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Medicaid Redesign Team
Supportive Housing Evaluation
Cost Report 2
Volume 2: Treatment versus
Comparison Group Pre-Post Analyses

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Executive Summary

This report details Medicaid spending changes associated with enrollment in programs sponsored by the New York State Medicaid Redesign Team’s Supportive Housing initiative (MRT-SH), including a summary of these projects and the Medicaid cost characteristics of the people enrolled versus a comparison group of people who were similar to MRT-SH clients but were not enrolled. For each included MRT-SH participant, Medicaid cost data are presented from one year before participant enrollment through the first year post-enrollment; for each included comparison participant, Medicaid cost data are presented for a similar two-year timespan. The goal of the analysis is to present a comparison between spending changes before and after MRT-SH program enrollment for enrolled clients versus similar but not enrolled Medicaid users.

INCLUSION CRITERIA AND METHODOLOGY

MRT-SH Treatment participants were included for analysis provided that they were enrolled prior to October 2016 in a program determined to be appropriate for a comparison group approach, and that for the period spanning from one year prior to program enrollment to one year after enrollment, they had full, continuous Medicaid coverage. Participants were included in the analysis according to an intent-to-treat methodology, such that participants were kept for pre-post cost analysis whether or not they remained enrolled in supportive housing for the post-period. Additionally, all clients were required to have at least one claim in one of the four major diagnostic categories (i.e., with a primary diagnosis of a serious mental illness (SMI), substance use disorder (SUD), HIV, or another chronic condition) during their pre-period year.

Comparison group participants were selected from a random sample of New York State Medicaid users who met these same coverage criteria and who had at least one claim in one of the four major diagnostic categories during their pre-period year between 2011 and 2016. All Treatment and Comparison clients were required to have some Medicaid spending in their pre-period year.

A matched set of comparison clients was then selected from this sample using a propensity score matching approach; see Comparison Group report for more detail. These procedures resulted in 2,037 pairs of unique Treatment and matched Comparison clients available for analysis. Pre- and post-period spending was then computed and compared between the Treatment and Comparison group participants. Two (time: pre-period, post-period) x two (group: Treatment, Comparison) repeated measures ANOVAs were then performed to examine the main effects of these factors and determine whether there was an interaction between time and group on changes in Medicaid claim spending, and thus whether the Treatment group showed a greater spending decrease (i.e., greater savings) than the Comparison.

KEY FINDINGS

- Overall, a significant treatment effect was found: while pre-period spending was similar (as expected after the matching process), Treatment participants demonstrated average savings of about \$6,800, which was significantly more than the \$3,700 average savings for Comparison participants. As such, enrollment in MRT-SH programs resulted in greater cost savings in Medicaid claims than “treatment as usual.”

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group	Mean Post-Pre Difference
Treatment	2,037	\$34,173	\$27,350	p=0.002	-\$6,822
Comparison	2,037	\$35,828	\$32,130		-\$3,699
Main Effect of Time		p<0.001		Interaction p=0.008	

- These treatment effects were likely driven by the Treatment clients in the highest deciles of pre-period spending. While both Treatment and Comparison participants in the lower spending deciles tended to demonstrate increased spending in the post-period, those in the top two spending deciles demonstrated significant cost savings, with greater savings for Treatment than Comparison clients.

- » Most MRT-SH programs used pre-period Medicaid spending as a targeting criterion, with the aim of enrolling particularly high-cost users. These results demonstrate that such a strategy is appropriate, as these initially high-spending clients are the ones most likely to show significant cost savings after enrollment.
- Further, these savings likely stemmed from decreased spending in three service categories.
 - » Hospital inpatient spending showed significant decreases in the post-period, though these decreases were greater for Comparison than Treatment clients.
 - » Nursing home and “other” spending showed significant savings for Treatment clients, while Comparison clients tended to show increases.
 - » It should be noted, however, that the propensity score matching approach used was optimized for overall spending, not for any spending subcategory. As such, these comparisons can point to potential overall cost drivers, but conclusions must be limited.

DIRECTIONS FOR FUTURE RESEARCH

- Some comparisons were also made between Treatment and Comparison clients who met the same diagnostic criteria or had the same prior housing histories. These analyses are more limited, as the compared subgroups were not selected to necessarily match each other (and thus the results seen could be attributable to other demographic or clinical differences). Significant treatment effects, where cost savings were significantly greater for Treatment than Comparison clients, were seen for clients with an SMI, SUD, or other chronic condition, and for those with a history of nursing home or homeless shelter stays in the pre-period. Future work should examine these patterns more closely through propensity score models specifically optimized for these comparisons.

CONCLUSIONS

The overall treatment effects found represent a promising result of MRT-SH interventions: Treatment clients demonstrate greater cost savings in the first year after MRT-SH enrollment than do their matched Comparison counterparts. These decreases are likely driven by clients who were particularly high utilizers before enrollment, and likely stem from decreases in inpatient, nursing home, and “other” service category spending. Treatment clients with an SMI, SUD, or other chronic condition, or with a history of OMH residential facility or nursing home stays, may especially benefit from MRT-SH programs, but further work is needed to better establish these subgroup-based patterns. As such, participation in a supportive environment, combined with enrollment in Health Homes or Medicaid managed care, may lead to a more efficient use of health care resources.



Introduction

This report details Medicaid cost changes associated with enrollment in programs sponsored by the New York State Medicaid Redesign Team's Supportive Housing initiative (MRT-SH), including a summary of these projects and the Medicaid cost characteristics of the people enrolled versus a comparison group of people who were similar to MRT-SH clients but were not enrolled. For each included MRT-SH participant, Medicaid cost data are presented from one year before participant enrollment through the first year post-enrollment; for each included Comparison participant, Medicaid cost data are presented for a similar two-year timespan. The goal of the analysis is to present a comparison between spending changes before and after MRT-SH program enrollment for enrolled clients versus similar but not enrolled Medicaid users.¹

Additionally, this report is based on the clients who had enrolled in these programs through September 2017. Medicaid beneficiaries move in and out of eligibility regularly. Therefore, this analysis is accurate for the participants in the sample; changes in program targeting may shift the outcomes seen. These descriptive analyses are based on a small panel of enrollees, and future estimates will depend in part on the clinical characteristics of new enrollees in these programs.

GOALS OF THE MEDICAID REDESIGN TEAM SUPPORTIVE HOUSING (MRT-SH) INITIATIVE

To address unprecedented health care cost growth and improve health care quality in New York's Medicaid program, Governor Andrew M. Cuomo created the Medicaid Redesign Team to develop a multi-year reform plan. Medicaid Redesign is premised on the idea that the only way to successfully control costs is to improve the health of program participants.

Studies have shown the powerful effects of social determinants of health, such as safe housing, nutrition, and education. However, the public spending dedicated to these social determinants is small relative to national health care spending overall.² Research also indicates that 5% of consumers are responsible for 50% of health care costs.³ In particular, the population targeted for the supportive housing program has high rates of emergency department utilization and inpatient hospitalizations, due in part to their greater likelihood of suffering from multiple chronic medical problems, behavioral health problems, and environmental risk factors associated with a lack of stable housing.

New York has recognized housing as a critical health intervention, with supportive housing identified as a promising model. Supportive housing is affordable housing paired with supportive services, such as on-site case management and referrals to community-based services, as well as scattered-site housing with tenancy support services.⁴ As a result, New York has allocated substantial funding from the State's Medicaid Redesign dollars to provide supportive housing to homeless, unstably housed, and/or other individuals with complex needs, who are high-cost, high-need Medicaid users. It is anticipated that MRT-SH will reduce the more expensive forms of health care utilization (emergency department visits, inpatient hospitalizations, and nursing home stays), potentially reduce overall health care costs, and improve quality of life and health outcomes.

INCLUDED MRT-SH PROJECTS

While MRT-SH initiatives include over 50 capital projects and 20 rental subsidy and supportive services programs and pilots, not all programs were appropriate to include in this comparison group testing. **Table 1** below shows the programs that are included in the cost study in the body of this report versus those included in previous work. The previous Cost 2 Volume 1 report included pre- versus post-period Medicaid claim spending comparisons between eligible Treatment individuals only; Cost 2 Volume 2 includes these comparisons versus those for the Comparison group. Supportive housing enrollment data for each MRT supportive housing participant included in this analysis is based on program records.⁵

¹ Note that for participants who are dually eligible for Medicaid and Medicare, Medicare costs are not included in the analysis.

² Bradley EH, Elkins BR, Herrin J, Elbel B. Health and social services expenditures: associations with health outcomes. *BMJ Quality & Safety*. 2011;20(10):826-831.

³ Stanton MW, Rutherford MK. The high concentration of U.S. health care expenditures. Rockville (MD): *Agency for Healthcare Research and Quality*; 2005. Research in Action Issue 19. AHRQ Pub. No. 06-0060.

⁴ Doran KM, Misa EJ, Shah NR. Housing as Health Care – New York's Boundary-Crossing Experiment. *New England Journal of Medicine*. 2013;369:2374-2377.

⁵ Program record verification dates: HHAP capital projects for participants enrolled through 5/2017; AIDS Institute programs and Health Homes Supportive Housing Pilot through 7/2017; OASAS-RSS and OPWDD-RSS through 8/2017; East 99th Street through 9/2017; HCR Capital projects,

Medicaid spending is based on Medicaid Data Warehouse (MDW) information for dates of service through 6/9/2019.⁶

Table 1. Summary characteristics of MRT Supportive Housing projects included in Cost 2 Volume 2 analyses

Program	Population Served	Number of People included in Cost 2 Volume 1 Report	Number of People included in Cost 2 Volume 2 Report
All Potential Clients at Included MRT-SH Programs		2,348 ⁷	2,037
Department Of Health – AIDS Institute			
AIDS Institute Services & Subsidies	HIV-positive adults living outside NYC, often referred by Health Homes	149	117
AIDS Institute Pilot	Homeless and unstably housed Health Home-eligible individuals in New York City who were diagnosed with HIV but did not qualify for other existing programs	17	13
Homes and Community Renewal (HCR): Capital			
East 99th Street	Physically disabled adults who did not qualify for existing New York City SH programs	150	107
3361 Third Ave		34	27
Boston Road	Chronically homeless single adults who suffer from a serious and persistent mental illness or who are diagnosed as mentally ill and chemically addicted	76	58
Norwood Terrace		29	28
VOA Creston Avenue		19	17
Office of Temporary and Disability Assistance (Homeless Housing and Assistance Program Capital)			
Opportunities for Broome	Chronically homeless single adults who are recovering from drug and/or alcohol abuse or have a mental illness or other disability	14	9
Son House	Chronically homeless single adults who have a documented disability	26	23
Hope Gardens	Chronically homeless single women with special needs such as mental illness, drug and alcohol abuse, or a history of domestic violence or physical or sexual assault	17	13
Evergreen Loft Apartments	Homeless adults who are living with HIV/AIDS, have a disabling health condition, and/or are physically disabled	22	12
Office of Temporary and Disability Assistance (Other)			
Homeless Senior and Disabled Placement Program	Health Home-eligible SSI recipients living in New York City homeless shelters	199	146
Office of Mental Health			
Rental Subsidies - Brooklyn	Single, Health Home eligible adults with a serious mental illness who either live in Brooklyn, are referred by a Brooklyn-based Health Home, reside in an OMH-operated residential program, or are discharged from an Article 28 or Article 31 hospital. Individuals must also be unstably housed or be individuals for whom housing would assist in a hospital diversion	336	290
Rental Subsidies - Statewide	Single, Health Home-eligible adults with a serious mental illness who are either referred by a Health Home, reside in an OMH Psychiatric Center or OMH-operated residential program, or are discharged from an Article 28 or Article 31 hospital. Individuals must also be unstably housed or be individuals for whom housing would assist in a hospital diversion	467	415

OMH RSS and RSB, and NHIL through 10/2017; Access to Home Expansion program through 11/2017.

⁶ Data was extracted on 12/9/2019.

⁷ Cost 2 Volume 1 report also included individuals at several programs excluded from comparison group analyses: AIDS Institute-Services Only; HCR Capital-Expand the Access to Homes program; HHAP Capital-Happiness House; OTDA-Eviction Prevention for Vulnerable Adults; OP-WDD-Rental Subsidies Statewide; and OHIP-Senior Supportive Housing Services; for a total of 3,649 clients.

Program	Population Served	Number of People included in Cost 2 Volume 1 Report	Number of People included in Cost 2 Volume 2 Report
Office of Alcoholism and Substance Abuse Services			
OASAS Rental Subsidies Statewide	Single adults with a substance use disorder who are homeless, unstably housed, or at risk of homelessness; are Medicaid eligible; and meet frequent utilizer criteria	441	436
Department Of Health – Office of Health Insurance Programs			
Health Homes Supportive Housing Program	Homeless individuals that are enrolling or enrolled in Health Homes	319	294
Nursing Home to Independent Living (Transitions)	Individuals who are elderly or physically disabled, homeless or transitioning out of a skilled nursing facility with the programs assistance	33	32
Comparison Clients			
No MRT-SH Enrollment	See Comparison Group report for client selection methodology, client characteristics.	0	2,037

ANALYSIS INCLUSION CRITERIA

All analyses presented below are for those programs that began enrolling participants prior to October 2016 and were determined to be appropriate for a comparison group approach. Participants were included for analysis provided that they were enrolled prior to October 2016, and provided that, for the period spanning from one year prior to program enrollment to one year after enrollment, they met both of the following full Medicaid coverage criteria:

1. No coverage under a Medicaid coverage type that was considered less than full coverage; and
2. No period of 60 days or longer without full Medicaid coverage.

Additionally, clients were required to have at least one claim for a primary diagnosis of a serious mental illness (SMI), substance use disorder (SUD), HIV, or another chronic condition during their pre-period year, and to have at least some Medicaid claim cost in that year (i.e., at least some spending was required). Total pre-period Medicaid spending was capped at one million dollars.

Medicaid spending for clients meeting these criteria was then analyzed over the twelve months prior to program enrollment (the pre-period) and twelve months after (post-period). Participants were included in the analysis according to an intent-to-treat methodology, such that participants were kept for pre-post cost analysis whether or not they remained enrolled in supportive housing for the post-period.

Comparison group participants were selected from a random sample of New York State Medicaid users who met these same coverage criteria and who had at least one claim for a primary diagnosis of a serious mental illness (SMI), substance use disorder (SUD), HIV, or another chronic condition during their pre-period year (i.e., their first year of coverage) between 2011 and 2016; as with the Treatment group, all clients were required to have some Medicaid spending in their pre-period year. A matched set of Comparison clients was then selected from this sample using a propensity score matching approach; see Comparison Group report for more details.

CLIENT CHARACTERISTICS

Spending Deciles

Clients were divided into ten spending deciles based on their pre-period spending. Decile ranges were determined by the distribution of total pre-period costs across the entire potential Treatment and Comparison (Random Sample) populations. Final matching of participants required total pre-period spending within the same decile. There were relatively few Treatment participants with lower pre-period spending, resulting in smaller lower-decile final groups (see **Table 2**).

