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Policy Research

REPORT

THIRD ANNUAL REPORT ADDENDUM

Evaluating the HCIA – Behavioral Health/Substance Abuse Awards: Addendum to the Third Annual Report

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EXECUTIVE SUMMARY

The Affordable Care Act authorized the Center for Medicare & Medicaid Innovation (CMMI) in the Centers for Medicare & Medicaid Services (CMS) to test innovative health care payment and service delivery models with the potential to lower spending on Medicare, Medicaid, and the Children's Health Improvement Program (CHIP) while maintaining or improving beneficiaries' health and the quality of care they receive. In the first round of the HCIA initiative, 10 awardees implemented programs that focused primarily on individuals with mental health or substance use disorders (Table ES.1).

These projects had some common goals—for example, training staff to coordinate care and using health information technology to monitor care—but the approaches to achieving them varied widely. The awardees also focused on different subgroups within the broad priority population, such as individuals with schizophrenia or with serious mental illness and a chronic physical condition. The awardees implemented their programs in settings that ranged from primary care practices and mental health clinics to a campus serving the homeless population.

In September 2013, CMMI contracted with Mathematica Policy Research to evaluate the 10 projects described in Table ES.1. In January 2017, we submitted our third annual report with complete evaluations of six of these awardees: the Center for Health Care Services, Felton Institute, Feinstein Institute for Medical Research, HealthLinkNow, Institute for Clinical Systems Improvement, and Vinfen Corporation. CMMI posted this report on its website in March, 2017 (https://downloads.cms.gov/files/cmmi/hcia-bhsa-thirdannualrpt.pdf).[1]

For the remaining four awardees—the Fund for Public Health in New York, Kitsap Mental Health Services, Maimonides Medical Center, and ValueOptions—we were able to obtain additional quantitative data and use these data to complete the awardees' evaluations. We report our findings for these four awardees in this document as an addendum to the third annual report. Thus, to obtain a full understanding of the outcomes of all 10 programs, readers should review both the third annual report and this addendum.

Table ES.1. Awardees in the field of behavioral health and substance abuse

Awardee[a]	Overview of intervention	Intervention population	Dollars awarded	Enrollment goal (percent achieved)
Center for Health Care Services (CHCS)	Integrated primary care clinic into behavioral health service setting	Adults in San Antonio, Texas, who are homeless	$4,557,969	260[b] (100)
The Felton Institute (Felton)	Implemented an integrated model of early intervention for psychosis	Patients (ages 14–29) with symptoms of schizophrenia, schizoaffective disorder, or schizophreniform disorder	$4,703,817	140 (100)

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[1] The first and second annual reports are available at https://innovation.cms.gov/Files/reports/HCIA-BHSA-FirstEvalRpt.pdf and https://innovation.cms.gov/Files/reports/hcia-bhsa-secondevalrpt.pdf, respectively.

Awardee[a]	Overview of intervention	Intervention population	Dollars awarded	Enrollment goal (percent achieved)
Feinstein Institute for Medical Research (Feinstein)	Improved treatment for schizophrenia through training, care management, and new technology	Patients with schizophrenia, recently discharged from the hospital and receiving community treatment in one of eight states	$9,380,855	770 (66)
Fund for Public Health in New York (FPHNY)	Provided crisis intervention services to facilitate early engagement with and continuity of care—combining community-based care, access to primary care, and peer support	Individuals in Manhattan, Brooklyn, the Bronx, and Queens who have been diagnosed with psychosis or severe mental illness	$17,608,085	2,232 (63)
HealthLinkNow (HLN)	Provided behavioral care services via telehealth to individuals in rural areas that lack access to these services	Patients with behavioral health needs in rural areas with shortages of behavioral health clinicians (Montana, Washington, and Wyoming)	$7,718,636	1,534 (88)
Institute for Clinical Systems Improvement (ICSI)	Implemented collaborative care management for patients with depression and diabetes or cardiovascular disease	High-risk adult patients with Medicare or Medicaid coverage in one of eight states who have (1) active depression and (2) uncontrolled diabetes or cardiovascular disease, or both	$17,999,635	2,704 (100)
Kitsap Mental Health Services (KMHS)	Integrated primary care and care for co-occurring physical disorders with mental health services	Adults with severe mental illness and one comorbidity; children with severe emotional disturbance and one physical comorbidity; Kitsap County, Washington	$1,858,437	Not applicable[c]
Maimonides Medical Center (MMC)	Coordinated mental and physical health care through advanced health IT	Adults with serious mental illness living in southwest Brooklyn	$14,842,826	500[d] (100)
ValueOptions (ValueOptions)	Provided support for recovery through reinforcement-based treatment model	Plan members in Massachusetts with two or more detoxification admissions	$2,760,737	1,492[b] (82)
Vinfen Corporation (Vinfen)	Integrated health care services into existing behavioral health outreach teams in community	Individuals in the Boston area with serious mental illness	$2,942,962	400 (54)

Source:　Enrollment targets are awardees' self-reported enrollment goals as specified in their applications or quarterly reports to CMMI's technical assistance contractor (the Lewin Group). We obtained award amounts in February 2015 from http://innovation.cms.gov/Files/x/HCIA-Project-Profiles.pdf.

[a] In this report, we generally use the acronym or name abbreviations in parentheses when we talk about the awardees.

[b] Program participants only.

[c] KMHS did not specify enrollment goals. Instead, it identified cohorts of individuals within its service population for whom it provided quantitative data on outcome measures.

[d] Direct participants only. MMC's program also included 7,000 Medicaid-enrolled indirect participants.

Evaluation goals and methods

Overall, our evaluation had three broad and interrelated goals. First, we responded to a series of specific evaluation questions that pertained to the effects of the awardees' programs. Second, we identified general lessons learned about successful projects by synthesizing findings for the different awardees. Our third goal involved "telling the story" of each awardee by describing its program objectives, implementation experiences, and participants' outcomes, basing our outcomes analysis on CMMI's four core measures to the extent possible (total Medicare and Medicaid expenditures, hospitalization rates, hospital readmission rates, and rates of emergency department (ED) use). For each awardee, we conducted a separate evaluation using a mixed-methods approach, tailored to their specific program participants, intervention components, and available data sources.

We drew on five types of data for our evaluation:

- Enrollment data obtained from CMMI's technical assistance contractor (the Lewin Group)

- Medicare and Medicaid claims data obtained either through CMS or states

- Survey and administrative data obtained directly from the awardees

- Data from our workforce survey, conducted in 2014 and 2015

- Qualitative data from interviews we conducted with key informants on our site visits in 2014 and 2015 and from focus groups we hosted in 2015

This addendum extends the analyses reported in the third annual report. The specific updates to the analyses vary by awardee. Specifically, we expanded the enrollment period for FPHNY, incorporated additional Medicaid data into analyses for KMHS, conducted an impact analysis for Medicaid enrollees and supplemental analyses of service use for Medicare and Medicaid enrollees for MMC, and conducted an impact analyses for ValueOptions. Subsequent chapters provide further details about the opportunities that allowed us to conduct additional analyses.

