time and counts each observation as an emergency room visit/new length of stay. Thus, we assume this assumption is satisfied to a degree within our results.

For both assumptions to be satisfied within our report, we assumed all participants in the reference and treatment group wanted to improve their personal quality of life, and random selection did occur.
Appendix E

Sensitivity Analysis

Due to the nature of our analysis, we assume that each enrollee has been enrolled since the beginning of the program, their costs and benefits being over a 3-year period. We adjusted our results within our main analysis and our propensity score matching analysis to accommodate this assumption. To further explore the net benefit, we explored a range of costs and benefits through 2 different methods.

Scenario 1

The first method calculates the costs and benefits assuming there is no continuous enrollment, and those individuals do not receive any benefit or incur any further costs after the year they enrolled in ends. The monthly service cost per person per month is $194.29, with an administrative cost of $14.04 per person per month, equating to a total cost per month of $208.33 per person. We calculate the total cost per year by finding the product of \((\text{number of months} \times \text{number of enrollees} \times \text{cost per month})\). The benefit is calculated the same as in the report, but instead of using the total number of enrollees, we use the number of enrollees for the calculation year. 2019 has only 1 month of program effectiveness, so we only account for one month of benefits and costs. In the below table, we visualize the non-continuous enrollment of the program, visually displaying the number of enrollees, benefits, and costs per year.
We find a total benefit of $3,777,996.97, a total cost of $3,451,124.47, and a net benefit of $329,872.50.

**Scenario 2**

The second sensitivity analysis we conducted in which the cost and benefit calculation considers the enrollment on a continuous basis, which adds the previous year’s number of enrollees to the current year. The monthly per-person cost and benefits are still calculated the same, but we aggregate the previous year’s number of enrollees. The chart below displays the cost and benefits in addition to the number of aggregated enrollees.
We find a total benefit of $9,067,330.83, a total cost of $8,255,643.68, and a net benefit of $811,687.15.

With both net benefits calculated, we define the range of net benefits. The graphic below displays the net benefit of our two sensitivity analyses, our primary analysis, our propensity matching analysis, and the average of all analyses.
We find that the primary (non-PSM) analysis is a generous net benefit and sensitivity analysis 1 is a conservative net benefit. When averaging all net benefits, we find a net benefit of approximately $740 thousand.
Works Cited


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Larimer, Mary E. “Health Care and Public Service Use and Costs before and after Provision of Housing for Chronically Homeless Persons with Severe Alcohol Problems.” 


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