Table 2. Number of Treatment and Comparison clients in each pre-period spending decile

Decile	Pre-Period Spending Range	N final participants in decile (Treatment + Comparison)
1	Minimum (\$20) - \$1,300	50
2	\$1,301 - \$2,474	86
3	\$2,475 - \$3,915	112
4	\$3,916 - \$5,865	232
5	\$5,866 - \$8,600	286
6	\$8,601 - \$12,605	356
7	\$12,606 - \$19,600	590
8	\$19,601 - \$33,600	828
9	\$33,601 - \$64,600	1024
10	\$64,601 - Maximum (\$660,500)	512

Comorbidities

Diagnoses were taken from the primary diagnosis of claims in the pre-period. As such, these rates likely underrepresent incidence, as clients with a chronic illness may not have had any claims for which their condition was the primary diagnosis in their pre-period year, but this gap was assumed to be small as most of these conditions result in regular claims. The “other chronic condition” category was comprised of twelve common chronic conditions other than serious mental illness, substance use disorder, and HIV, and included hypertension, asthma, diabetes, osteoarthritis, coronary heart disease, chronic kidney disease, chronic obstructive pulmonary disease, cerebrovascular disease, congestive heart failure, cancer, angina, and acute myocardial infarction.

The population served by the MRT-SH programs is a seriously ill population with high rates of comorbidities. Additionally, given the inclusion criteria of at least one pre-period claim with a diagnosis in one of our four major categories, all MRT-SH Treatment and Comparison clients had at least some diagnosis, thus increasing the rates of occurrence for all but HIV. This decrease for HIV was not unexpected, though, given the exclusion of the AIDS Institute: Services Only program from all analyses involving the Comparison group. Importantly, the rates of occurrence were highly similar between the final selected Treatment and Comparison groups (see **Table 3A**).

Table 3A. Comorbidity distribution for Treatment and Comparison clients

	Original MRT-SH	Treatment	Comparison
Serious Mental Illness	62%	77%	78.5%
Substance Use Disorder	41%	51.5%	54%
Other Chronic Condition	33.5%	49%	52%
HIV	23.5%	5%	5%
3 or more of the above	24%	20%	21%
All 4 of the above	3%	1%	1.5%

Enrollment Duration

As analyses followed an intent-to-treat methodology, not all Treatment participants in the study were retained in MRT-SH for a full year. Across all included MRT-SH Treatment clients, about one-quarter were enrolled for a maximum of one year, about one-third were enrolled for one to two years, and just over one-third for more than two years (see **Table 3B**). These rates were reasonably similar to those in the original MRT-SH sample. No comparison clients were enrolled at MRT-SH programs at any point.

Table 3B. Enrollment duration for enrollees analyzed

	Original MRT-SH	Treatment
Less than 6 months	13%	11%
Between 6 and 12 months	19%	16%
Between 13 and 18 months	19%	14%
Between 19 and 24 months	15%	20%
More than 24 months	33%	39%

Care Coordination

Pre-period enrollment in care coordination services did differ between the original MRT-SH sample and the final selected group (likely as a result of \$0 claims being dropped), but was quite similar between the selected MRT-SH Treatment and Comparison participants. About two-fifths were enrolled in Medicaid Managed Care, about two-fifths were enrolled in Health Homes, and about one-tenth were dually eligible for Medicaid and Medicare (see **Table 3C**).

Table 3C. Care coordination for enrollees analyzed

	Original MRT-SH	Treatment	Comparison
Medicaid Managed Care Enrollment	70.5%	41%	43%
Health Homes Enrollment ⁸	55%	38.5%	38%
Dual Eligibility	23%	9%	11.5%

Prior Housing Status

Homeless shelter history was defined as any pre-period stay in an HMIS facility. OMH residential facility history was defined as any pre-period stay recorded in CAIRS or MHARS. Nursing home history was defined as having at least \$1,000 worth of nursing home-related claims in the pre-period.⁹ The selected Treatment and Comparison groups had similar rates of pre-period HMIS and OMH use, but the Comparison group had a much greater incidence of pre-period nursing home use than did the Treatment (see **Table 3D**).

Table 3D. Prior housing status for enrollees analyzed

Prior Housing Status Distribution	Treatment	Comparison
Homeless/In Shelter (HMIS)	26%	20%
OMH (CAIRS or MHARS)	13%	7%
Nursing Home (from claims)	2.5%	15%

⁸ Health Homes Enrollment was determined based on presence of Health Homes outreach or enrollment claims.

⁹ Three participants (2 Treatment, 1 Comparison) had nursing home-related claims of less than \$1000 in the pre-period; none had any nursing-home related post-period spending, and inclusion of these participants did not shift any results.

Methodology

MDW fee-for-service claims (excluding capitation payments) and managed care plan reported (encounter) data, pulled on 12/9/2019 (thus valid through 6/9/2019)¹⁰, were used to calculate pre- and post-period costs. For program participants who are dually eligible for Medicare and Medicaid, only Medicaid costs are included in the analysis. Additionally, the cost of the MRT-SH intervention is not included in any of the analyses that follow.

Pre- and post-period spending was then computed and compared between the Treatment and Comparison group participants. A two (time: pre-period, post-period) x two (group: Treatment, Comparison) repeated measures ANOVA was then performed to examine the main effects of these factors and determine whether there was an interaction between time and group on changes in Medicaid claim spending, and thus whether the Treatment group showed a greater mean spending decrease (i.e., greater savings) than the Comparison. Both time and group were treated as within-subjects factors in these main analyses, as Treatment and Comparison participants were matched on propensity scores and thus drawn from the same underlying distribution. Differences between groups within a time point, between the differences between time points, and within a group between time points, were compared using paired-samples t-tests. Given the assumptions of a propensity score matching approach, Standard Errors were adjusted using the Abadie-Imbens (2006) adjustment to account for the allowed replacement and non-randomness in the selected Comparison group.¹¹

CATEGORIES OF SERVICE

Pre- and post-period costs within service categories were also compared using the same 2x2 repeated measures ANOVA approach to determine the drivers of cost changes. Notably, while selected Treatment and Comparison participants were matched on overall pre-period Medicaid claim spending, within-category spending was not included in the propensity score model, and thus the model was not optimized for these comparisons. As such, the two groups could be significantly different on spending within each category to start. MRT-SH treatment effects are thus best described through a difference-in-differences approach, where changes in spending patterns are compared between groups across the two time periods. Unadjusted standard errors were used in these analyses, since category of service spending was not included in the modeling process. Any results from these analyses should be taken as preliminary, but can be used to determine potential cost drivers that result in the overall spending effects seen.

Service categories were identified by Category of Service codes, rate codes, and claim transaction source codes (see Appendix A.1 for more information). Analyzed categories of service include:

- Clinic;
- Durable Medical Equipment (DME);
- Emergency Department;
- Health Home/Care Management;
- Hospital Inpatient;
- Hospital Outpatient;
- Lab;
- Non-Institutional Long-Term Care (e.g., home health agency professional services, health home medical supply, vendor personal care services, personal emergency response services, assisted living programs, home care programs, long term home health care);
- Nursing Home (e.g., skilled nursing facilities, day cares);
- Other;
- Pharmacy;
- Physician Services;
- Transportation Services (e.g., ambulances, taxis, livery services, day treatment transportation).

¹⁰ Client claims were assumed to be complete within six months. As such, a six-month claims lag was instituted, wherein data pulled on 10/17/2019 was assumed to be complete for services provided through 4/17/2019.

¹¹ Abadie A & Imbens I. Large Sample Properties of Matching Estimators for Average Treatment Effects. *Econometrica*. 2006;74: 235-267.

The “Other” category includes all other costs not otherwise excluded. The most prominent “other” costs included OMH Community Residences and OASAS Personalized Recovery Oriented Services, though many other types of costs were also included (e.g., chiropractic services, dental services, eyeglasses, social worker or physical therapist services, and any Graduate Medical Education (GME)-associated costs in any other category).

DIRECTIONS FOR FUTURE RESEARCH: DIAGNOSIS AND PRIOR HOUSING STATUS

Spending for MRT-SH Treatment and Comparison clients with each diagnosis, and with three or more (or all four) diagnoses; and spending for clients with pre-period histories of stays in homeless shelters, OMH residential facilities, and nursing homes, was also compared. As these analyses did not rely on matched pairs of participants, but instead used subgroups of each group, group was treated as an independent factor in these analyses.

Again, though, while diagnosis and at least homeless shelter and OMH facility history were included as variables in the propensity score model, matching on these items was not required for pair selection. As such, while the subgroup of participants with each diagnosis or prior housing status can be identified, and spending compared under the same procedures, the subgroups are not necessarily well-matched on pre-period spending or on any other modeled factor (e.g., demographics, histories, etc.). Pre-period spending must thus be carefully examined, and interpretations and conclusions from any interactions found limited, as differences may be driven by some other unbalanced factor. Other covariates that differ between the Treatment and Comparison subgroups must also be examined and included in the analysis to partial out any variance due simply to these factors. Unadjusted standard errors were used in these analyses, as these breakout analyses draw from subgroups instead of the full modeled group. Future propensity score models should be optimized specifically for these each of these sub-group populations.

Expected Outcomes

As overall pre-period spending was included as a fixed factor in the propensity score matching process, and selected matched participants were thus required to be within the same pre-period spending decile, Treatment and Comparison participants were not expected to significantly differ in spending in any full-group or decile-based pre-period comparison. However, differences in pre-period spending were anticipated when subtypes of spending, or participant subgroups, were considered.

The Cost 2 Volume 1 report demonstrated a significant overall decrease in spending for Treatment clients from the pre- to the post-periods tested. As such, Treatment clients included here were also expected to show such a decrease. Comparison group clients were not particularly expected to show significant spending changes from pre to post, as by definition they did not receive the intervention.

Most importantly, the decline in spending for the Treatment group across the period tested was expected to be significantly larger than any spending decline for Comparison clients. Treatment clients were thus expected to save more money after enrolling in MRT-SH programs than the Comparison clients who were not enrolled in any such program. Clients in higher spending deciles were expected to demonstrate greater cost savings than those in lower spending deciles, in part given their increased “room to decrease.”

Several categories of service were expected to be major drivers of cost changes, as MRT-SH enrollment was expected to particularly impact spending in these domains. Notable decreases were expected for hospital inpatient, emergency department, and nursing home-related costs. MRT-SH programs were often focused on targeting clients with high spending in these areas, and aimed to reduce such spending after program participation. Inpatient and nursing home-related costs were demonstrated to be major categories of pre-period spending, and post-period saving, in the Cost 2 Volume 1 report; these domains were thus expected to decrease more for Treatment participants, in response to MRT-SH enrollment, than Comparison.

Results

OVERALL SPENDING CHANGE COMPARISON

All Treatment (N=2,037) and Comparison (N=2,037) participants were first compared to determine whether there were any significant differences on changes in Medicaid spending from the pre- to the post-period.

Table 4A. Spending treatment effects for full group

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ¹²	Mean Post-Pre Difference
Treatment	2,037	\$34,172.61	\$27,350.25	**	-\$6,822.36
Comparison	2,037	\$35,828.11	\$32,129.58		-\$3,698.53
Main Effect of Time¹³				***	
					Interaction¹⁴
					**

Table 4B. Pre-post spending difference percentiles

Percentile	Treatment	Comparison
5	-\$56,613.89	-\$52,093.21
10	-\$39,961.62	-\$33,484.09
25	-\$16,571.59	-\$14,200.80
50	-\$2,996.46	-\$2,344.77
75	\$4,351.82	\$7,266.39
90	\$18,494.28	\$25,638.26
95	\$34,377.59	\$44,034.89

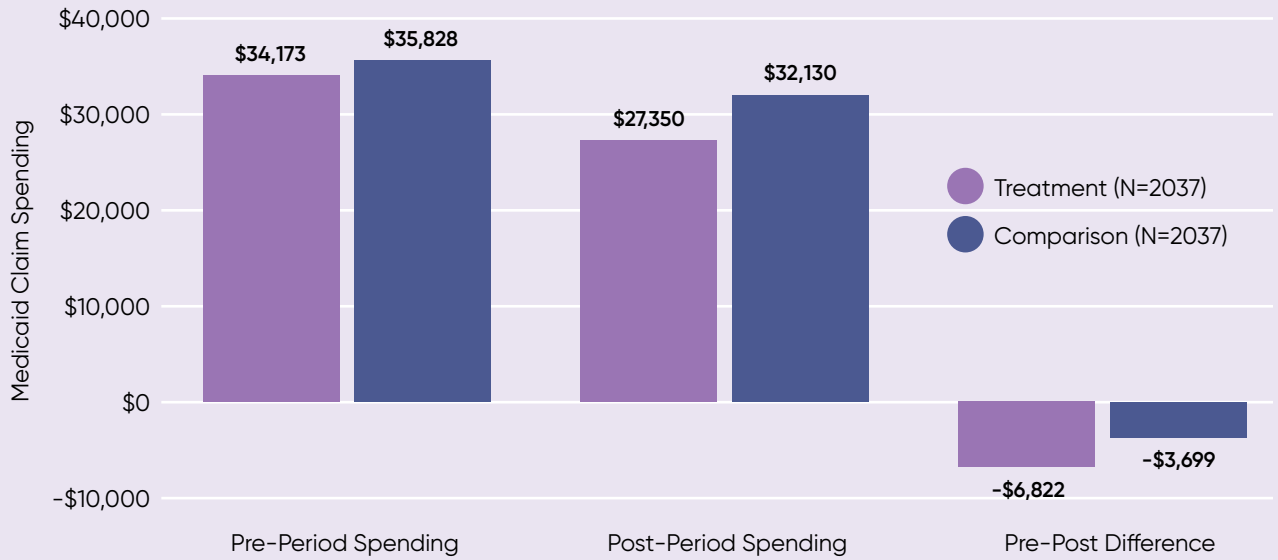
A 2 (time: pre, post) x 2 (group: Treatment, Comparison) repeated measures ANOVA demonstrated significant main effects of time, $F(1,4072)=80.326, p<0.001$, and group, $F(1,4072)=9.534, p=0.002$, and a significant interaction between these factors, $F(1,4072)=7.082$, adjusted Standard Error = 996, $p=0.008$. Examination of the simple main effects demonstrated that Treatment and Comparison participants did not show any differences in pre-period spending ($p>0.2$). This similarity was expected, as participants were explicitly matched on pre-period spending during the propensity score matching process. However, Treatment and Comparison participants were significantly different on post-period spending, with Treatment about \$5,000 less than Comparison ($t(1,2036)=4.764, p<0.001$). And while both Treatment and Comparison participants showed significant decreases over the examined window, Treatment participants demonstrated a larger decrease than Comparison by about \$3,000. As such, there was a significant effect of MRT-SH enrollment on Medicaid claim spending.