For the four awardees included in this addendum, we were able to use a comparison group design and conduct difference-in-differences analyses (Table ES.2). This approach allowed us to examine what might have happened had the HCIA-funded program not been implemented (that is, the counterfactual) and to draw reasonably strong conclusions about a program's impact on outcomes of interest.[2] Although we were able to apply the difference-in-differences analytic approach to estimate program impacts on key outcomes, we faced several limitations in our analyses, such as small sample sizes. We discuss these limitations in detail in the chapters on each individual awardee.

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[2] A difference-in-differences analysis calculates a program impact by comparing the average change over time in the selected outcome variable for the intervention group (which received the program) with the average change over time for the control or comparison group (which did not). Thus, it examines how the difference between the two groups varies over time.

Table ES.2. Evaluation design features for four behavioral health/substance abuse awardees

Awardee	Intervention group	Control or comparison group	Data sources for outcomes	Outcome measures	Key analytic limitations
FPHNY	Adults in New York City with a mental health crisis and an episode of psychosis or severe mental illness	Similar New York City Medicaid beneficiaries	New York State Medicaid data files, 2010–2016	Expenditures, hospitalizations, ED visits	Medicaid analysis only and only on a small proportion of all participants
KMHS	Patients served by community mental health center in Washington State	Similar Medicare FFS beneficiaries served by other mental health providers in Washington State; similar Medicaid beneficiaries in Washington State	Medicare data files, 2010–2015; Medicaid data files, 2011–2014	Expenditures, hospitalizations, ED visits, office visits	Expenditures not available for Medicaid participants; Medicaid data not available for full intervention period
MMC	Adults with severe mental illness living in southwest Brooklyn	Similar Medicare FFS beneficiaries living in three similar cities; similar Medicaid beneficiaries in other health homes in New York City	Medicare 2010–2015; New York State Medicaid data files 2010–2015	Expenditures, hospitalizations, readmissions, ED visits	Small number of Medicare program participants
ValueOptions	Plan members in Massachusetts with two or more detoxification admissions in the past year	Awardee-selected comparison group of similar members receiving care at non-intervention sites	Awardee-provided Medicaid claims and clinical assessment data	Expenditures, ED visits, residential stays, days of intensive day treatment	Small number of participants and comparison group members

Notes: For these awardees, we conducted multivariate longitudinal analysis of intervention and comparison group outcomes or expenditures, controlling for factors specific to each awardee and using a "difference-in-differences" analysis. We excluded Medicare Advantage participants from our Medicare analyses because expenditures and utilization data for this population are not included in the available Medicare administrative data. Similarly, we excluded Part D pharmacy services and expenditures from our analyses because data on them were unavailable.

Key findings on CMMI's four core measures

CMMI is particularly interested in the effects of the HCIA-funded programs on total Medicare and Medicaid expenditures and three measures of service use: hospitalizations, readmissions, and ED visits. For participants in this group of programs, readmissions were quite rare; as a result, impact estimates would have been unreliable. Hence, our impact estimates focused on total expenditures, hospitalizations, and ED visits.[3]

Table ES.3 highlights key findings for three measures: total Medicare or Medicaid expenditures, hospitalizations, and ED visits. Impacts are presented both in the aggregate and per beneficiary month. Overall, the programs for all four awardees had significant impacts, although not necessarily in the expected direction.

Specifically, we estimated program impacts on Medicaid expenditures for three of the four awardees. (Medicaid expenditures were not available for KMHS participants.) We found the following results, which were statistically significant at the $p < 0.10$ level:

- Relative to the experience of the comparison group, the mobile crisis team component of FPHNY's program appears to have increased total Medicaid expenditures by $2,759,000 and its crisis respite center component appears to have reduced total expenditures by $9,700,000 during the program period.

- Relative to the experience of the comparison group, MMC's program appears to have reduced total Medicaid expenditures by $48,020,000 during the program period.

- Relative to the experience of the comparison group, ValueOptions appears to have reduced total Medicaid expenditures by $4,907,000 during the program period.

We calculated program impacts on rates of hospitalizations for Medicaid participants in three of the four awardees' programs. (We did not calculate hospitalization rates for ValueOptions for reasons we report in Chapter V.) KMHS' program appeared to have no effect on participants' hospitalizations. For the other two awardees, we found the following results, which were statistically significant at the $p < 0.10$ level:

- Relative to the experience of the comparison group, the mobile crisis team component of FPHNY's program appears to have resulted in 152 more hospitalizations and its crisis respite center component appears to have resulted in 882 fewer hospitalizations during the program period.

- Relative to the experience of the comparison group, MMC's program appears to have resulted in 1,581 fewer hospitalizations during the program period.

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[3] MMC is an exception to this pattern. We were able to calculate readmissions for Medicare-enrolled participants and found no program impacts on this measure. The chapter on MMC provides more details about our analysis.

Table ES.3. Impacts of four awardees' programs on CMMI core measures

| | | | Change relative to comparison group | |
		Measure	Aggregate expenditures (in thousands of dollars)	Per beneficiary per month expenditures (in dollars)
FPHNY	Mobile crisis teams			
	Worked with individuals after a mental health crisis to develop and implement an individualized action plan	Medicaid expenditures for Medicaid participants	$2,759 higher*	$1,064 higher*
		Hospitalizations for Medicaid participants	152 more*	0.06 more*
		ED visits for Medicaid participants	14 fewer	0.01 fewer
FPHNY	Crisis respite centers			
	Provided alternative to hospitalization for individuals who needed temporary residential or respite care	Medicaid expenditures for Medicaid participants	$9,700 lower*	$1,609 lower*
		Hospitalizations for Medicaid participants	882 fewer*	0.15 fewer*
		ED visits for Medicaid participants	156 more	0.03 more
KMHS				
	Integrated primary care and care for co-occurring physical disorders with mental health services	Medicare expenditures for participants in FFS Medicare	$5,144 lower*	$266 lower*
		Hospitalizations for participants in FFS Medicare	297 fewer*	0.02 fewer*
		ED visits for participants in FFS Medicare	546 fewer*	0.03 fewer*
		Hospitalizations for Medicaid participants	343 more	0.006 more
		ED visits for Medicaid participants	2,211 more*	0.037 more*
MMC				
	Coordinated mental and physical health care through advanced health information technology	Medicare expenditures for participants in FFS Medicare	$26 lower	$3.44 lower
		Hospitalizations for participants in FFS Medicare	39 less	0.01 less
		ED visits for participants in FFS Medicare	71 less	0.01 less
		Medicaid expenditures for Medicaid participants	$48,020 lower*	$944 lower*
		Hospitalizations for Medicaid participants	1,581 fewer*	0.031 fewer*
		ED visits for Medicaid participants	84 fewer	0.002 fewer
ValueOptions				
	Provided support for recovery through a reinforcement-based treatment model	Medicaid expenditures for Medicaid participants	$4,907 less*	$632 less*
		ED visits for Medicaid participants	1,098 fewer*	0.14 fewer**

Source: Analyses of Medicare and Medicaid data. See awardee-specific chapters for details.