¹² Repeated Measures ANOVA within-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

¹³ Repeated Measures ANOVA within-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

¹⁴ Repeated Measures ANOVA interaction; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

Figure 1. Overall Medicaid spending for Treatment and Comparison client



SPENDING CHANGE COMPARISON FOR PARTICIPANTS BY DECILE

Pre- to post-period changes in spending were then examined within each cost decile. Results are shown within each spending decile, then summarized across deciles.

Decile 1

Table 5A. Spending treatment effects for decile 1

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ¹⁵	Mean Post-Pre Difference
Treatment	25	\$854.84	\$8,813.23	n.s.	\$7,958.39
Comparison	25	\$682.51	\$4,906.33		\$4,223.83
Main Effect of Time¹⁶		**		Interaction¹⁷ n.s.	

Table 5B. Pre-post spending difference percentiles for decile 1

Percentile	Treatment	Comparison
5	-\$869.48	-\$1,173.67
10	-\$482.89	-\$841.26
25	\$203.13	-\$425.50
50	\$2,112.06	\$194.05
75	\$13,537.94	\$1,797.24
90	\$27,080.86	\$18,334.99
95	\$45,284.22	\$42,669.29

Clients in the first (lowest) spending decile demonstrated a significant main effect of time, $F(1,48)=12.594, p=0.001$, reflecting the overall increase in spending seen across the period, but no main effect of group and no interaction (p values >0.2); as such, spending increased similarly for Treatment and Comparison participants over this interval. Such an increase is not unexpected, as these clients were especially low-spending in the pre-period, and thus likely under-utilizing needed medical services; the increase seen for Treatment participants may reflect improved access to services after enrollment, and the increase for Comparison simple change in the only available direction over time.

¹⁵ Repeated Measures ANOVA within-subjects effect; “+” – $p < 0.1$; “*” – $p < 0.05$, “**” – $p < 0.01$, “***” – $p < 0.001$, “n.s.” – not significant.

¹⁶ Repeated Measures ANOVA within-subjects effect; “+” – $p < 0.1$; “*” – $p < 0.05$, “**” – $p < 0.01$, “***” – $p < 0.001$, “n.s.” – not significant.

¹⁷ Repeated Measures ANOVA interaction; “+” – $p < 0.1$; “*” – $p < 0.05$, “**” – $p < 0.01$, “***” – $p < 0.001$, “n.s.” – not significant.

Decile 2

Table 6A. Spending treatment effects for decile 2

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ¹⁸	Mean Post-Pre Difference
Treatment	43	\$1,901.17	\$9,880.33	n.s.	\$7,979.16
Comparison	43	\$1,771.70	\$4,922.54		\$3,150.84
Main Effect of Time¹⁹		**		Interaction²⁰ n.s.	

Table 6B. Pre-post spending difference percentiles for decile 2

Percentile	Treatment	Comparison
5	-\$1,496.48	-\$1,950.80
10	-\$915.07	-\$1,479.03
25	\$81.32	-\$976.31
50	\$1,054.34	\$365.35
75	\$5,570.66	\$5,926.87
90	\$16,177.32	\$14,445.14
95	\$41,140.68	\$19,222.56

Participants in the second (second-to-lowest) spending decile demonstrated a significant main effect of time, $F(1,84)=8.917$, $p=0.004$, reflecting the overall increase in spending seen across the period, but no main effect of group and no interaction (p values>0.15); as such, spending increased similarly for Treatment and Comparison participants over this interval. But as with the first decile, such an increase is not unexpected given the relatively low pre-period spending and likely under-utilization of needed medical services; the increase seen for Treatment participants may reflect improved access to services after enrollment, and the increase for Comparison simple change in the only available direction over time.

¹⁸ Repeated Measures ANOVA within-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

¹⁹ Repeated Measures ANOVA within-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

²⁰ Repeated Measures ANOVA interaction; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

Decile 3

Table 7A. Spending treatment effects for decile 3

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ²¹	Mean Post-Pre Difference
Treatment	56	\$3,315.57	\$7,369.82	*	\$4,054.25
Comparison	56	\$3,004.85	\$4,764.25		\$1,759.40
Main Effect of Time²²		***		Interaction²³ n.s.	

Table 7B. Pre-post spending difference percentiles for decile 3

Percentile	Treatment	Comparison
5	-\$2,220.95	-\$2,776.01
10	-\$2,084.85	-\$2,546.53
25	-\$1,439.68	-\$1,217.62
50	\$880.71	\$332.47
75	\$6,623.96	\$2,334.73
90	\$15,801.65	\$6,914.26
95	\$28,888.32	\$9,837.46

Treatment and Comparison participants in the third spending decile demonstrated a significant increase in spending over time, $F(1,110)=16.576, p<0.001$. There was a significant main effect of group ($F(1,110)=4.113, p=0.045$), where Treatment spending was higher than Comparison, but no significant interaction between the two factors ($p=0.3$). Again, the increases seen for Treatment participants may reflect improved access to services after enrollment in MRT-SH.

²¹ Repeated Measures ANOVA within-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

²² Repeated Measures ANOVA within-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

²³ Repeated Measures ANOVA interaction; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

Decile 4

Table 8A. Spending treatment effects for decile 4

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ²⁴	Mean Post-Pre Difference
Treatment	116	\$4,904.02	\$12,595.44	n.s.	\$7,691.41
Comparison	116	\$4,802.60	\$10,801.53		\$5,998.92
Main Effect of Time²⁵		***		Interaction²⁶ n.s.	

Table 8B. Pre-post spending difference percentiles for decile 4

Percentile	Treatment	Comparison
5	-\$4,219.61	-\$4,609.66
10	-\$3,500.35	-\$3,970.93
25	-\$1,422.86	-\$3,255.63
50	\$785.68	\$1,638.98
75	\$8,548.45	\$7,191.52
90	\$25,097.16	\$24,994.76
95	\$41,096.83	\$34,469.28

While there was a significant main effect of time, $F(1,230)=28.697, p<0.001$, where participants in the fourth spending decile demonstrated increased spending from the pre- to the post-periods, there were no significant effects by group and no significant interaction (F 's<1, p 's>0.2). As such, the spending increases seen are not related to MRT-SH participation.

²⁴ Repeated Measures ANOVA within-subjects effect; "+" – $p<0.1$; "*" – $p<0.05$, "**" – $p<0.01$, "****" – $p<0.001$, "n.s." – not significant.

²⁵ Repeated Measures ANOVA within-subjects effect; "+" – $p<0.1$; "*" – $p<0.05$, "**" – $p<0.01$, "****" – $p<0.001$, "n.s." – not significant.

²⁶ Repeated Measures ANOVA interaction; "+" – $p<0.1$; "*" – $p<0.05$, "**" – $p<0.01$, "****" – $p<0.001$, "n.s." – not significant.

Decile 5

Table 9A. Spending treatment effects for decile 5

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ²⁷	Mean Post-Pre Difference
Treatment	143	\$7,239.43	\$10,411.62	n.s.	\$3,172.20
Comparison	143	\$7,148.84	\$12,395.88		\$5,247.04
Main Effect of Time²⁸		***		Interaction²⁹ n.s.	

Table 9B. Pre-post spending difference percentiles for decile 5

Percentile	Treatment	Comparison
5	-\$6,255.07	-\$7,191.34
10	-\$5,027.88	-\$5,965.33
25	-\$2,392.87	-\$4,135.84
50	\$322.21	\$607.35
75	\$4,628.73	\$8,531.62
90	\$14,199.32	\$20,907.56
95	\$22,448.81	\$29,458.18

While there was a significant main effect of time, $F(1,284)=20.631, p<0.001$, where participants from the fifth spending decile demonstrated increased spending from the pre- to the post-periods, there were no significant effects by group and no significant interaction (p values>0.2). As such, the spending increases seen are not related to MRT-SH participation.

²⁷ Repeated Measures ANOVA within-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “****” – $p<0.001$, “n.s.” – not significant.
²⁸ Repeated Measures ANOVA within-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “****” – $p<0.001$, “n.s.” – not significant.
²⁹ Repeated Measures ANOVA interaction; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “****” – $p<0.001$, “n.s.” – not significant.

Decile 6

Table 10A. Spending treatment effects for decile 6

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ³⁰	Mean Post-Pre Difference
Treatment	178	\$10,597.94	\$16,440.52	n.s.	\$5,842.58
Comparison	178	\$10,383.09	\$13,690.81		\$3,307.72
Main Effect of Time³¹		***		Interaction³² n.s.	

Table 10B. Pre-post spending difference percentiles for decile 6

Percentile	Treatment	Comparison
5	-\$7,228.60	-\$9,677.29
10	-\$6,512.42	-\$8,521.73
25	-\$3,684.63	-\$6,075.47
50	\$576.49	-\$835.73
75	\$7,221.10	\$6,532.09
90	\$16,500.01	\$22,676.89
95	\$25,463.70	\$41,262.88

Treatment and Comparison participants in the sixth spending decile demonstrated a small but significant main effect of time, $F(1,354)=16.444, p<0.001$, with some increase in spending from the pre- to the post-periods. However, there were no significant effects by group and no significant interaction (p values>0.2). As such, the spending increases seen are not related to MRT-SH participation.

³⁰ Repeated Measures ANOVA within-subjects effect; “+” – $p<0.1$; “**” – $p<0.05$, “***” – $p<0.01$, “****” – $p<0.001$, “n.s.” – not significant.

³¹ Repeated Measures ANOVA within-subjects effect; “+” – $p<0.1$; “**” – $p<0.05$, “***” – $p<0.01$, “****” – $p<0.001$, “n.s.” – not significant.

³² Repeated Measures ANOVA interaction; “+” – $p<0.1$; “**” – $p<0.05$, “***” – $p<0.01$, “****” – $p<0.001$, “n.s.” – not significant.

Decile 7

Table 11A. Spending treatment effects for decile 7

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ³³	Mean Post-Pre Difference
Treatment	295	\$15,871.85	\$18,147.84	n.s.	\$2,276.00
Comparison	295	\$16,202.35	\$18,011.68		\$1,809.33
Main Effect of Time³⁴			*	Interaction³⁵ n.s.	

Table 11B. Pre-post spending difference percentiles for decile 7

Percentile	Treatment	Comparison
5	-\$12,562.56	-\$15,808.91
10	-\$11,542.51	-\$14,404.73
25	-\$6,923.10	-\$11,323.09
50	-\$1,639.53	-\$4,098.15
75	\$5,063.87	\$6,443.79
90	\$16,699.21	\$23,907.92
95	\$31,403.58	\$39,367.54

Treatment and Comparison participants in the seventh spending decile demonstrated a small but significant main effect of time, $F(1,588)=5.982, p=0.015$, with some slight increase in spending from the pre- to the post-periods. However, there were no significant effects by group and no significant interaction (p values>0.2). As such, the spending increases seen are not related to MRT-SH participation.

³³ Repeated Measures ANOVA within-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “***” – $p<0.01$, “*****” – $p<0.001$, “n.s.” – not significant.

³⁴ Repeated Measures ANOVA within-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “***” – $p<0.01$, “*****” – $p<0.001$, “n.s.” – not significant.

³⁵ Repeated Measures ANOVA interaction; “+” – $p<0.1$; “*” – $p<0.05$, “***” – $p<0.01$, “*****” – $p<0.001$, “n.s.” – not significant.

Decile 8

Table 12A. Spending treatment effects for decile 8

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ³⁶	Mean Post-Pre Difference
Treatment	414	\$26,012.17	\$25,186.13	n.s.	-\$826.04
Comparison	414	\$25,645.58	\$25,806.62		\$161.04
Main Effect of Time³⁷		n.s.		Interaction³⁸ n.s.	

Table 12B. Pre-post spending difference percentiles for decile 8

Percentile	Treatment	Comparison
5	-\$23,535.06	-\$24,090.71
10	-\$19,361.41	-\$22,077.16
25	-\$14,293.98	-\$15,978.77
50	-\$6,173.52	-\$6,310.86
75	\$5,684.24	\$8,524.70
90	\$24,534.58	\$27,428.12
95	\$36,819.74	\$49,085.63

For clients in the eight spending decile, there were no significant main effects of time or group, and no significant interaction (all F's<1).

³⁶ Repeated Measures ANOVA within-subjects effect; "+" – p<0.1; "*" – p<0.05, "****" – p<0.01, "*****" – p<0.001, "n.s." – not significant.

³⁷ Repeated Measures ANOVA within-subjects effect; "+" – p<0.1; "*" – p<0.05, "****" – p<0.01, "*****" – p<0.001, "n.s." – not significant.

³⁸ Repeated Measures ANOVA interaction; "+" – p<0.1; "*" – p<0.05, "****" – p<0.01, "*****" – p<0.001, "n.s." – not significant.

Decile 9

Table 13A. Spending treatment effects for decile 9

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ³⁹	Mean Post-Pre Difference
Treatment	512	\$46,029.80	\$34,911.42	***	-\$11,118.37
Comparison	512	\$46,154.76	\$42,944.58		-\$3,210.19
Main Effect of Time⁴⁰		***		Interaction⁴¹ ***	

Table 13B. Pre-post spending difference percentiles for decile 9

Percentile	Treatment	Comparison
5	-\$45,026.10	-\$46,984.27
10	-\$40,938.62	-\$39,418.70
25	-\$32,654.48	-\$28,231.26
50	-\$16,109.52	-\$7,735.02
75	-\$273.02	\$12,048.16
90	\$24,835.72	\$31,776.55
95	\$39,932.09	\$62,901.86

Clients in the ninth (second-to-highest) spending decile demonstrated significant shifts in spending from the pre- to post-periods. There were significant main effects of time ($F(1,1022)=43.084, p<0.001$), where spending tended to decrease over the examined interval, and group ($F(1,1022)=12.662, p<0.001$), where Treatment clients spending was lower than for Comparison, and a significant interaction between the two factors ($F(1,1022)=13.124$, adjusted Standard Error=2076, $p<0.001$). As such, while both Treatment and Comparison participants showed significant decreases over the examined window, Treatment participants demonstrated a larger decrease than Comparison, indicating a significant effect of MRT-SH enrollment on Medicaid claim spending for these high-spending clients.

³⁹ Repeated Measures ANOVA within-subjects effect; "+" – $p<0.1$; "*" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

⁴⁰ Repeated Measures ANOVA within-subjects effect; "+" – $p<0.1$; "*" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

⁴¹ Repeated Measures ANOVA interaction; "+" – $p<0.1$; "*" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

Decile 10

Table 14A. Spending treatment effects for decile 10

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ⁴²	Mean Post-Pre Difference
Treatment	256	\$104,843.73	\$59,159.65	***	-\$45,684.08
Comparison	256	\$118,306.07	\$83,637.58		-\$34,668.49
Main Effect of Time⁴³				***	Interaction⁴⁴
					*

Table 14B. Pre-post spending difference percentiles for decile 10

Percentile	Treatment	Comparison
5	-\$154,972.57	-\$149,731.81
10	-\$110,545.05	-\$103,288.58
25	-\$74,553.82	-\$64,025.94
50	-\$44,503.63	-\$23,047.89
75	-\$9,122.61	\$7,550.51
90	\$18,678.57	\$28,786.41
95	\$49,961.00	\$45,302.02

Clients in the tenth (highest) spending decile demonstrated significant main effects of time ($F(1,510)=166.727, p<0.001$), where spending tended to decrease over the examined interval, and group ($F(1,510)=20.692, p<0.001$), where Treatment clients spending was lower than for Comparison, as well as a significant interaction between these two factors ($F(1,510)=3.133$, adjusted Standard Error=5572, $p=0.02$). As such, while both Treatment and Comparison participants showed significant decreases over the examined window, Treatment participants demonstrated a larger decrease than Comparison, indicating a significant effect of MRT-SH enrollment on Medicaid claim spending for these high-spending clients.