* Indicates statistical significance at the $p < 0.10$ level.

** Indicates statistical significance at the $p < 0.20$ level.

We calculated program impacts on ED visit rates for Medicaid participants in all four awardees' programs. FPHNY's and MMC's programs appeared to have no effect on participants' ED visits. For the other two awardees, we found the following results, which were statistically significant at the $p < .10$ level:

- Relative to the experience of the comparison group, KMHS's program appears to have resulted in 2,211 more ED visits during the program period.

- Relative to the experience of the comparison group, ValueOptions' program appears to have resulted in 1,098 fewer ED visits during the program period.

We calculated impacts on total Medicare expenditures and on hospitalizations and ED visits for Medicare participants in KMHS's and MMC's programs. We found that, relative to the experience of the comparison group, KMHS's program appears to have decreased Medicare expenditures by $5,144,000 and resulted in 297 fewer hospitalizations and 546 fewer ED visits (all statistically significant at the $p < .10$ level). We found no statistically significant impacts of MMC's program for Medicare participants.

For each awardee, we highlight key findings here, describing them in more detail in Chapters II through V:

FPHNY. Overall, we found that Medicaid-funded hospitalizations and expenditures rose for individuals using mobile crisis team services.[4] In contrast, crisis respite centers helped lower rates of Medicaid-funded hospitalizations and Medicaid expenditures by providing participants with a residential, community-based alternative to psychiatric hospitalization.

KMHS. Overall, robust evidence from our evaluation suggests that KMHS' program of integrating primary care into a mental health treatment setting may have reduced Medicare expenses for its Medicare clients, possibly by cutting down on their ED visits, hospitalization rates, and office visits. In contrast, our analysis of data for Medicaid-enrolled KMHS clients found that the program had no effect on hospitalizations, and may have increased ED visits. Heightened awareness of their physical health needs may have led these clients to seek more, rather than less, treatment in the ED. Alternatively, however, the differences between the results for the Medicare and Medicaid population could be due to lack of data from the last 12 months of the program for Medicaid enrolled patients.

MMC. Although our findings indicate no significant impacts for Medicare-enrolled participants (who comprised a small percentage of the overall program participants), the program's health home services and information technology platform resulted in significant savings for services to Medicaid enrollees. Our findings show the program saved about $944 per Medicaid participant per month during the program period, with an estimated total savings of about $48 million. A substantial proportion of these cost savings likely resulted from significantly fewer hospitalizations for program participants relative to the comparison group.

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[4] Findings from our analysis of mobile crisis teams should be interpreted with caution due to small sample size.

ValueOptions. Our findings indicate that ValueOptions' recovery support model for individuals with substance use disorders reduced ED visits and total expenditures for program participants relative to a comparison group.

Conclusions

As we noted in the third annual report, the HCIA awardees in behavioral health and substance abuse implemented programs with the common aim of improving health outcomes and service delivery and reducing costs of care for individuals with mental illness and substance use disorders. Although the overall evidence is mixed (both across the four awardees described in this addendum and across all 10 awardees), our evaluation indicates that some programs achieved some of these goals. Our results from the impact analyses, together with an exceptionally broad array of "lessons learned" based on analysis of qualitative data, could give staff at CMMI and other federal and state agencies ideas for initiatives that build on the work of these awardees. For example, further synthesis of awardees' experiences integrating mental health and primary care services for individuals with serious mental illness could contribute to other initiatives related to this topic, such as efforts underway through CMS' Innovation Accelerator Program.

These awardees received more than $80 million through an initiative that has yielded a wealth of experiences in implementing different approaches to improving care and reducing federal expenditures for individuals with mental health and substance use disorders. For most awardees, key program elements will be sustained in some fashion, potentially bringing further returns to the government's substantial investment.

I.   INTRODUCTION

A. The HCIA initiative

The Affordable Care Act authorized the Center for Medicare & Medicaid Innovation (CMMI) in the Centers for Medicare & Medicaid Services (CMS) to test innovative health care payment and service delivery models that have the potential to lower spending on Medicare, Medicaid, and the Children's Health Insurance Program while maintaining or improving beneficiaries' health. As part of CMMI's efforts, the first round of the Health Care Innovation Awards (HCIA) initiative gave 107 organizations the funding to implement a broad range of service delivery models (https://innovation.cms.gov/initiatives/Health-Care-Innovation-Awards/). The models focus on groups of beneficiaries with poor clinical outcomes or heavy utilization of services. CMMI will examine the evidence about the program's implementation and key outcomes, and might promote replication of the most promising models of care. Consequently, rigorous evaluation of the HCIA initiative is vital for CMMI to achieve its mission.

B. Overview of the behavioral health awardees

In the first round of the HCIA initiative, 10 awardees implemented programs focused primarily on people with mental health and substance use disorders (Table I.1). The projects shared some cross-cutting themes (for example, training staff to coordinate care and using information technology to plan or monitor services) but they involved different subgroups of the priority population—such as individuals with schizophrenia or with serious mental illness and a chronic physical condition. The awardees implemented their programs in a range of community-based settings, including primary care practices and mental health clinics.

In September 2013, CMMI contracted with Mathematica Policy Research to evaluate the 10 projects described in Table I.1. In January 2017, we submitted our third annual report with complete evaluations of six of these awardees: the Center for Health Care Services, Felton Institute, Feinstein Institute for Medical Research, HealthLinkNow, Institute for Clinical Systems Improvement, and Vinfen Corporation.

For the remaining four awardees—the Fund for Public Health in New York, Kitsap Mental Health Services, Maimonides Medical Center, and ValueOptions—we obtained additional quantitative data, which we used to complete the awardees' evaluations. We report our findings in this addendum to the third annual report. For all four awardees, the three-year awards began in early July 2012. For *KMHS,* the project period ended three years later, on June 30, 2015. MMC received a four-month, no-cost extension to close out its programs. FPHNY and ValueOptions received no-cost extensions of six months, which allowed them to complete their own evaluations and transition their projects to sustainable sources of funding.