Decile Summary

Not all of the ten spending deciles demonstrated significant cost savings. Both Treatment and Comparison participants in the lower deciles tended to show statistically significant increases in spending from the pre- to the post-periods that were similar between groups (i.e., a main effect of time). These increases may reflect a simple “nowhere to go but up” regression to the mean, but given the slightly greater increases seen for Treatment, may also demonstrate improved access to needed services after program enrollment. In most cases, these increases were typically a few hundred to a few thousand dollars.

However, participants whose pre-period spending ranked them in the top two deciles demonstrated significant decreases in spending across the interval; and importantly, in both cases, these decreases were greater for Treatment than Comparison clients. The decreases seen for Comparison clients may reflect the fact that with pre-period spending so high, there was more “room” to show improvement over the post-period; however, the fact that savings were significantly greater for Treatment clients indicates that the decreases found can be attributed to the program itself and not simply to regression to the mean.

⁴² Repeated Measures ANOVA within-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

⁴³ Repeated Measures ANOVA within-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

⁴⁴ Repeated Measures ANOVA interaction; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

Figure 2. Pre-post treatment effects by pre-period spending decile



SPENDING CHANGE COMPARISON FOR PARTICIPANTS BY CATEGORY OF SERVICE

Pre- to post-period changes in spending were then examined across all participants but within each category of service. Again, it is important to note that while Treatment and Comparison participants were matched on overall pre-period Medicaid claim spending, within-category spending was not included in the propensity score model, and thus the model was not optimized for these comparisons. As such, the two groups could be significantly different on spending within each category to start. Treatment effects are thus best described through a difference-in-differences approach, where changes in spending patterns are compared between groups across the two time periods. Any results from these analyses should be taken as preliminary, but can be used to determine potential cost drivers that result in the overall spending effects seen. Results are shown within each category, then summarized across categories.

Clinic

Table 15A. Spending treatment effects for Clinic

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ⁴⁵	Mean Post-Pre Difference
Treatment	2,037	\$2,684.93	\$2,062.07	***	-\$622.86
Comparison	2,037	\$2,100.08	\$1,761.12		-\$338.96
Main Effect of Time⁴⁶		***		Interaction⁴⁷	
				*	

Table 15B. Pre-post spending difference percentiles for Clinic

Percentile	Treatment	Comparison
5	-\$6,738.15	-\$6,358.05
10	-\$4,020.65	-\$3,715.38
25	-\$1,218.42	-\$762.27
50	\$0.00	\$0.00
75	\$188.69	\$75.31
90	\$2,100.33	\$2,052.89
95	\$3,990.91	\$4,954.03

Treatment and Comparison group clients demonstrated several significant differences on Clinic-related costs over the window. There were significant main effects of time ($F(1,4072)=69.867, p<0.001$), where spending tended to decrease over the period, and group ($F(1,4072)=16.879, p<0.001$), where Treatment group spending was greater than Comparison. There was also a significant interaction between these two factors ($F(1,4072)=6.087, p=0.014$), where Treatment clients showed a greater decrease than Comparison. However, the total spending in this category of service was relatively low, and the pre-to-post change small.

⁴⁵ Repeated Measures ANOVA within-subjects effect; "+" – $p<0.1$; "*" – $p<0.05$, "**" – $p<0.01$, "****" – $p<0.001$, "n.s." – not significant.

⁴⁶ Repeated Measures ANOVA within-subjects effect; "+" – $p<0.1$; "*" – $p<0.05$, "**" – $p<0.01$, "****" – $p<0.001$, "n.s." – not significant.

⁴⁷ Repeated Measures ANOVA interaction; "+" – $p<0.1$; "*" – $p<0.05$, "**" – $p<0.01$, "****" – $p<0.001$, "n.s." – not significant.

Durable Medical Equipment

Table 16A. Spending treatment effects for DME

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ⁴⁸	Mean Post-Pre Difference
Treatment	2,037	\$145.47	\$117.52	n.s.	-\$2795
Comparison	2,037	\$94.30	\$101.15		\$6.85
Main Effect of Time⁴⁹			n.s.	Interaction⁵⁰	
				n.s.	

Table 16B. Pre-post spending difference percentiles for DME

Percentile	Treatment	Comparison
5	-\$342.58	-\$268.53
10	-\$124.72	-\$38.04
25	\$0.00	\$0.00
50	\$0.00	\$0.00
75	\$0.00	\$0.00
90	\$0.00	\$0.00
95	\$115.15	\$193.99

There were no significant main effects or changes in DME-related spending for the periods and groups examined. However, mean DME-related spending was quite low both pre- and post-, as most participants did not have any DME-related costs, so this nonsignificance is not surprising.

⁴⁸ Repeated Measures ANOVA within-subjects effect; "+" – p<0.1; "*" – p<0.05, "****" – p<0.01, "*****" – p<0.001, "n.s." – not significant.

⁴⁹ Repeated Measures ANOVA within-subjects effect; "+" – p<0.1; "*" – p<0.05, "****" – p<0.01, "*****" – p<0.001, "n.s." – not significant.

⁵⁰ Repeated Measures ANOVA interaction; "+" – p<0.1; "*" – p<0.05, "****" – p<0.01, "*****" – p<0.001, "n.s." – not significant.

Emergency Department

Table 17A. Spending treatment effects for Emergency Department

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ⁵¹	Mean Post-Pre Difference
Treatment	2,037	\$691.26	\$438.71	n.s.	-\$252.56
Comparison	2,037	\$641.64	\$492.89		-\$148.74
Main Effect of Time⁵²		***		Interaction⁵³ *	

Table 17B. Pre-post spending difference percentiles for Emergency Department

Percentile	Treatment	Comparison
5	-\$1,805.76	-\$1,436.82
10	-\$1,057.74	-\$924.30
25	-\$383.15	-\$383.86
50	\$0.00	\$0.00
75	\$55.99	\$43.59
90	\$470.86	\$500.47
95	\$857.92	\$987.57

Treatment and Comparison group clients demonstrated several significant differences in Emergency Department-related costs over the window. There was a significant main effect of time ($F(1,4072)=88.417, p<0.001$), where spending tended to decrease over the period, but not of group ($p>0.2$). However, there was also a significant interaction between these two factors ($F(1,4072)=5.917, p=0.016$), where Treatment clients showed a greater decrease than Comparison.

Emergency department spending was expected to decrease particularly after enrollment in MRT-SH programs. These results support this hypothesis. Notably, as characterized in Cost Report 2 Volume 1, emergency department visits do not tend to be especially costly, and are not especially frequent. But they still may represent a domain of medical spending particularly impacted by MRT-SH programming.

⁵¹ Repeated Measures ANOVA within-subjects effect; "†" – $p<0.1$; "***" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.
⁵² Repeated Measures ANOVA within-subjects effect; "†" – $p<0.1$; "***" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.
⁵³ Repeated Measures ANOVA interaction; "†" – $p<0.1$; "***" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

Health Home/Care Management

Table 18A. Spending treatment effects for Health Home/Care Management

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ⁵⁴	Mean Post-Pre Difference
Treatment	2,037	\$1,828.65	\$2,502.95	***	\$674.30
Comparison	2,037	\$590.52	\$933.55		\$343.03
Main Effect of Time⁵⁵		***		Interaction⁵⁶ ***	

Table 18B. Pre-post spending difference percentiles for Health Home/Care Management

Percentile	Treatment	Comparison
5	-\$2,113.66	-\$885.00
10	-\$1,196.56	-\$376.33
25	-\$140.15	\$0.00
50	\$406.16	\$0.00
75	\$1,554.35	\$399.23
90	\$2,889.66	\$1,771.43
95	\$3,956.09	\$2,813.25

Treatment and Comparison group clients demonstrated several significant differences on Health Home and care management-related costs over the window. There were significant main effects of time ($F(1,4072)=329.483, p<0.001$), where spending tended to increase over the period, and group, ($F(1,4072)=497.056, p<0.001$), where Treatment participants had greater spending than Comparison. There was also a significant interaction between these two factors ($F(1,4072)=34.936, p<0.001$), where Treatment clients showed a greater spending increase than Comparison.

Health home enrollment was an important component of eligibility for MRT-SH programs. Further, programs often aimed to enroll new clients into health homes upon their entry into MRT-SH. As such, it is not surprising that Treatment client’s health home/care management spending increased over this window, as it likely reflects receipt of needed services.

⁵⁴ Repeated Measures ANOVA within-subjects effect; “+” – p<0.1; “*” – p<0.05, “**” – p<0.01, “****” – p<0.001, “n.s.” – not significant.
⁵⁵ Repeated Measures ANOVA within-subjects effect; “+” – p<0.1; “*” – p<0.05, “**” – p<0.01, “****” – p<0.001, “n.s.” – not significant.
⁵⁶ Repeated Measures ANOVA interaction; “+” – p<0.1; “*” – p<0.05, “**” – p<0.01, “****” – p<0.001, “n.s.” – not significant.

Hospital Inpatient

Table 19A. Spending treatment effects for Hospital Inpatient

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ⁵⁷	Mean Post-Pre Difference
Treatment	2,037	\$10,931.20	\$7,724.25	**	-\$3,206.95
Comparison	2,037	\$14,763.71	\$8,238.52		-\$6,525.18
Main Effect of Time⁵⁸		***		Interaction⁵⁹ ***	

Table 19B. Pre-post spending difference percentiles for Hospital Inpatient

Percentile	Treatment	Comparison
5	-\$34,578.12	-\$43,693.27
10	-\$20,289.94	-\$27,753.43
25	-\$6,289.79	-\$10,721.83
50	\$0.00	\$0.00
75	\$0.00	\$0.00
90	\$10,457.44	\$8,940.11
95	\$20,598.38	\$18,634.71

Treatment and Comparison group clients demonstrated several significant differences on hospital inpatient-related costs over the window. There were significant main effects of time ($F(1,4072)=106.605, p<0.001$), where spending tended to decrease over the period, and group, ($F(1,4072)=9.825, p=0.002$), where Treatment participants had lower spending than Comparison. There was also a significant interaction between these two factors ($F(1,4072)=12.393, p=0.001$), where Treatment clients showed a smaller spending decrease than Comparison.

As such, hospital inpatient-related spending was potentially impacted by MRT-SH enrollment, as demonstrated by the within-group decrease seen for Treatment clients, but this decrease was still smaller than that found for Comparison clients. However, Comparison clients also showed significantly greater pre-period spending in this category ($t(1,2036)=-4.733, p<0.001$), thus allowing more “room” to decrease down to a similar level over the examined window.

⁵⁷ Repeated Measures ANOVA within-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “****” – $p<0.001$, “n.s.” – not significant.

⁵⁸ Repeated Measures ANOVA within-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “****” – $p<0.001$, “n.s.” – not significant.

⁵⁹ Repeated Measures ANOVA interaction; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “****” – $p<0.001$, “n.s.” – not significant.

Hospital Outpatient

Table 20A. Spending treatment effects for Hospital Outpatient

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ⁶⁰	Mean Post-Pre Difference
Treatment	2,037	\$3,084.29	\$2,628.28	***	-\$456.01
Comparison	2,037	\$2,022.07	\$2,092.70		\$70.62
Main Effect of Time⁶¹		**		Interaction⁶² ***	

Table 20B. Pre-post spending difference percentiles for Hospital Outpatient

Percentile	Treatment	Comparison
5	-\$6,847.85	-\$5,017.00
10	-\$4,037.26	-\$2,825.97
25	-\$1,416.94	-\$738.18
50	-\$54.77	\$0.00
75	\$576.55	\$648.25
90	\$2,776.92	\$2,858.78
95	\$5,067.28	\$5,384.21

Treatment and Comparison group clients demonstrated several significant differences on hospital outpatient-related costs over the window. There were significant main effects of time ($F(1,4072)=8.516, p=0.004$), where spending tended to decrease over the period, and group, ($F(1,4072)=44.517, p<0.001$), where Treatment participants had greater spending than Comparison. There was also a significant interaction between these two factors ($F(1,4072)=15.902, p<0.001$), where Treatment clients showed a greater spending decrease than Comparison.

As such, hospital outpatient-related spending was impacted by MRT-SH enrollment: while Treatment clients started at a higher level of spending ($t(1,2036)=7.959, p<0.001$), they also tended to show a decrease in spending, while Comparison clients' outpatient spending did not show any significant changes over this window.

⁶⁰ Repeated Measures ANOVA within-subjects effect; "+" – $p<0.1$; "*" – $p<0.05$, "**" – $p<0.01$, "****" – $p<0.001$, "n.s." – not significant.
⁶¹ Repeated Measures ANOVA within-subjects effect; "+" – $p<0.1$; "*" – $p<0.05$, "**" – $p<0.01$, "****" – $p<0.001$, "n.s." – not significant.
⁶² Repeated Measures ANOVA interaction; "+" – $p<0.1$; "*" – $p<0.05$, "**" – $p<0.01$, "****" – $p<0.001$, "n.s." – not significant.

Lab

Table 21A. Spending treatment effects for Lab

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ⁶³	Mean Post-Pre Difference
Treatment	2,037	\$247.92	\$186.31	*	-\$61.61
Comparison	2,037	\$180.52	\$140.86		-\$39.66
Main Effect of Time⁶⁴		**		Interaction⁶⁵ n.s.	

Table 21B. Pre-post spending difference percentiles for Lab

Percentile	Treatment	Comparison
5	-\$761.05	-\$549.17
10	-\$364.41	-\$279.98
25	-\$69.17	-\$58.03
50	\$0.00	\$0.00
75	\$0.00	\$0.00
90	\$98.93	\$125.73
95	\$325.38	\$361.09

Treatment and Comparison group clients demonstrated several significant differences on lab-related costs over the window. There were significant main effects of time ($F(1,4072)=7.272, p=0.007$), where spending tended to decrease over the period, and group, ($F(1,4072)=4.728, p=0.030$), where Treatment participants had greater spending than Comparison. But there was no significant interaction between these two factors ($p>0.2$); as such, both Treatment and Comparison participants tended to show similar decreases. However, the total spending in this category of service was relatively low, and the pre-to-post change particularly small, making this category a minor cost driver.

⁶³ Repeated Measures ANOVA within-subjects effect; "+" – $p<0.1$; "*" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

⁶⁴ Repeated Measures ANOVA within-subjects effect; "+" – $p<0.1$; "*" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

⁶⁵ Repeated Measures ANOVA interaction; "+" – $p<0.1$; "*" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

Non-Institutional Long-Term Care

Table 22A. Spending treatment effects for Non-Institutional Long-Term Care

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ⁶⁶	Mean Post-Pre Difference
Treatment	2,037	\$1,032.42	\$1,455.59	n.s.	\$423.17
Comparison	2,037	\$972.77	\$2,006.07		\$1,033.30
Main Effect of Time⁶⁷		***		Interaction⁶⁸ **	

Table 22B. Pre-post spending difference percentiles for Non-Institutional Long-Term Care

Percentile	Treatment	Comparison
5	\$0.00	\$0.00
10	\$0.00	\$0.00
25	\$0.00	\$0.00
50	\$0.00	\$0.00
75	\$0.00	\$0.00
90	\$159.39	\$0.00
95	\$3,950.33	\$3,167.68

Treatment and Comparison group clients demonstrated several significant differences on NILTC-related costs over the window. There was a significant main effect of time ($F(1,4072)=44.388, p<0.001$), where spending tended to increase over the period, but no main effect of group ($p>0.2$). However, there was a significant interaction between these two factors ($F(1,4072)=7.789, p=0.005$), where Treatment clients tended to show a smaller increase in spending than Comparison clients. Interestingly, no participants demonstrated decreases in NILTC costs; only spending increases were seen. This pattern implies that participants did not stop receiving NILTC services over this period, but some, and particularly Comparison group clients, may have started to receive them, or receive more.

However, as demonstrated by the pre-post spending difference percentiles, few clients had any spending in this category to begin with, and fewer had any major changes (those being increases); as such, these shifts are likely driven by only a few individuals and may not be generalizable across the full population.

⁶⁶ Repeated Measures ANOVA within-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

⁶⁷ Repeated Measures ANOVA within-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

⁶⁸ Repeated Measures ANOVA interaction; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

Nursing Home

Table 23A. Spending treatment effects for Nursing Home

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ⁶⁹	Mean Post-Pre Difference
Treatment	2,037	\$1,309.32	\$178.83	***	-\$1,130.49
Comparison	2,037	\$8,371.20	\$9,492.55		\$1,121.35
Main Effect of Time⁷⁰		n.s.		Interaction⁷¹ ***	

Table 23B. Pre-post spending difference percentiles for Nursing Home

Percentile	Treatment	Comparison
5	\$0.00	-\$2,378.24
10	\$0.00	\$0.00
25	\$0.00	\$0.00
50	\$0.00	\$0.00
75	\$0.00	\$0.00
90	\$0.00	\$1,857.67
95	\$0.00	\$17,397.40

Treatment and Comparison group clients demonstrated several significant differences on nursing home-related costs over the window. There was not a significant main effect of time ($p>0.2$), but there was a significant main effect of group ($F(1,4072)=226.024, p<0.001$), where Treatment clients consistently demonstrated lower spending than Comparison. A significant interaction ($F(1,4072)=33.977, p<0.001$) shows that spending for Treatment clients tended to decrease over the period, while spending for Comparison clients tended to increase. Nursing home spending was limited to a small proportion of Treatment clients, and so did not change for 96% of this group; as such, the pre-post spending difference percentiles are unable to accurately reflect the changes in spending for the remaining 4% of clients.

Notably, pre-period nursing home-related spending was significantly greater for Comparison than Treatment clients ($t(1,2036)=-13.567, p<0.001$). In this case, the fact that Comparison spending actually showed an upward trend while Treatment spending decreased demonstrates a direct impact of MRT-SH enrollment on nursing home-related costs: enrollment may decrease spending, or prevent increases.

⁶⁹ Repeated Measures ANOVA within-subjects effect; "+" – $p<0.1$; "*" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

⁷⁰ Repeated Measures ANOVA within-subjects effect; "+" – $p<0.1$; "*" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

⁷¹ Repeated Measures ANOVA interaction; "+" – $p<0.1$; "*" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

Other

Table 24A. Spending treatment effects for Other

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ⁷²	Mean Post-Pre Difference
Treatment	2,037	\$4,131.88	\$1,991.22	**	-\$2,140.66
Comparison	2,037	\$2,040.14	\$2,662.18		\$622.04
Main Effect of Time⁷³		***		Interaction⁷⁴ ***	

Table 24B. Pre-post spending difference percentiles for Other

Percentile	Treatment	Comparison
5	-\$26,554.73	-\$4,643.87
10	-\$7,175.34	-\$2,169.19
25	-\$1,059.08	-\$415.88
50	-\$51.61	\$0.00
75	\$136.65	\$196.49
90	\$2,601.44	\$3,430.91
95	\$6,014.87	\$7,506.46

Treatment and Comparison group clients demonstrated several significant differences on “other” costs over the window. There were significant main effects of time ($F(1,4072)=31.386, p<0.001$), where spending tended to decrease from the pre- to the post-period, and group ($F(1,4072)=11.688, p=0.001$), where Treatment clients demonstrated greater spending than Comparison. However, a significant interaction ($F(1,4072)=103.873, p<0.001$) showed that spending for Treatment clients tended to decrease over the period, while spending for Comparison clients tended to increase: while Treatment clients started with greater spending ($t(1,2036)=8.352, p<0.001$), their post-period spending was actually slightly lower than that for Comparison clients. As such, MRT-SH enrollment may have a direct impact on “other” costs.

⁷² Repeated Measures ANOVA within-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

⁷³ Repeated Measures ANOVA within-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

⁷⁴ Repeated Measures ANOVA interaction; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

Pharmacy

Table 25A. Spending treatment effects for Pharmacy

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ⁷⁵	Mean Post-Pre Difference
Treatment	2,037	\$5,240.29	\$5,834.96	***	\$594.67
Comparison	2,037	\$2,606.68	\$3,412.74		\$806.06
Main Effect of Time⁷⁶		**		Interaction⁷⁷ n.s.	

Table 25B. Pre-post spending difference percentiles for Pharmacy

Percentile	Treatment	Comparison
5	-\$6,142.25	-\$3,023.14
10	-\$2,844.80	-\$1,364.17
25	-\$541.42	-\$122.65
50	\$0.00	\$2.24
75	\$669.58	\$672.00
90	\$3,764.87	\$3,861.58
95	\$8,605.50	\$7,004.85

While pharmacy costs for Treatment and Comparison group clients showed significant main effects of time (($F(1,4072)=10.764, p=0.001$), where spending tended to increase from the pre- to the post-period), and group ($F(1,4072)=64.627, p<0.001$), where Treatment clients demonstrated greater spending than Comparison, there was no significant interaction ($p>0.2$). As such, Treatment clients consistently had higher spending than Comparison, and both showed significant but relatively small increases in pharmacy-related spending over the interval examined.

⁷⁵ Repeated Measures ANOVA within-subjects effect; "+" – $p<0.1$; "*" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

⁷⁶ Repeated Measures ANOVA within-subjects effect; "+" – $p<0.1$; "*" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

⁷⁷ Repeated Measures ANOVA interaction; "+" – $p<0.1$; "*" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

Physician Services

Table 26A. Spending treatment effects for Physician Services

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ⁷⁸	Mean Post-Pre Difference
Treatment	2,037	\$1,931.30	\$1,304.59	†	-\$626.71
Comparison	2,037	\$1,700.61	\$1,177.01		-\$523.60
Main Effect of Time⁷⁹		***		Interaction⁸⁰ n.s.	

Table 26B. Pre-post spending difference percentiles for Physician Services

Percentile	Treatment	Comparison
5	-\$4,577.90	-\$4,518.86
10	-\$3,004.23	-\$2,670.29
25	-\$1,255.25	-\$995.15
50	-\$155.64	-\$146.40
75	\$105.33	\$111.18
90	\$1,186.02	\$1,182.11
95	\$2,469.78	\$2,427.82

Treatment and Comparison clients demonstrated similar decreases in physician service-related spending over the period. There was a significant main effect of time, $F(1,4072)=89.846, p<0.001$, and a marginal effect of group, $F(1,4072)=3.424, p=0.064$, but no interaction between the two ($p>0.2$). As such, both Treatment and Comparison clients' physician-service related spending tended to decrease over the period; while Treatment clients' spending was slightly higher, the difference was only marginal.

⁷⁸ Repeated Measures ANOVA within-subjects effect; "†" – $p<0.1$; "***" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

⁷⁹ Repeated Measures ANOVA within-subjects effect; "†" – $p<0.1$; "***" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

⁸⁰ Repeated Measures ANOVA interaction; "†" – $p<0.1$; "***" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

Transportation

Table 27A. Spending treatment effects for Transportation

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ⁸¹	Mean Post-Pre Difference
Treatment	2,037	\$1,039.60	\$1,146.10	***	\$106.50
Comparison	2,037	\$625.74	\$809.86		\$184.12
Main Effect of Time⁸²		***		Interaction⁸³ n.s.	

Table 27B. Pre-post spending difference percentiles for Transportation

Percentile	Treatment	Comparison
5	-\$4,577.90	-\$4,518.86
10	-\$3,004.23	-\$2,670.29
25	-\$1,255.25	-\$995.15
50	-\$155.64	-\$146.40
75	\$105.33	\$111.18
90	\$1,186.02	\$1,182.11
95	\$2,469.78	\$2,427.82

Treatment and Comparison clients demonstrated similar increases in transportation-related spending over the period. There was a significant main effect of time, $F(1,4072)=16.263, p<0.001$, where spending increased over the period, and of effect of group, $F(1,4072)=28.940, p<0001$, where spending was higher for Treatment clients than Comparison, but no interaction between the two ($p>0.2$). As such, both Treatment and Comparison clients' transportation-related spending tended to increase over the period; while Treatment clients' spending was slightly higher, the pattern was similar.

⁸¹ Repeated Measures ANOVA between-subjects effect; "+" – $p<0.1$; "***" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.
⁸² Repeated Measures ANOVA within-subjects effect; "+" – $p<0.1$; "***" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.
⁸³ Repeated Measures ANOVA interaction; "+" – $p<0.1$; "***" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

Category of Service Summary

Pre- versus post-period spending for Treatment and Comparison clients was examined within the thirteen categories of service. Most categories showed only small changes in spending over the interval, where Treatment and Comparison initial spending and changes were similar. However, three categories showed either large overall spending changes or a notable interaction between groups over time, and thus likely constitute much of the overall spending decrease seen.

First, hospital inpatient spending demonstrated large decreases for both Treatment and Comparison clients. Cost Report 2 Volume 1 demonstrated significant decreases in hospital inpatient spending for the full MRT-SH Treatment group; this result was thus conserved for this Treatment subsample. This drop was larger for Comparison than Treatment; however, Comparison also showed greater inpatient spending in the pre-period, allowing more “room” to decrease. Whether MRT-SH thus can be said to result in lower hospital inpatient spending than “treatment as usual” is unclear, though the consistent spending decrease seen is promising.

However, in two other cases, Treatment spending decreased while Comparison spending increased, illustrating a clear effect of intervention. Nursing home spending decreased for Treatment clients, while increasing for Comparison, even given Comparison’s greater spending in the pre-period, resulting in an MRT-SH specific savings of about \$2,250. Nursing home settings are particularly expensive; as such, moving clients from nursing homes to more independent supportive housing environments, or preventing such stays to begin with, can represent major cost savings. Treatment clients appeared to demonstrate such active savings, while Comparison clients maintained or increased their nursing home-related spending, likely because nursing home stays were neither actively prevented nor ended.

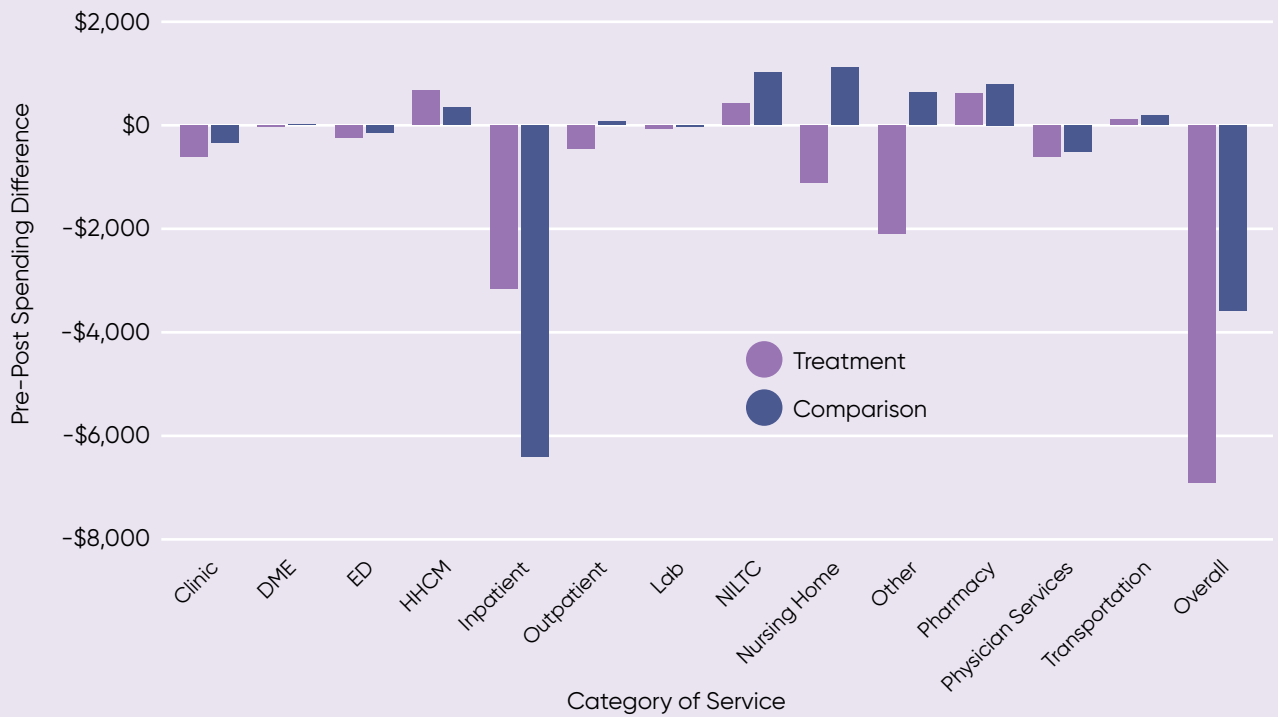
“Other” claims also decreased for Treatment clients, while remaining relatively steady for Comparison, resulting in an MRT-SH specific savings of about \$2,760. In Cost Report 2 Volume 1, these differences were primarily due to decreases in OMH rehabilitative services and GME costs. Here, most other costs were related to OMH Community Residences (39% of Other claims; rate codes = 4369, 4520, 4521, 4522, 4523, 4524, 4722), Personalized Recovery Services (29% of Other claims; rate codes 4510, 4521, 4525, 4526, 4527), or Graduate Medical Education (16% of Other claims; rate codes 3130, 3131). As such, Treatment clients may thus need less of these services after MRT-SH enrollment, or may incur fewer such charges due to lowered utilization, while Comparison clients continue to need these services.