Table I.1. Behavioral health and substance abuse awardees

Awardee (name abbreviation used in report)	Overview of program (dollars awarded)[a]	Program population (target number of direct participants)[b]
Center for Health Care Services (CHCS)	Integrated primary care clinic into behavioral health service setting ($4,557,969)	Adults in San Antonio, Texas, who are homeless (260)
The Felton Institute (Felton)	Implemented an integrated treatment model to improve intervention for psychosis ($4,703,817)	Patients (ages 14–29) with symptoms of schizophrenia, schizoaffective disorder, or schizophreniform disorder (140)
Feinstein Institute for Medical Research (Feinstein)	Improved treatment of schizophrenia through training, care management, and new technology ($9,380,855)	Patients with schizophrenia who were recently discharged from the hospital and are receiving care at a community intervention center in one of eight states (770)
Fund for Public Health in New York (FPHNY)	Provided crisis intervention services to facilitate early engagement with and continuity of care—combining community-based care with access to primary care ($17,608,085)	Individuals in Manhattan, Brooklyn, the Bronx, and Queens who have been diagnosed with psychosis or severe mental illness (2,232)
HealthLinkNow (HLN)	Provided behavioral care services via telemedicine to individuals in rural areas who lack access to these services ($7,718,636)	Patients with behavioral health needs in rural areas in Montana, Washington, and Wyoming with shortages of behavioral health clinicians (1,534)
Institute for Clinical Systems Improvement (ICSI)	Implemented collaborative care management model for patients with depression and diabetes or cardiovascular disease ($17,999,635)	High-risk adult patients with Medicare or Medicaid coverage in one of eight states who have depression and diabetes or cardiovascular disease (2,704)
Kitsap Mental Health Services (KMHS)	Integrated primary health care for individuals with severe mental illness ($1,858,437)	Patients served by community mental health center in Kitsap County, Washington[c]
Maimonides Medical Center (MMC)	Coordinated mental and physical health care through advanced health information technology ($14,842,826)	Adults with serious mental illness living in southwest Brooklyn (500)
ValueOptions, Inc. (ValueOptions)	Provided support for recovery through reinforcement-based treatment model ($2,760,737)	Plan members in Massachusetts with two or more detoxification admissions (1,492)
Vinfen Corporation (Vinfen)	Integrated health care services into existing behavioral health outreach teams in community ($2,942,962)	Individuals in Boston with serious mental illness (470)

Note: In this report, we usually use the acronym or name abbreviations indicated in parentheses to designate the awardees. In subsequent tables, we list awardees in alphabetical order based on their full names, as we do here.

[a] Dollar amounts accessed from http://innovation.cms.gov/Files/x/HCIA-Project-Profiles.pdf.

[b] Awardees' self-reported enrollment goals as specified in their applications or quarterly reports to CMMI's technical support contractor (the Lewin Group).

[c] KMHS did not define a specific enrollment target for its Race to Health! program because KMHS staff intended the program to reach everyone who used KMHS' outpatient services during the study period.

C. Evaluation goals

Our evaluation, which concludes in September 2017, has three broad and interrelated goals. First, using diverse sources of data, we have responded to a series of specific evaluation questions that CMMI asked us to address. Previous reports—the first and second annual report—provide the results of early analyses conducted to answer these questions.[5] In these reports, we paid particular attention to CMMI's four core quantitative measures of program effectiveness:

- Total Medicare and Medicaid expenditures

- Hospitalization rates

- Hospital readmission rates

- Rates of emergency department (ED) use

The second goal involves identifying general lessons learned about successful projects based on a synthesis of findings across awardees. For example, in our previous reports, we discussed common challenges that awardees faced in implementing their projects and the solutions they developed to address them.

In the third annual report, we focused on the third goal: "telling the story" of the awardees by describing their program objectives, implementation experiences, and outcomes, basing the outcome analysis on CMMI's four core measures to the extent possible. This addendum augments the stories of four awardees by providing additional quantitative findings from analyses conducted after submission of the third annual report.

D. Evaluation methods

For the four awardees described in this addendum, we were able to use a comparison group design and conduct difference-in-differences analyses (Table I.2). This approach allows us to examine what might have happened had the HCIA-funded program not been implemented (that is, the counterfactual) and to draw reasonably strong conclusions about a program's impact on the outcomes of interest to CMMI.[6]

This addendum extends the analyses reported in the third annual report. The updates to the analyses varies by awardee:

FPHNY. The analyses reported in third annual report included individuals who began participating in the Parachute NYC program between January 2013 and January 2015. Here, we expand this analysis to include an additional ten months of enrollment through November 2015.

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[5] See https://innovation.cms.gov/Files/reports/HCIA-BHSA-FirstEvalRpt.pdf and https://innovation.cms.gov/Files/reports/hcia-bhsa-secondevalrpt.pdf.

[6] In a difference-in-differences analysis, we calculate a program's impact by comparing the average change over time in the selected outcome variable for the intervention group (which received the program's services) with the average change over time for a control or comparison group (which did not). Thus, we can examine how the difference between the two groups varies over time.

KMHS. In this addendum, we present findings from quantitative analyses incorporating an additional three months of Medicaid data obtained after we completed the third annual report.

MMC. In this addendum, we provide supplemental analyses of service use for both Medicare and Medicaid beneficiaries who participated in MMC's program. In addition, we update the Medicaid analyses based on new data we received after we completed the third annual report. Specifically, in third annual report, we reported findings of quantitative analyses using a pre-post design; for this addendum, we report findings from a differences-in-differences analysis with a matched comparison group. We also provide more detailed on expenditures by service type for the Medicaid-enrolled participants.

ValueOptions. We were not able to include quantitative impact analysis in the third annual report for ValueOptions because MBHP was unable to provide complete data in time. MBHP was able to provide data to conduct impact analyses for this addendum. We report the findings from quantitative and impact analyses using these data.

Although we were able to apply the difference-in-differences analytic approach to estimate program impacts on key outcomes, we faced several limitations in our analyses, such as small sample sizes. Overall, we urge readers to interpret our conclusions carefully in light of these and other limitations that we note in each subsequent chapter of this addendum.

Table I.2. Evaluation design features for four behavioral health/substance abuse awardees

Awardee	Intervention group	Comparison group	Data sources for outcomes	Outcome measures	Key analytic limitations
FPHNY	Adults in New York City with a mental health crisis and an episode of psychosis or severe mental illness	Similar New York City Medicaid beneficiaries	New York State Medicaid data files, 2010–2016	Expenditures hospitalizations, ED visits	Medicaid analysis only; small proportion of participants in analyses
KMHS	Patients served by community mental health center in Washington State	Similar Medicare FFS beneficiaries served by other mental health providers in Washington State; similar Medicaid beneficiaries in Washington State	Medicare data files, 2010–2015; Medicaid data files, 2011–2014	Expenditures, hospitalizations, ED visits, office visits	Expenditures not available for Medicaid participants; Medicaid data not available for full intervention period
MMC	Adults with severe mental illness living in southwest Brooklyn	Similar Medicare FFS beneficiaries living in three similar cities; similar Medicaid beneficiaries in other health homes in New York City	Medicare 2010–2015; New York State Medicaid data files 2010–2015	Expenditures, hospitalizations, readmissions, ED visits	Small number of Medicare program participants
ValueOptions	Plan members in Massachusetts with two or more detoxification admissions in the past year	Awardee-selected comparison group of similar members receiving care at non-intervention sites	Awardee-provided Medicaid claims and clinical assessment data	Expenditures, ED visits, residential stays, days of intensive day treatment	Small number of participants and comparison group members

Notes: For these awardees, we conducted multivariate longitudinal analysis of intervention and comparison group outcomes or expenditures, controlling for factors specific to that awardee using a "difference-in-differences" analysis. We excluded Medicare Advantage participants from our Medicare analyses because expenditures and utilization data for this population are not included in the available Medicare administrative data. Similarly, we excluded Part D pharmacy services and expenditures from our analyses because the data were unavailable.