Emergency Department spending was hypothesized to be significantly impacted by MRT-SH; however, while spending did significantly decrease more for Treatment than Comparison, the overall drop was small and the group difference was only about \$100. As Emergency Department visits are both relatively infrequent and relatively inexpensive at each encounter (as characterized in Cost Report 2 Volume 1), this domain may not represent an area of likely large savings after MRT-SH enrollment, but more likely to show small improvements.

Notably, several categories demonstrated significant increases for both Treatment and Comparison clients; both groups showed increased spending for Health Homes/Care Management, Non-Institutional Long-Term Care, and Pharmacy domains in the post-period. Both Health Homes/Care Management and Pharmacy also demonstrated average increases for the full MRT-SH group in Cost Report 2 Volume 1; the increases seen here are thus consistent with those patterns, but also demonstrate that the changes themselves are likely not due to MRT-SH participation, as Comparison clients showed similar increases. Non-Institutional Long-Term Care costs had previously been shown to decrease very slightly overall, but here increased for both Treatment and Comparison; again, this shift is likely not attributable to the MRT-SH intervention, but may reflect continued needs in this domain regardless of treatment situation. However, these increases were, on average, only a few hundred dollars, and thus unlikely to represent changes holding MRT-SH programs back from achieving cost savings.

Again, though, while clients were matched on overall pre-period spending, within-category spending was not included in the propensity score model, and thus the model was not optimized for these comparisons. As such, these results should be taken as preliminary, but can be used to determine potential cost drivers that result in the overall spending effects seen.

Figure 3. Pre-post treatment effects by Medicaid claim category of service



Directions for Future Research

As noted in the Methodology section, comparisons between subsets of Treatment and Comparison clients cannot be considered as reliable as comparisons between the full groups (or between subsets explicitly matched in the propensity score modeling process, e.g., by spending decile), as the model implemented was not optimized for such breakouts. Specifically, while diagnosis and prior housing status (at least two of the three settings) were included in the propensity score model as covariates, and thus were part of the creation of the propensity score, matching was not a *requirement* during Comparison participant selection. As such, while the subgroup of participants with each diagnosis or prior housing situation can be identified, and spending compared under the same procedures, the subgroups may not be well-matched on pre-period spending or on any other modeled factor (e.g., demographics, histories, clinical background, etc.).

However, provided certain conditions are met, these subset analyses can be performed in a more exploratory manner; the patterns found may direct future research in useful directions and point to more specific models based around these factors. As such, the feasibility of subset analyses based on each diagnosis and prior housing status was first examined. The number of Treatment and Comparison clients meeting analysis criteria was first examined; at least 25 clients in each group were required. The distribution of covariates between Treatment and Comparison clients meeting each criteria was then evaluated to determine how well-matched these subgroups were. Any items which demonstrated significant group differences in distributions were included as covariates in the ANCOVA to at least partially account for any differences. Further, in these ANCOVAs, group was treated as an independent factor, as the subgroups were not necessarily pairs of clients drawn from the same underlying distribution. The breakout analyses were then performed, though interpretations and conclusions are necessarily limited.

SPENDING CHANGE COMPARISON FOR PARTICIPANTS BY DIAGNOSIS

Spending for MRT-SH Treatment and Comparison clients with each diagnosis, and with three or more (or four) diagnoses, was first compared.

Serious Mental Illness

The distribution of covariates within pairs of Treatment and Comparison clients with an SMI was evaluated to determine how well-matched this subgroup was. Treatment clients were less likely to have had a pre-period inpatient stay (52% vs 62%, $t(1,3160)=-5.686, p<0.001$), less likely to have an SUD (51% vs 57%, $t(1,3160)=-3.269, p=0.001$), less likely to have been receiving managed care (41% vs 46%, $t(1,3160)=-2.987, p=0.003$), less likely to have had a stay in an OMH facility (5.5% vs 7%, $t(1,3160)=-2.082, p=0.037$), and more likely to be white (44% vs 39%, $t(1,3160)=-2.49, p=0.013$). As such, these factors were included as covariates in the ANCOVA to at least partially account for any group differences.

Table 28A. Spending treatment effects for participants with an SMI

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ⁸⁴	Mean Post-Pre Difference
Treatment	1,563	\$34,942.15	\$26,603.42	*	-\$8,338.73
Comparison	1,599	\$37,153.50	\$32,922.63		-\$4,230.87
Main Effect of Time⁸⁵		n.s.		Interaction⁸⁶ ***	

Table 28B. Pre-post spending difference percentiles for participants with an SMI

Percentile	Treatment	Comparison
5	-\$55,414.08	-\$53,914.23
10	-\$40,704.54	-\$35,658.71
25	-\$17,467.00	-\$14,874.19
50	-\$3,615.90	-\$2,863.41
75	\$4,004.95	\$7,676.62
90	\$16,904.38	\$25,770.52
95	\$32,358.27	\$43,955.46

Pre-period spending did not significantly differ between the Treatment and Comparison clients with an SMI ($t(1,3160)=-1.574, p>0.1$). While there was not a significant main effect of time ($p>0.15$), there was a main effect of group ($F(1,3155)=6.291, p=0.012$), where Treatment clients had lower spending than Comparison. There was also a significant interaction between these two factors ($F(1,3155)=18.312, p<0.001$); as such, Treatment clients with an SMI showed a significantly greater spending decrease than did Comparison.

It is important to note that these two groups were not selected to necessarily match each other: as such, the differences seen could be attributable to MRT-SH enrollment, but also could be due to some other demographic or clinical difference between these groups that the simple inclusion of covariates in the ANCOVA was unable to overcome. However, the substantial spending decrease seen particularly for Treatment clients is promising.

⁸⁴ Repeated Measures ANCOVA between-subjects effect; "†" – $p<0.1$; "***" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

⁸⁵ Repeated Measures ANCOVA within-subjects effect; "†" – $p<0.1$; "***" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

⁸⁶ Repeated Measures ANCOVA interaction; "†" – $p<0.1$; "***" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

Substance Use Disorder

The distribution of covariates within pairs of Treatment and Comparison clients with an SUD was evaluated to determine how well-matched this subgroup was. Several variables were significantly different between the Treatment and Comparison samples: Treatment clients were likely to be older (46 years vs 42 years, $t(1,2143)=7.224, p<0.001$), have higher pre-period spending (\$37,000 vs \$32,077, $t(1,2143)=3.281, p=0.001$), be from an urban central city region (41% vs 34%, $t(1,2143)=3.168, p=0.002$), and be white (47% vs 37%, $t(1,2143)=4.743, p<0.001$) or of an other race (5% vs 3%, $t(1,2143)=1.961, p=0.05$); and were less likely to have been involved in care coordination (managed care: $t(1,2143)=-4.202, p<0.001$; health homes: $t(1,2143)=-3.479, p=0.001$), have an SMI (76% vs 83%, $t(1,2143)=-4.065, p<0.001$), be black (32% vs 38%, $t(1,2143)=-3.046, p=0.002$), be from New York City (41% vs 51%, $t(1,2143)=-4.674, p<0.001$), have a history of HMIS shelter use (23% vs 28%, $t(1,2143)=-2.677, p=0.007$), or be male (63% vs 68%, $t(1,2143)=-2.571, p=0.01$). As such, these factors (excluding pre-period cost) were included as covariates in the ANCOVA to at least partially account for any group differences.

Table 29A. Spending treatment effects for participants with an SUD

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ⁸⁷	Mean Post-Pre Difference
Treatment	1,050	\$37,000.56	\$28,496.82	n.s.	-\$8,503.74
Comparison	1,095	\$32,077.29	\$28,022.85		-\$4,054.44
Main Effect of Time⁸⁸		n.s.		Interaction⁸⁹ **	

Table 29B. Pre-post spending difference percentiles for participants with an SUD

Percentile	Treatment	Comparison
5	-\$60,192.25	-\$48,240.92
10	-\$40,797.47	-\$33,623.04
25	-\$17,799.22	-\$16,284.89
50	-\$5,288.41	-\$4,871.99
75	\$3,900.97	\$6,170.79
90	\$18,273.43	\$25,608.86
95	\$35,959.27	\$45,955.64

Again, Treatment and Comparison participants with an SUD demonstrated significantly different pre-period spending ($t(1,2143)=3.281, p=0.001$), where spending for Treatment clients with an SUD was significantly higher than that for Comparison participants. There were no significant main effects of time or group (p 's>0.2), but there was a significant interaction between these two factors, ($F(1,312)=8.088, p=0.004$), where Treatment participants with an SUD demonstrated a greater decrease in spending from the pre- to the post-period than did Comparison participants.

It is important to note that these two groups were not selected to necessarily match each other: as such, the differences seen could be attributable to MRT-SH enrollment, but also could be due to some other demographic or clinical difference between these groups that the simple inclusion of covariates in the ANCOVA was unable to overcome. However, the substantial spending decrease seen particularly for Treatment clients is promising.

⁸⁷ Repeated Measures ANCOVA between-subjects effect; "†" – $p<0.1$; "***" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

⁸⁸ Repeated Measures ANCOVA within-subjects effect; "†" – $p<0.1$; "***" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

⁸⁹ Repeated Measures ANCOVA interaction; "†" – $p<0.1$; "***" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

Other Chronic Condition

The distribution of covariates within pairs of Treatment and Comparison clients with an other chronic condition was evaluated to determine how well-matched this subgroup was. Several variables were significantly different between the Treatment and Comparison samples: Treatment clients were likely to be younger (51 years vs 54.5 years, $t(1,2057)=-4.758$, $p<0.001$), less likely to have a pre-period inpatient visit (53% vs 62%, $t(1,2057)=-4.154$, $p<0.001$), and less likely to be eligible for Medicare (10% vs 15%, $t(1,2057)=-3.405$, $p=0.001$), and more likely to have a higher propensity score (0.069 vs 0.059, $t(1,2057)=2.603$, $p=0.009$) and to be black (41% vs 36%, $t(1,2057)=2.333$, $p=0.02$). As such, these factors (excluding pre-period cost) were included as covariates in the ANCOVA to at least partially account for any group differences.

Table 30A. Spending treatment effects for participants with an other chronic condition

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ⁹⁰	Mean Post-Pre Difference
Treatment	999	\$40,507.71	\$32,527.23	n.s.	-\$7,980.48
Comparison	1,060	\$41,913.60	\$36,567.08		-\$5,346.52
Main Effect of Time⁹¹		n.s.		Interaction⁹² *	

Table 30B. Pre-post spending difference percentiles for participants with an other chronic condition

Percentile	Treatment	Comparison
5	-\$68,023.30	-\$58,756.00
10	-\$44,343.68	-\$39,759.64
25	-\$18,042.85	-\$16,305.28
50	-\$3,047.18	-\$2,277.86
75	\$4,974.32	\$9,499.58
90	\$24,576.43	\$27,026.75
95	\$40,182.74	\$47,206.81

Pre-period spending did not significantly differ between the Treatment and Comparison clients with an other chronic condition ($p>0.2$). There were no significant main effects of time or group (p values >0.2), but there was a significant interaction between these two factors, ($F(1,312)=4.701$, $p=0.030$), where Treatment participants with an SUD demonstrated a greater decrease in spending from the pre- to the post-period than did Comparison participants.

It is important to note that these two groups were not selected to necessarily match each other: as such, the differences seen could be attributable to MRT-SH enrollment, but also could be due to some other demographic or clinical difference between these groups that the simple inclusion of covariates in the ANCOVA was unable to overcome. Even so, the substantial spending decrease seen particularly for Treatment clients is promising.

⁹⁰ Repeated Measures ANCOVA between-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

⁹¹ Repeated Measures ANCOVA within-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

⁹² Repeated Measures ANCOVA interaction; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

HIV

The distribution of covariates within pairs of Treatment and Comparison clients with HIV was evaluated to determine how well-matched this subgroup was. Several variables were significantly different between the Treatment and Comparison samples: Treatment clients were likely to be older (47.9 years vs 42.8 years, $t(1,200)=3.239, p=0.001$), more likely to be enrolled in care coordination (managed care: 83.5% vs 47%, $t(1,200)=5.886, p<0.001$; health homes: 55% vs 30%, $t(1,200)=3.566, p<0.001$), and more likely to live in an urban central city area (32% vs 14%, $t(1,200)=3.046, p=0.003$), and less likely to live in New York City (58% vs 80%, $t(1,200)=-3.515, p=0.001$), less likely to have an SMI (64% vs 82%, $t(1,200)=-2.933, p=0.004$) or an SUD (52% vs 69.5%, $t(1,200)=-2.648, p=0.009$), less likely to have a pre-period inpatient (44% vs 62%, $t(1,200)=-3.515, p=0.001$) or emergency department visit (61% vs 74%, $t(1,200)=-3.515, p=0.001$), less likely to have an HMIS shelter stay (22% vs 35%, $t(1,200)=-2.146, p=0.033$), and likely to have a lower propensity score (0.0232 vs 0.719, $t(1,200)=-4.135, p<0.001$). As such, these factors were included as covariates in the ANCOVA to at least partially account for any group differences.

Table 31A. Spending treatment effects for participants with HIV

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ⁹³	Mean Post-Pre Difference
Treatment	97	\$32,924.47	\$29,986.72	n.s.	-\$2,937.75
Comparison	105	\$31,032.49	\$27,901.82		-\$3,130.68
Main Effect of Time⁹⁴		n.s.		Interaction⁹⁵ n.s.	

Table 31B. Pre-post spending difference percentiles for participants with HIV

Percentile	Treatment	Comparison
5	-\$45,064.50	-\$51,062.15
10	-\$29,564.57	-\$31,823.21
25	-\$13,497.83	-\$12,679.29
50	-\$1,380.27	\$604.36
75	\$4,753.79	\$11,659.74
90	\$23,012.63	\$25,896.16
95	\$47,903.86	\$34,199.74

While Treatment and Comparison clients with HIV did not differ in pre-period spending ($p>0.2$), they also did not show any significant differences or changes in post-period spending (all p values >0.2). As such, spending did not change significantly either by group or time for clients with HIV. However, this subgroup was also particularly small, and differed on several covariates even initially, and so conclusions must especially be limited.

⁹³ Repeated Measures ANCOVA between-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

⁹⁴ Repeated Measures ANCOVA within-subjects effect; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

⁹⁵ Repeated Measures ANCOVA interaction; “+” – $p<0.1$; “*” – $p<0.05$, “**” – $p<0.01$, “***” – $p<0.001$, “n.s.” – not significant.