For the evaluation overall, we drew on the five types of data noted below. This addendum focuses primarily on analyses of new quantitative data that were unavailable before submission of the third annual report. However, for the summary sections of the subsequent chapters, we used other data sources, such as workforce surveys and qualitative data, to provide context for the new quantitative findings and help identify key conclusions. Overall, our data sources included:

1. **Enrollment data**. We obtained enrollment data from CMMI's technical assistance contractor (the Lewin Group) and used these numbers to determine each awardee's progress toward its final enrollment goal. Awardees specified an enrollment goal in their early reports; most of them revised these goals as they implemented their projects.

2. **Medicare and Medicaid claims data.** We used these data primarily to estimate program impacts on CMMI's four core measures and on other outcomes. We were unable to obtain these data for all awardees because some could not provide the information we needed to identify participants' Medicaid or Medicare data or because of lags in the availability of Medicaid data. In some cases, we were able to obtain these data for only a small number of participants and, as a result, did not conduct analyses because they would have yielded unreliable findings.[7]

3. **Awardee's survey and administrative data.** Some awardees were able to provide adequate data from their electronic health records, surveys, or clinical assessments of participants. Generally, we used awardee data to assess program implementation (for example, by identifying what services were delivered to whom). In some cases, we used these data to assess certain outcomes, such as changes in participants' symptoms and functional status. In the case of one awardee, CHCS, all the data we used to evaluate the program came from the awardee.

4. **Workforce surveys.** We conducted a workforce survey in 2014 and 2015 that provided information about staff burnout and stress, job satisfaction, and perceptions of training and job support, and we included the findings from our analysis of survey data in our second annual report and the eighth quarterly report. In this report, we draw on survey results only to help identify lessons learned from the overall evaluation.

5. **Qualitative data from interviews and focus groups.** We conducted interviews with key informants during site visits to awardees in spring 2014 and 2015. During these site visits, we met with awardee leaders and staff, program participants, and other stakeholders to learn more about the implementation process and their experiences with various components of the programs. During the visits in 2015, we also conducted focus groups with staff and, where possible, with program participants and nonparticipants. We held focus groups with members of these two groups to understand differences in their experiences with care.

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[7] Medicaid claims files do not include psychiatric stays for adults in institutions for mental disorders. Consequently, our quantitative analyses may undercount hospitalizations and readmissions for Medicaid-enrolled program participants.

E. Road map to the report

The following chapters (II–V) contain findings from our evaluation of the four programs covered in this addendum. In each awardee narrative, we:

- Describe enrollment outcomes and participants' demographic characteristics

- Define the methods and data we used for the evaluation

- Present results of our quantitative analyses

- Conclude with a summary of lessons learned, incorporating findings from our quantitative and qualitative analyses

The technical appendices (Appendices A–D) provide more details about the quantitative analyses we conducted for each of the four awardees that are part of this addendum.

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II. FUND FOR PUBLIC HEALTH IN NEW YORK[8]

> **Findings from Mathematica's Evaluation of the Fund for Public Health in New York's HCIA Program**
>
> - For Medicaid enrollees, Parachute NYC's crisis respite services (CRCs) were associated with fewer hospitalizations and lower costs, but its need-adapted mobile crisis teams (NA-MCTs) were associated with more hospitalizations and higher costs. Neither CRCs nor NA-MCTs were associated with changes in ED visits.
>
> - Peer support was a key feature of the program, but integrating peer support specialists into the NA-MCTs and establishing their role in Parachute NYC were challenging.
>
> - New York's Medicaid reform offered a unique opportunity to build a sustainable payment model into state legislation.
>
> - As of April 2016, all components of the Parachute NYC program are being sustained, with some modifications.

A. Introduction

The Fund for Public Health in New York (FPHNY), a nonprofit organization dedicated to improving the health and well-being of city residents, partnered with the Division of Mental Hygiene in New York City's Department of Health and Mental Hygiene to implement Parachute NYC. This project focused on adults in New York City who experienced a mental health crisis and an episode of psychosis or severe mental illness. Parachute NYC was designed to give them better care at a lower cost by moving beyond the crisis model of care and focusing on patient-centered care; long-term, community-integrated treatment; and better access to primary care services.

Parachute NYC had three main components:

- **Need-adapted mobile crisis teams (NA-MCTs).** NA-MCTs consisted of clinicians and peers who provided in-home mental health services to participants in each of four boroughs (Brooklyn, the Bronx, Manhattan, and Queens). The NA-MCTs provided psychosocial education, psychotherapy, peer support, and referral to community services.

- **Crisis respite centers (CRCs).** CRCs provided a supportive, safe environment for individuals experiencing or anticipating a psychiatric crisis. Throughout the four boroughs, the CRCs offered 24-hour peer support, education in self-advocacy, and training in self-help. The CRCs were designed to be a short-term alternative to hospitalization where participants could stay for up to fourteen days.

- **Support line.** The citywide "warm support line" was a confidential phone service operated by peer staff; it offered counseling and referral services to callers in emotional distress.

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[8] We thank New York State Department of Health (NYSDOH) for providing Medicaid data to support these analyses. The findings and conclusions presented are those of Mathematica Policy Research alone and not those of NYSDOH.

Parachute NYC was the first large-scale implementation of the need-adapted treatment model (NATM) in the United States. This model integrated a multidisciplinary team with the client's personal support network and incorporated ongoing support and follow-up. FPHNY designed the Parachute NYC model to test the hypothesis that adding intentional peer support (IPS) to mobile crisis teams would help avoid hospitalizations and use of the emergency department (ED).

Although the Parachute NYC program introduced the CRCs, the mobile crisis teams were in place before the program began. These teams, managed by different health service agencies in New York City, provided rapid assessment and short-term, in-home counseling and referrals to people who were experiencing a psychiatric crisis. FPHNY contracted with these agencies, and Parachute NYC trained the teams on the new IPS and NA-MCT treatment modalities. To help fulfill the program's mission, the mobile crisis teams incorporated peers into their teams and treatment practices. The teams offered enhanced Parachute NYC services to program participants, while continuing to provide their traditional short-term services to clients who were not participating in the program.

In the third annual report, we presented evaluation findings based on qualitative and quantitative data available through July 2016, including information on FPHNY's administrative context and progress through the phases of innovation. In this addendum, we report findings from analyses incorporating additional data obtained between August 2016 and February 2017. In particular, the analyses reported in third annual report included individuals who began participating in the Parachute NYC program between January 2013 and January 2015. Here, we expand this analysis to include an additional ten months of enrollment (that is, enrollment through October 2015).

1. Enrollment

By the end of the extension period (October 31, 2015), Parachute NYC had provided services to 1,703 participants, or 77 percent of its enrollment target of 2,208 (Figure II.1). Project leaders said that, in retrospect, their initial enrollment goal was overly optimistic.

Figure II.1. Percent of target enrollment achieved by quarter
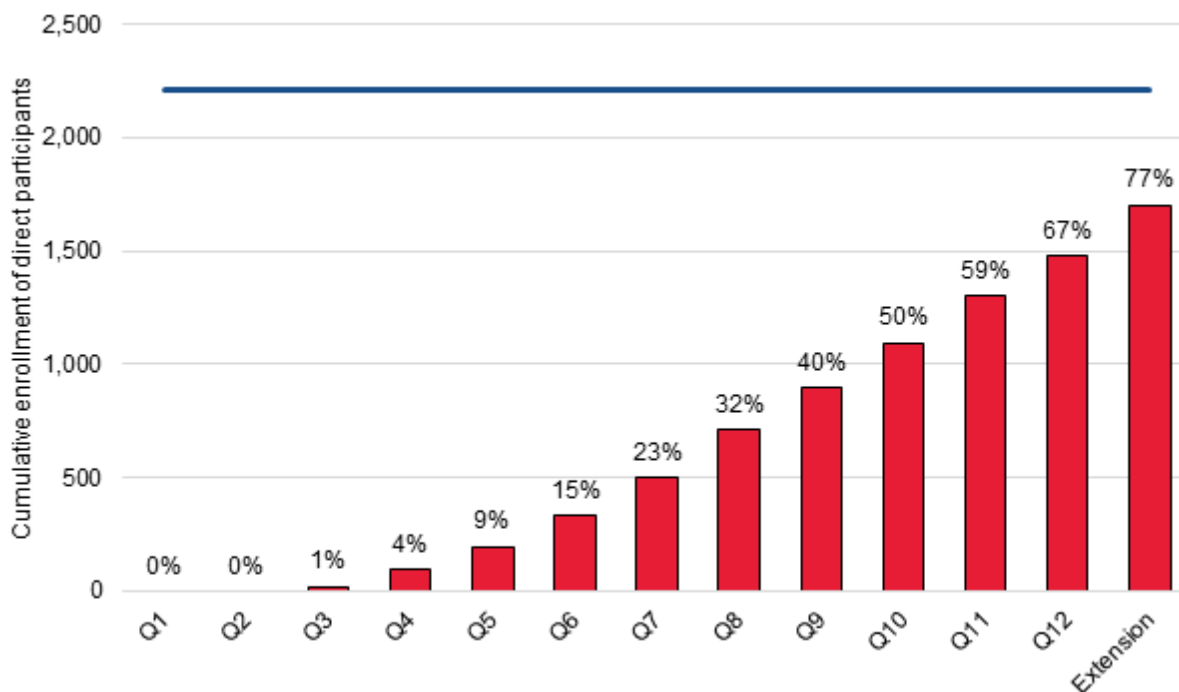
Source: Mathematica analysis of program enrollment data provided by FPHNY.

Note: The blue horizontal line represents FPHNY's enrollment target of 2,208 unique participants. FPHNY received an HCIA award extension to continue providing services through October 2015.

2.   Participants' demographic characteristics

When they first used Parachute NYC's services, almost two thirds of intervention group members in the analysis sample were under age 45 (Table II.1). Two thirds of members were either black or Hispanic, and slightly over half were disabled.

Table II.1. Demographic characteristics at initial service use, FPHNY Medicaid beneficiaries included in analyses, January 2013–November 2015[a]

	Number	Percent
Total	537	100.0
Age		
Less than 18	12	2.2
18–34	224	41.7
35–44	99	18.4
45–54	127	23.7
55–64	75	14.0
Gender		
Female	256	47.7
Male	281	52.3
Race/ethnicity		
Black	213	39.7
Hispanic	143	26.6
White or other	181	33.7
Disability status[b]		
Disabled	300	55.9
Not disabled	237	44.1

Source: Mathematica analysis of Medicaid administrative data, January 2013–November 2015.

[a] The HCIA grant funded services through October 2015. New York continued program services after grant funding ended and provided Mathematica with Medicaid administrative data through April 2016. To increase the sample size available for our analysis, we included all participants enrolled through November 2015 and services provided through April 2016.

[b] Based on reason for Medicaid eligibility.

B. Methods

1.   Quantitative methods

For this addendum we used the same analytic approach we used in the third annual report. The analyses in the third annual report included NYS Medicaid claims and enrollment data through June 2015. Here, we extend the analysis period to include data through April 2016.

We conducted an impact analysis with a difference-in-differences model and a matched comparison group. For this analysis, we used Medicaid claims and administrative data provided by the New York State Department of Health. Therefore, the analysis was limited to intervention group members enrolled in Medicaid. The analysis focused on three of the four core outcomes that CMMI prioritized for all HCIA awardees: total Medicaid expenditures,[9] hospitalizations,[10] and ED visits. We did not include re-admissions because there were so few of them that impact estimates would have been unreliable.

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[9] These expenditures include both fee-for-service and managed care payments. When service level payment information was not available for managed care covered services, we estimated these payment amounts based on fee-for-service payment guidelines.

[10] Fee-for-service Medicaid does not cover inpatient care in institutions for mental diseases (IMDs) for individuals 21 to 64 years old. However, Medicaid does cover inpatient care for psychiatric conditions at general hospitals, and, in some states, some IMD stays may be covered, in whole or in part, through managed care or 1115 waivers.

FPHNY staff reported that 1,401 participants were on Medicaid. However, when we searched the New York State Medicaid files, we discovered that the FPHNY and state files had consistent identifying information for only 1,321 of these individuals.[11] Of these 1,321, we had to exclude 784 (approximately 60 percent), leaving an analytic sample of 537 participants. We excluded each of the 784 individuals for one or more of the following reasons:

- They were dually enrolled in Medicare, did not have full coverage for the state's Medicaid benefit package, or had third-party coverage. We took this step to ensure that all individuals in our analytic sample had consistent Medicaid service coverage during the analysis period, including having Medicaid as the first payer for hospitalizations and ED visits.

- They were not enrolled in Medicaid for at least six months before and at least five months after they received Parachute NYC services. This ensured that we had enough data in the pre- and post-intervention periods for each individual included in the analysis.

- They did not have a behavioral health diagnosis in the claims data.

We then took the following steps to identify a well-matched comparison group of Medicaid beneficiaries:

- We selected a pool of potential comparison group members who resembled the intervention population in the following respects: (1) resided in New York City, (2) were not enrolled in Medicare, and (3) had at least one claim with a behavioral health diagnosis between January 2012 and November 2015.

- For each potential comparison group member in each month between January 2012 and November 2015, we identified use of (1) inpatient, (2) ED, (3) psychiatric, or (4) non-psychiatric office services with a behavioral health diagnosis. Then, from among the months in which the comparison group member received a behavioral health service, we randomly selected a pseudo-enrollment month (that is, a month they could have been enrolled in Parachute NYC if it had been available to them) for each comparison group member. This random selection was weighted such that the distribution of program enrollment and pseudo-enrollment months for intervention and potential comparison group members, respectively, were proportionally similar across calendar months. For the intervention and potential comparison pool, the program enrollment month and the pseudo-enrollment month were deemed the first month in the intervention period in our analysis.