Three or More Diagnoses

The distribution of covariates within pairs of Treatment and Comparison clients with at least three of these four diagnoses was evaluated to determine how well-matched this subgroup was. Several variables were significantly different between the Treatment and Comparison samples: Treatment clients were older (48 years vs 45 years, $t(1,832)=4.469, p<0.001$), had higher propensity scores (0.127 vs 0.0995, $t(1,832)=4.469, p=0.001$) and higher pre-period spending (\$46,410 vs \$38,575, $t(1,832)=4.469, p=0.005$), more likely to live in an urban central city area (39% vs 28%, $t(1,832)=3.327, p=0.001$), more likely to be white (39% vs 29%, $t(1,832)=3.03, p=0.003$), and more likely to have another chronic condition (96% vs 92%, $t(1,832)=2.376, p=0.018$), and were less likely to be enrolled in care coordination (managed care: 46% vs 61%, $t(1,832)=-4.396, p<0.001$; 43% vs 50%, health homes: $t(1,832)=-2.022, p=0.044$), less likely to live in New York City (47% vs 60%, $t(1,832)=-3.755, p<0.001$), have a pre-period HMIS stay (24% vs 34%, $t(1,832)=-3.16, p=0.002$), or have HIV (13% vs 18%, $t(1,832)=-2.015, p=0.044$). As such, these factors (exempting pre-period cost) were included as covariates in the ANCOVA to at least partially account for any group differences.

Table 32A. Spending treatment effects for participants with three or more diagnoses

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ⁹⁶	Mean Post-Pre Difference
Treatment	399	\$46,410.18	\$32,779.08	n.s.	-\$13,631.10
Comparison	435	\$38,575.45	\$31,749.52		-\$6,825.93
Main Effect of Time⁹⁷		n.s.		Interaction⁹⁸ *	

Table 32B. Pre-post spending difference percentiles for participants with three or more diagnoses

Percentile	Treatment	Comparison
5	-\$76,446.84	-\$60,329.41
10	-\$52,366.48	-\$43,592.53
25	-\$21,412.96	-\$20,439.77
50	-\$6,706.54	-\$5,258.44
75	\$2,411.26	\$6,775.35
90	\$18,611.68	\$25,704.29
95	\$34,366.32	\$53,402.67

Treatment and Comparison participants with at least three of the four diagnoses demonstrated significantly different pre-period spending ($t(1,832)=4.469, p=0.005$), where spending for Treatment clients with at least three diagnoses was significantly higher than that for Comparison participants. And while overall spending in the post-period did not differ between groups ($p>0.2$), Treatment participants with at least three diagnoses also demonstrated a greater decrease in spending from the pre- to the post-period than did Comparison participants with at least three diagnoses, as shown by a significant interaction between time and group ($F(1,822)=4.650, p=0.031$).

It is important to note that these two groups were not selected to necessarily match each other: as such, the differences seen could be attributable to MRT-SH enrollment, but also could be due to some other demographic or clinical difference between these groups that the simple inclusion of covariates in the ANCOVA was unable to overcome. However, the substantial spending decrease seen particularly for Treatment clients is promising.

⁹⁶ Repeated Measures ANCOVA between-subjects effect; "†" – $p<0.1$; "***" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

⁹⁷ Repeated Measures ANCOVA within-subjects effect; "†" – $p<0.1$; "***" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

⁹⁸ Repeated Measures ANCOVA interaction; "†" – $p<0.1$; "***" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

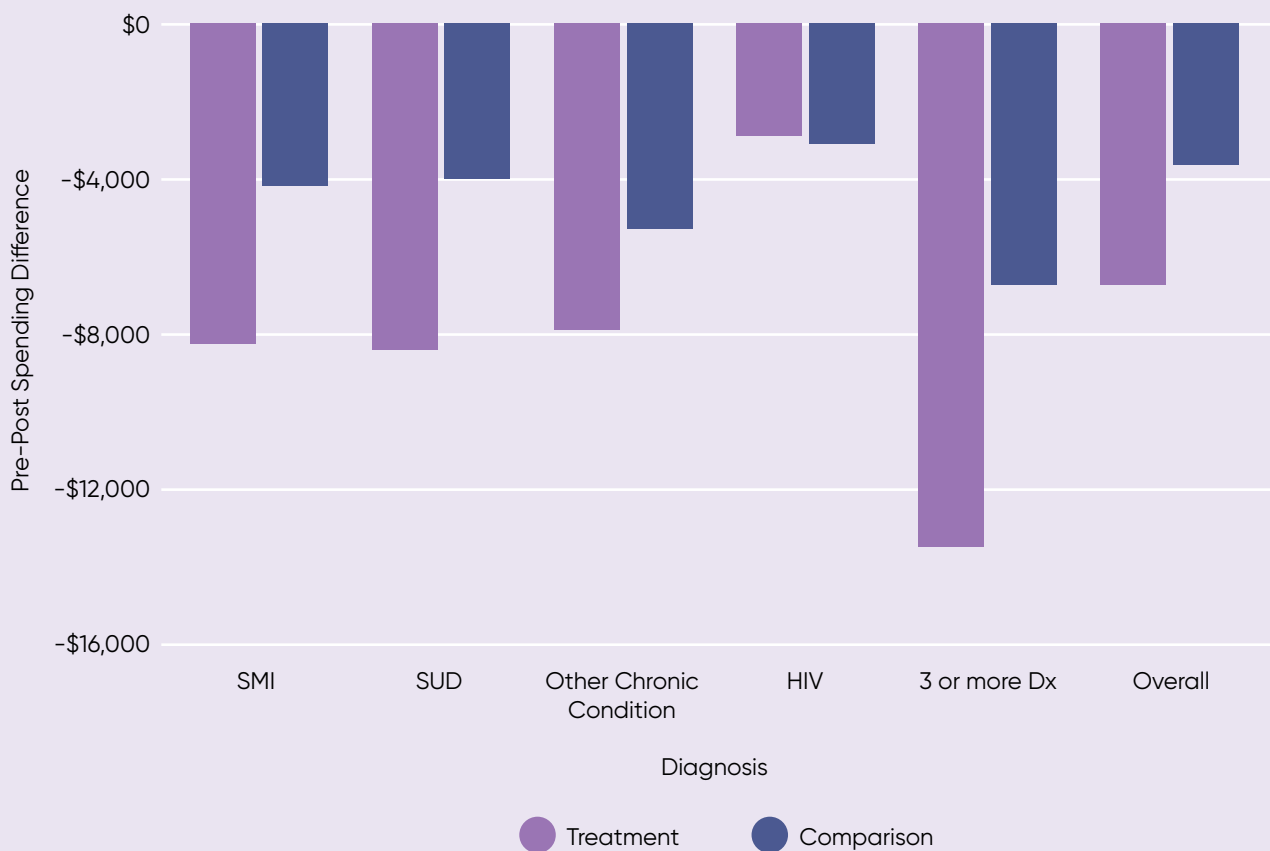
All 4 Diagnoses

There was a very limited pool of clients who met the criteria for all four diagnoses: only 22 Treatment and 31 Comparison clients met this definition. As there were not at least 25 Treatment clients available, no further analyses were performed.

Diagnosis Summary

Comparisons based on pre-period diagnosis are tenuous, as the Treatment and Comparison participants included are not necessarily well-matched on any other modeled factors. As such, these analyses should be treated as exploratory and any patterns taken only as directions for future research with models optimized for such comparisons. But the findings do point to consistency with prior analyses. In general, Treatment participants with a serious mental illness, substance use disorder, or other chronic condition tended to show greater overall savings than did the Comparison participants. Participants with HIV did not show such an interaction. Further, Treatment clients with more complex conditions (e.g., three or more diagnoses) showed greater savings than did Comparison, though their pre-period spending was also significantly higher. Most MRT-SH programs either target individuals with a particular condition (or diagnosis), or aim to serve especially complex cases; these analyses demonstrate that such cases are particularly likely to show significant cost savings beyond "treatment as usual," making these targeting criteria appropriate to pursue, at least from this preliminary look.

Figure 4. Pre-post treatment effects for clients with diagnoses



SPENDING BY PRIOR HOUSING STATUS

Spending for MRT-SH Treatment and Comparison clients with pre-period histories of stays in homeless shelters, OMH residential facilities, and nursing homes was also compared.

Homeless shelter and OMH facility history were included as variables in the propensity score model, but matching on these items was not required for selection. Thus, the subgroups of participants with these histories may not be well-matched on pre-period spending or on any other modeled factor. As such, pre-period spending must be carefully examined, and interpretations and conclusions from any interactions found limited, as differences may be driven by some other unbalanced factor.

HMIS History

The distribution of covariates within pairs of Treatment and Comparison clients with a pre-period HMIS shelter stay was evaluated to determine how well-matched this subgroup was. Several variables were significantly different between the Treatment and Comparison samples: Treatment clients were more likely to be older (48 years vs 42.2 years, $t(1,937)=7.478, p<0.001$), and less likely to have been enrolled in care coordination (managed care: 47% vs 62%, $t(1,937)=-4.784, p<0.001$; health homes: 39% vs 51%, $t(1,937)=-3.677, p<0.001$); have an SUD (62% vs 79%, $t(1,937)=-5.842, p<0.001$), HIV (5% vs 9%, $t(1,937)=-2.688, p=0.007$), or SMI (79% vs 84%, $t(1,937)=-2.278, p=0.023$); or have a pre-period inpatient stay (53% vs 70%, $t(1,937)=-5.393, p<0.001$). As such, these factors were included as covariates in the ANCOVA to at least partially account for any group differences.

Table 33A. Spending treatment effects for participants with a history of HMIS use

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ⁹⁹	Mean Post-Pre Difference
Treatment	532	\$31,917.32	\$25,891.86	†	-\$6,025.46
Comparison	407	\$30,122.64	\$26,846.41		-\$3,276.23
Main Effect of Time¹⁰⁰		n.s.		Interaction¹⁰¹ **	

Table 33B. Pre-post spending difference percentiles for participants with a history of HMIS use

Percentile	Treatment	Comparison
5	-\$61,848.78	-\$45,791.34
10	-\$36,803.07	-\$35,971.47
25	-\$13,205.03	-\$16,763.11
50	-\$2,083.72	-\$5,327.90
75	\$5,181.19	\$6,669.09
90	\$18,583.43	\$26,515.18
95	\$37,097.34	\$50,531.07

Treatment and Comparison participants with a history of homelessness did not demonstrate significantly different pre-period spending ($p>0.2$), indicating reasonable similarity to start. While there was no significant main effect of time ($p>0.1$), there was a marginally significant main effect of group, $F(1,930)=3.569, p=0.059$, and a significant interaction between the two factors, $F(1,930)=5.757, p=0.017$, where Medicaid spending tended to decrease more for Treatment than Comparison clients over the interval.

⁹⁹ Repeated Measures ANCOVA between-subjects effect; "†" – $p<0.1$; "****" – $p<0.05$, "*****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

¹⁰⁰ Repeated Measures ANCOVA within-subjects effect; "†" – $p<0.1$; "****" – $p<0.05$, "*****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

¹⁰¹ Repeated Measures ANCOVA interaction; "†" – $p<0.1$; "****" – $p<0.05$, "*****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

Importantly, these two groups were not selected to necessarily match each other: therefore, the differences seen could be attributable to MRT-SH enrollment, but also could be due to some other demographic or clinical difference between these groups that the simple inclusion of covariates in the ANCOVA was unable to overcome. However, the groups are reasonably well-matched in pre-period spending (i.e., they are not significantly different), and the substantial spending decrease seen particularly for Treatment clients is promising.

Nursing Home History

The distribution of covariates within pairs of Treatment and Comparison clients with at least \$1,000 in pre-period nursing home claim spending was evaluated to determine how well-matched this subgroup was. Several variables were significantly different between the Treatment and Comparison samples: Treatment clients were significantly younger than Comparison (59.9 years vs 72.3 years, $t(1,359)=-5.743, p<0.001$), less likely to have an SMI (47% vs 74%, $t(1,359)=-3.887, p<0.001$) but more likely to have an other chronic condition (90% vs 74%, $t(1,359)=2.511, p=0.012$), more likely to be black (39% vs 23%, $t(1,359)=3.012, p=0.003$) or Hispanic/Latino (22% vs 8%, $t(1,359)=2.442, p=0.015$) and less likely to be white (33% vs 48%, $t(1,359)=3.456, p=0.001$), and more likely to be from a later treatment year (4.35 vs 3.89, $t(1,359)=3.456, p=0.001$), be enrolled in managed care (16% vs 5%, $t(1,359)=2.819, p=0.005$), and be male (63% vs 45%, $t(1,359)=2.297, p=0.022$). As such, these factors were included as covariates in the ANCOVA to at least partially account for any group differences.

Table 34A. Spending treatment effects for participants with a history of nursing home stays

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ¹⁰²	Mean Post-Pre Difference
Treatment	51	\$93,328.00	\$72,759.16	*	-\$20,568.84
Comparison	310	\$79,914.72	\$69,348.17		-\$10,566.55
Main Effect of Time¹⁰³			*		
				Interaction¹⁰⁴	*

Table 34B. Pre-post spending difference percentiles for participants with a history of nursing home stays

Percentile	Treatment	Comparison
5	-\$110,026.53	-\$78,669.53
10	-\$97,537.82	-\$52,044.79
25	-\$75,161.89	-\$16,059.40
50	-\$56,341.15	\$2,242.16
75	-\$26,763.37	\$15,595.80
90	\$28,278.07	\$32,455.99
95	\$83,913.14	\$47,918.73

Treatment and Comparison participants with a history of nursing home stays (defined as nursing home-related claims totaling at least \$1,000 in the pre-period) did not demonstrate significantly different pre-period spending ($p>0.2$), indicating reasonable similarity to start. There was a significant main effect of time ($F(1,350)=4.972, p=0.026$), a significant main effect of group ($F(1,350)=4.597, p=0.033$), and a significant interaction between the two factors ($F(1,350)=6.037, p=0.014$). As such, while Treatment clients with histories of nursing home stays typically demonstrated higher spending than Comparison, and both Treatment and Comparison clients showed at least some average spending decrease, Treatment clients demonstrated a significantly greater decrease in overall spending than did Comparison.

Notably, there were far more Comparison clients with a history of nursing home stays than there were Treatment clients. However, the spending difference percentiles indicate that almost all Treatment participants showed decreased spending (in fact, only six Treatment participants with a history of nursing home-related claims showed spending increases in the post-period, versus over half of the Comparison clients), demonstrating a significant impact of the MRT-SH intervention on reducing and preventing nursing home-related costs.

It is important to note that these two groups were not selected to necessarily match each other: as such, the differences seen could be attributable to MRT-SH enrollment, but also could be due to some other demographic or clinical difference between these groups that the simple inclusion of covariates in the ANCOVA was unable to overcome. However, the groups

¹⁰² Repeated Measures ANCOVA between-subjects effect; "+" - $p<0.1$; "***" - $p<0.05$, "****" - $p<0.01$, "*****" - $p<0.001$, "n.s." - not significant.

¹⁰³ Repeated Measures ANCOVA within-subjects effect; "+" - $p<0.1$; "***" - $p<0.05$, "****" - $p<0.01$, "*****" - $p<0.001$, "n.s." - not significant.

¹⁰⁴ Repeated Measures ANCOVA interaction; "+" - $p<0.1$; "***" - $p<0.05$, "****" - $p<0.01$, "*****" - $p<0.001$, "n.s." - not significant.

are reasonably well-matched in pre-period spending (i.e., they are not significantly different), and the substantial spending decrease seen specifically for Treatment clients is promising.