- We then retained only those potential comparison pool members who had full-benefit Medicaid enrollment and Medicaid as their primary payer for at least six months before and at least five months after the pseudo-enrollment month.[12] Based on these criteria, over 316,000 individuals were included in the potential comparison pool.

- After defining the intervention group and the potential comparison pool, we used matching methods to select a narrower comparison group that was comparable to the intervention

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[11] Identifying information was deemed consistent if three out of four of the following fields matched: gender, day of birth, month of birth, and year of birth.

[12] This ensured some data for analysis for each comparison group member in the pre- and post-intervention periods.

population in the baseline period. We matched up to 20 members of the comparison pool to each intervention group member, using a two-stage process:

- In the first stage, the matching algorithm matched the intervention group members who first used CRCs to members of the comparison pool with an inpatient stay in their pseudo-enrollment month.[13]

- In the second stage, we used the remaining potential comparison pool members (excluding those beneficiaries that were matched to the CRC intervention subgroup) to search for matches for the intervention group members who first used the NA-MCT.

- We matched on the following characteristics:

  - Program enrollment or pseudo-enrollment month and type of BH service used in that month (inpatient, ED, psychiatric, or non-psychiatric office service)

  - Volume of BH service use (again, inpatient, ED visits, psychiatric, and non-psychiatric office service) and total Medicaid expenditures in the year prior to program enrollment or pseudo-enrollment

  - Mental and physical health diagnoses

  - Demographics (age, gender, race/ethnicity)

  - Disability status

  - Chronic Illness and Disability Payment System (CDPS) condition indicators

  - Full continuous year of Medicaid enrollment prior to program enrollment or pseudo-enrollment

- We ran matching diagnostic statistics, which indicated a strong match.

Our final comparison pool included 100,727 Medicaid enrollees. Further information on the methodology used to construct groups for the impact analysis is in Appendix A. We limited the follow-up period for each individual to two years because sample sizes for longer follow-up periods were too small to produce reliable results.

C. Summative findings

1. Descriptive analyses

Before developing impact estimates for the intervention and comparison groups, we analyzed trends in regression-adjusted means for three core outcome measures: total Medicaid expenditures, hospitalizations, and ED visits. We examined trends in the three years before the program enrollment or pseudo-enrollment month and in the two years following that month.

We conducted separate analyses for two subgroups of participants: those receiving CRC services and those receiving NA-MCT services. We decided to examine these groups separately because of the substantial differences in these two program components, and because fewer than

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[13] Intervention group members using CRC services at enrollment were matched to comparison pool individuals with an inpatient stay in their pseudo-enrollment month because CRC services were provided to individuals who required out-of-home care substituting for hospitalization.

20 participants received both types of services. Those receiving both services were assigned to the subgroup for the service they received first. About half received CRC services first and were assigned to the CRC subgroup; the others were assigned to the NA-MCT subgroup.

Medicaid expenditures. For both the CRC and NA-MCT subgroups, average total Medicaid expenditures were similar and generally rose over time for the intervention and comparison groups in the baseline period.

- Figure II.2 shows total per-person Medicaid expenditures during the baseline and post-intervention periods for the CRC subgroup. The average difference between the intervention and comparison groups during the baseline period is close to zero. At the I1 measurement point, however, expenditures trend sharply upward for the comparison group, but not for the intervention group. Had they not received CRC services, the intervention group's expenditures might have continued to be like the comparison group's expenditures (as they were in the baseline period). This did not happen, suggesting that the CRC intervention may have prevented the upward trend. Because of the way we selected comparison group members, they (like the intervention group) were having a crisis at the start of the I1 period. Unlike the intervention group, however, members of the comparison group would have received costly hospital or ER services to deal with the crisis; in contrast, the intervention group would have received less expensive care at the CRC. Then when the crisis passed, the comparison group goes back to previous service use patterns—as indicated at the I2 through I4 measurement points. Overall, this pattern suggests that, in the absence of the CRC, intervention participants would also have used more costly inpatient and emergency services.

- Figure II.3 shows total Medicaid expenditures during the baseline and post-intervention period for the NA-MCT subgroup. As for the CRC, the trend lines for both the NA-MCT and comparison groups are similar during the baseline period. At the I1 measurement point, however, the intervention group's line trends upward, leading to a significant difference from the comparison group. Although expenditures decrease on average for both groups in the later intervention periods (I2 through I4), the difference between them remains significantly different than the average difference between them during the baseline period. This suggests provision of NA-MCT services may have led to an increase in per-person Medicaid expenditures.

Figure II.2. Total Medicaid expenditures per FPHNY CRC participant per 6-month period
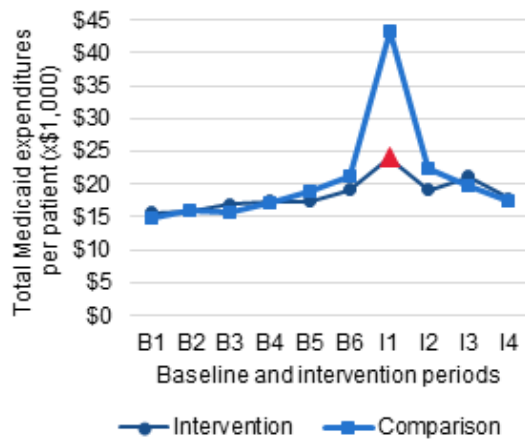
Figure II.3. Total Medicaid expenditures per FPHNY NA-MCT participant per 6-month period
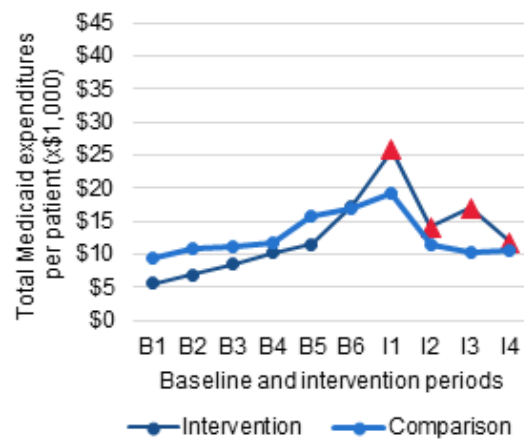
Source: Mathematica analysis of Medicaid administrative data, January 2010–April 2016.

Note: Means are regression-adjusted and are given in thousands of dollars per person. The regression model controlled for age (linear and squared), gender, race/ethnicity, whether 12 months of baseline data were available, disability status, Chronic Illness and Disability Payment System condition indicators, calendar month and year of program enrollment, and diagnoses at enrollment. Red dots indicate significant difference-in-differences estimates for the given intervention period relative to the average over all baseline periods.