OMH Facility History

The distribution of covariates within pairs of Treatment and Comparison clients with a pre-period OMH residential facility stay was evaluated to determine how well-matched this subgroup was. Several variables were significantly different between the Treatment and Comparison samples: Treatment clients were more likely to be white (50% vs 37%, $t(1,421)=2.469$, $p=0.012$) and less likely to be black (32% vs 43%, $t(1,421)=-2.334$, $p=0.02$); less likely to live in an urban central city area (21% vs 50%, $t(1,421)=-6.454$, $p<0.001$) and more likely to live in New York City (54% vs 34%, $t(1,421)=3.696$, $p<0.001$) or an urban non-central city area (17% vs 10%, $t(1,421)=2.131$, $p=0.034$); less likely to have been enrolled in health homes (39% vs 57%, $t(1,421)=-3.614$, $p<0.001$) but more likely to have been enrolled in managed care (36% vs 26%, $t(1,421)=2.147$, $p=0.032$); less likely to have a pre-period inpatient visit (50% vs 62%, $t(1,421)=-2.336$, $p=0.02$) or a nursing home stay (>1% vs 4%, $t(1,421)=-2.769$, $p=0.006$); and more likely to have an earlier treatment year (3.45 versus 3.75, $t(1,421)=-3.274$, $p=0.001$). Additionally, Treatment clients tended to have lower average propensity scores than Comparison clients (0.054 vs 0.076, $t(1,421)=-2.831$, $p=0.005$). As such, these factors were included as covariates in the ANCOVA to at least partially account for any group differences.

Table 35A. Spending treatment effects for participants with a history of OMH facility stays

Group	N	Mean Pre-Period Spending	Mean Post-Period Spending	Main Effect of Group ¹⁰⁵	Mean Post-Pre Difference
Treatment	270	\$49,624.92	\$28,103.22	†	-\$21,521.69
Comparison	153	\$51,112.60	\$47,533.10		-\$3,579.51
Main Effect of Time¹⁰⁶		n.s.		Interaction¹⁰⁷ **	

Table 35B. Pre-post spending difference percentiles with a history of OMH facility stays

Percentile	Treatment	Comparison
5	-\$74,554.87	-\$81,598.26
10	-\$53,469.70	-\$44,507.41
25	-\$39,701.99	-\$17,581.01
50	-\$23,176.34	-\$1,037.62
75	-\$1,499.97	\$15,526.48
90	\$12,753.14	\$37,354.37
95	\$32,224.96	\$55,426.80

Treatment and Comparison participants with a history of OMH facility stays (defined as records in the CAIRS or MHARS systems) did not demonstrate significantly different pre-period spending ($p>0.2$), indicating reasonable similarity to start. There were no significant main effects of time ($F's<1$), but there was a main effect of group that trended toward significance ($F(1,410)=2.851$, $p=0.092$), and a significant interaction between these factors ($F(1,410)=10.704$, $p=0.001$). As such, spending for the Treatment participants with histories of OMH facility stays declined more than for the Comparison clients with such histories.

Notably, these two groups were not selected to necessarily match each other: as such, the differences seen could be attributable to MRT-SH enrollment, but also could be due to some other demographic or clinical difference between these groups that the simple inclusion of covariates in the ANCOVA was unable to overcome. However, the groups are reasonably well-matched in pre-period spending (i.e., they are not significantly different), and the substantial spending decrease seen specifically for Treatment clients is promising.

¹⁰⁵ Repeated Measures ANCOVA between-subjects effect; "†" – $p<0.1$; "***" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.
¹⁰⁶ Repeated Measures ANCOVA within-subjects effect; "†" – $p<0.1$; "***" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.
¹⁰⁷ Repeated Measures ANCOVA interaction; "†" – $p<0.1$; "***" – $p<0.05$, "****" – $p<0.01$, "*****" – $p<0.001$, "n.s." – not significant.

Prior Housing Status Summary

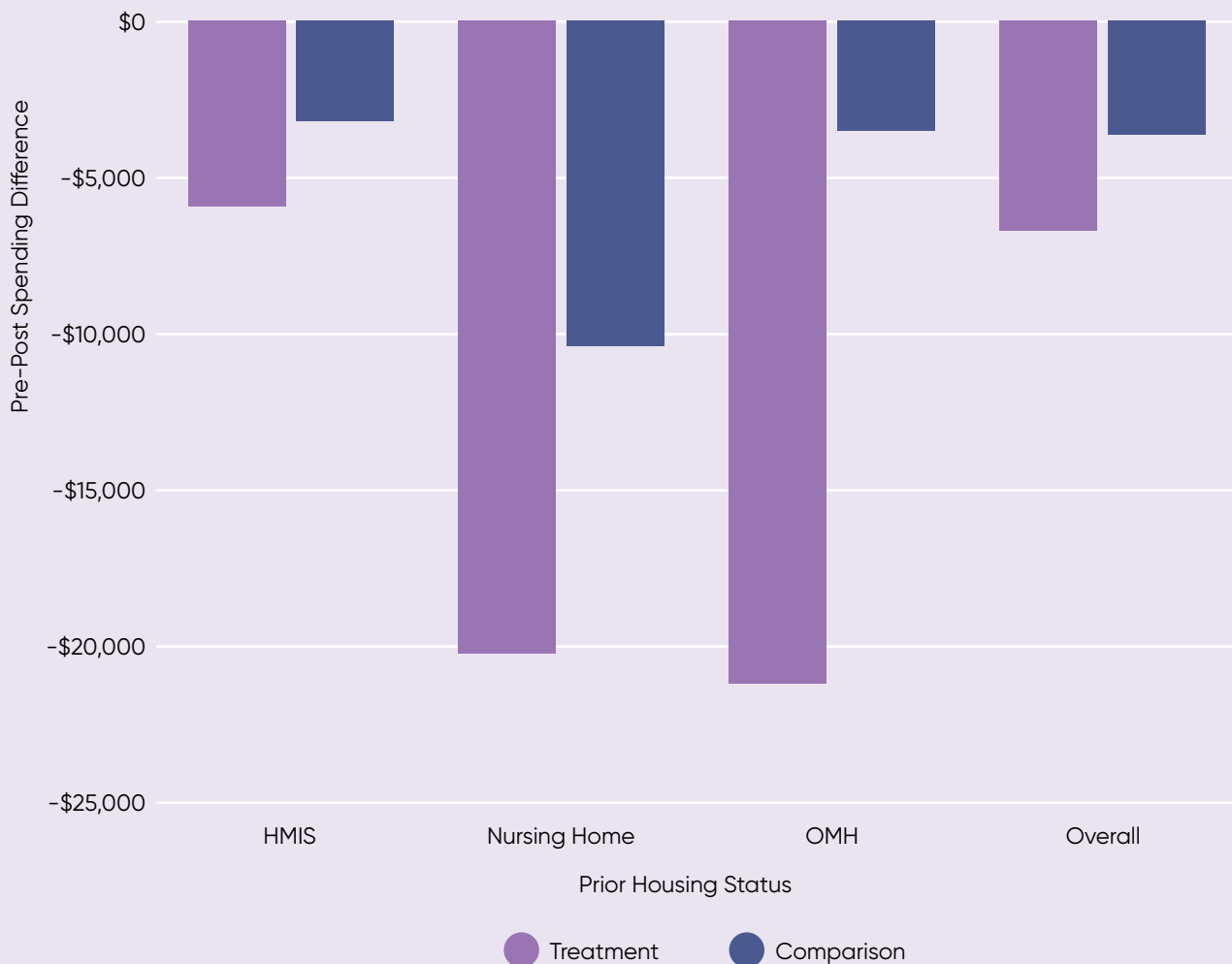
Comparisons based on pre-period housing history are tenuous, as the Treatment and Comparison participants included are not necessarily well-matched on any other modeled factors, even with the inclusion of covariates in the ANCOVAs. As such, these analyses should be treated as exploratory and any patterns taken only as directions for future research, but are still interesting to examine.

All three housing histories demonstrated patterns wherein Treatment clients with such housing histories showed greater decreases in spending over the examined period than did Comparison clients, or significant interactions between time and group, even after inclusion of the necessary covariates.

Notably, while there were similar numbers of Treatment and Comparison clients with histories of HMIS stays, there were more Treatment clients with OMH facility stays, and many more Comparison clients with histories of nursing home stays. These unbalanced samples may have resulted in skewed results; as such, propensity score models optimized for such comparisons should be implemented in future work.

Several MRT-SH programs target individuals with a history of homelessness, or who are currently in nursing homes or OMH residential facilities but do not need such a high level of care. These analyses demonstrate that such cases are particularly likely to show significant cost savings beyond “treatment as usual,” making these targeting criteria appropriate to pursue, at least from this preliminary look.

Figure 5. Pre-post treatment effects for clients with prior housing statuses



Summary

Selected MRT-SH Treatment clients were compared to a matched set of Comparison individuals to determine the impact of enrollment in MRT-SH on Medicaid claim spending. Overall, a significant treatment effect was found: while pre-period spending was similar after the matching process (as expected), Treatment participants demonstrated average savings of about \$7,000, which was significantly more than the \$3,600 average savings for Comparison participants. As such, enrollment in MRT-SH programs resulted in greater cost savings in Medicaid claims than “treatment as usual,” at least on a global basis.

These treatment effects are likely driven by Treatment clients who were initially high spenders: while both Treatment and Comparison participants in the lower spending deciles tended to demonstrate increased *spending* in the post-period, those in the top two spending deciles demonstrated significant cost *savings*, with greater savings for Treatment than Comparison clients. Most MRT-SH programs used pre-period Medicaid spending as a targeting criterion, with the aim of enrolling particularly high-cost users. These results demonstrate that such a strategy is appropriate, as these initially high-spending clients are the ones most likely to show significant cost savings after enrollment.

Further, these savings likely stemmed from decreased spending in three service categories. Hospital inpatient spending showed significant decreases in the post-period, though these decreases were greater for Comparison than Treatment clients. But nursing home and “other” spending showed significant savings for Treatment clients, while Comparison clients tended to show increases. While several other categories demonstrated some significant cost increases, they were all small (e.g., less than \$1,000) and unlikely to represent shifts holding MRT-SH programs back from achieving cost savings.

The comparisons within diagnosis and prior housing subgroups are more tenuous, as the Treatment and Comparison participants included are not necessarily well-matched on any other modeled factors. As such, these analyses should be treated as exploratory and any patterns taken only as directions for future research. But the findings do point to consistency with prior analyses. First, Treatment clients with an SMI, SUD, other chronic condition, or at least three diagnoses showed greater overall savings than did the Comparison participants. Most MRT-SH programs either target individuals with a particular condition (or diagnosis), or aim to serve especially complex cases; these analyses suggest that such cases are particularly likely to show significant cost savings beyond “treatment as usual,” making these targeting criteria appropriate to pursue.

Further, Treatment clients with a history of homelessness (HMIS shelter use), OMH facility stay (inpatient psychiatric or OMH residential facility), or nursing home use demonstrate greater spending decreases than did the Comparison clients with such histories, even after the inclusion of potentially confounding covariates. Again, nursing home and OMH settings are particularly expensive; this decrease may reflect Treatment clients’ successful moves from these settings to more independent supportive housing environments, while Comparison clients may not have achieved such setting changes.

Current Conclusions

The overall treatment effects represent a promising result of MRT-SH interventions: Treatment clients demonstrate greater cost savings in the first year after MRT-SH enrollment than do their matched Comparison counterparts. These decreases are likely driven by clients who were particularly high utilizers before enrollment, and likely stem from decreases in inpatient, nursing home, and “other” service category spending. Treatment clients with an SMI, SUD, or other chronic condition, or with a history of homeless shelter, nursing home, or OMH residential facility stays, may especially benefit from MRT-SH programs, but further work is needed to better establish these subgroup-based patterns.

MRT-SH programs tend to target clients who are high Medicaid utilizers, both in terms of cost and number of visits, have certain diagnoses, and/or are in nursing homes or residential treatment facilities. These results demonstrate that clients in these situations, or with these backgrounds, are the ones most likely to show significant treatment effects, and thus represent appropriate candidates for programs. Some targeting criteria may not have as much impact on spending changes: clients with HIV or with more emergency department visits may show some cost savings but not savings greater than “treatment as usual.” However, more research specifically focused on diagnoses, prior housing status, and other subgroup factors is needed to directly examine changes in Medicaid spending with appropriately created and matched groups.

Appendices

Table A.1. Category of service definitions¹⁰⁸

Service Category	COS Code	Description
Clinic	160	Diagnostic and Treatment Center Services
DME	321	Medical Appliance, Equipment, Supply Dealer
Emergency Department ¹⁰⁹ Rate code & claim source code	2879 & claim trans src code = C or P 1402 & claim trans src code = C or P 1419 & claim trans src code = C or P 99281 & claim trans src code = E	Rate codes for ED (Fee For Service)
	99282 & claim trans src code = E 99283 & claim trans src code = E 99284 & claim trans src code = E 99285 & claim trans src code = E	Rate codes for ED procedures (Managed Care)
Hospital Inpatient	285	Inpatient
Hospital Outpatient	287	Hospital-Based Outpatient Services
Lab	1000	Laboratory (Free-Standing)
Non-Institutional Long-Term Care	0	Chain Pharmacy/Other NILTC
	260	Home Health Agency Professional Services
	263	HHA/Medical/Surgical Supply and DME
	264	Vendor Personal Care Services
	266	Personal Emergency Response Services
	267	Assisted Living Program
	284	Home Care Program
	388	Long Term Home Health Care
Nursing Home	286	Skilled Nursing Facility
	381	Skilled Nursing Facility
	383	Day Care
Pharmacy	441	Drugs
Physician Services	46	Physician Group
	460	Physician Services
Transportation	601	Ambulance-Emergency
	602	Ambulette
	603	Taxi
	605	Livery Services
	606	Transportation Day Treatment

¹⁰⁸ The table above shows Medicaid category of service (COS) codes and descriptions that were rolled up to define the broader categories of service used in the pre-post analysis. Medicaid COS codes are associated with Medicaid claims in the Medicaid database based on the nature and setting of the claim.

¹⁰⁹ Emergency Department services were defined as any claim line with rate code 2879, 1402, or 1419 or procedure code 99281 – 99285, regardless of the category of service code on the claim line.

Table A.2. Medicaid coverage types considered “full” for inclusion in pre-post analysis

For the purposes of the pre-post analysis, a participant was considered to have full coverage and kept for analysis if they had coverage codes contained in the following table. Coverage of any other type excluded the participant from the pre-post analysis. A 60-day or more gap in coverage within the pre-period or the post-period also excluded the participant from the pre-post analysis.

Coverage Code	Coverage Code Description
01	All Benefits
06	Provisional Eligibility
11	Legal Alien – Full Coverage
16	Home Relief
19	Community Coverage with Community LTC
20	Community Coverage with no LTC
24	Community Coverage with no LTC, Alien 5-year ban
30	Client is eligible for Medicaid and enrolled in a patient care plan
36	Family Health Plus Guarantee

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