Hospitalizations. The pattern of hospitalization rates was similar to that of expenditures, suggesting that hospitalization rates may be driving expenditure patterns (Figures II.4 and II.5). Once again, during the baseline periods, the difference between the intervention and comparison groups was small. For the CRC subgroup, the difference increased at I1 because of the growing hospitalization rate for the comparison group. For the NA-MCT subgroup, the difference widened because hospitalizations rose for the intervention group relative to the comparison group.

Figure II.4. Hospitalizations per FPHNY CRC participant per 6-month period
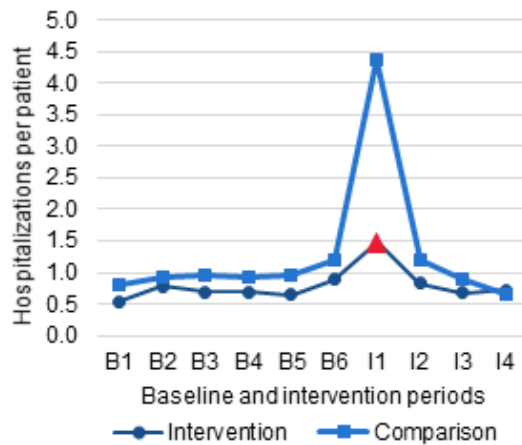
Figure II.5. Hospitalizations per FPHNY NA-MCT participant per 6-month period
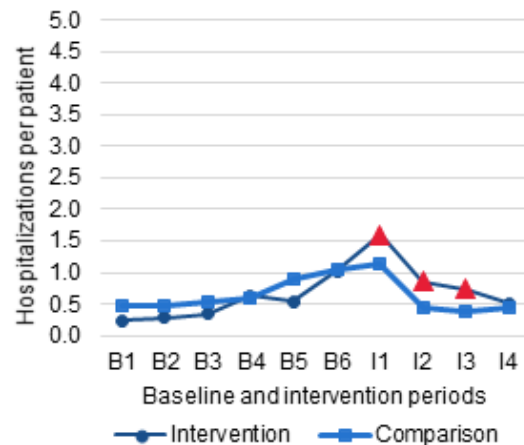
Source: Mathematica analysis of Medicaid administrative data, January 2010–April 2016.

Note: Means are regression-adjusted. The regression model controlled for age (linear and squared), gender, race/ethnicity, whether 12 months of baseline data were available, disability status, Chronic Illness and Disability Payment System condition indicators, calendar month and year of program enrollment, and diagnoses at enrollment. Red dots indicate significant difference-in-differences estimates for the given intervention period relative to the average over all baseline periods.

ED visits. The trend lines for the intervention and comparison groups closely parallel each other for both the CRC and NA-MCT participants (Figures II.6 and II.7). The ED visit rate for both groups increased during the baseline period, then declined after program enrollment or pseudo-enrollment. The differences between intervention and comparison groups in any intervention period were not significantly different from the average baseline difference, thus offering no evidence that FPHNY's program had any effect on ED visits.

Figure II.6. ED visits per FPHNY CRC participant per 6-month period
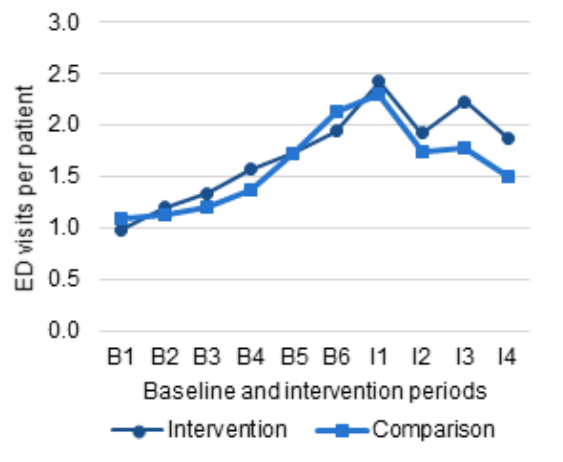
Figure II.7. ED visits per FPHNY NA-MCT participant per 6-month period
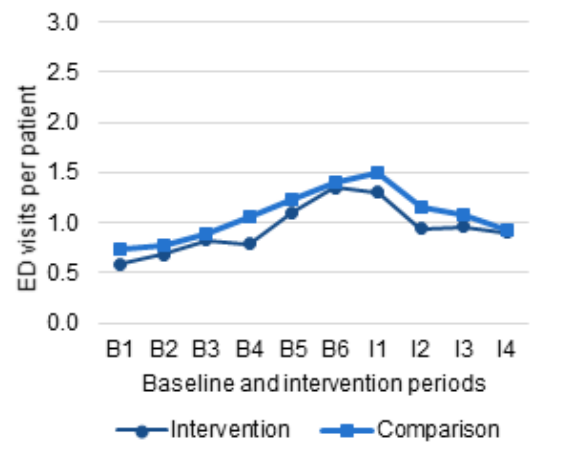
Source: Mathematica analysis of Medicaid administrative data, January 2010–April 2016.

Note: Means are regression-adjusted. The regression model controlled for age (linear and squared), gender, race/ethnicity, whether 12 months of baseline data were available, disability status, Chronic Illness and Disability Payment System condition indicators, calendar month and year of program enrollment, and diagnoses at enrollment. Red dots indicate significant difference-in-differences estimates for the given intervention period relative to the average over all baseline periods.

2.   Description of impact estimates

Findings from our impact analysis (Table II.2) corroborate the results of the descriptive analysis.[14] Specifically, we note the following:

- Across all participants in the analytic sample (combining data from the CRC and NA-MCT subgroups), the impact analysis revealed that the program significantly reduced the number of hospitalizations by 713 for the two years after enrollment ($p < .001$).

- The substantial reduction in hospitalizations for the CRC group was partially offset by a smaller (but still significant) increase for the NA-MCT group.

- Possibly as a result of the changes in hospitalization rates, total Medicaid expenditures diminished significantly for the CRC group, but rose significantly for the NA-MCT group.

- Our analysis revealed no significant impacts of the program on ED use for either the CRC or the NA-MCT group.

Impacts in each intervention year are presented in Appendix A. Overall and for the CRC subgroup, impacts on hospitalizations and total Medicaid expenditures were significant only in the first intervention year. For the NA-MCT subgroup, the increases in hospitalizations and expenditures were sustained in both years. We found no impacts on ED use for either subgroup in either year.

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[14] In contrast with the descriptive analysis, in which we report means for 6-month periods, the impact regressions were based on 12-month periods, including three baseline 12-month periods and two 12-month intervention period.

Table II.2. Medicaid impacts attributable to FPHNY's program

	All intervention group members			CRC only			NA-MCT only		
	Change	90% CI	80% CI	Change	90% CI	80% CI	Change	90% CI	80% CI
Aggregate results									
Total Medicaid expenditures (in thousands)	-$6,725	[-$10,044, -$3,406]	[-$9,532, -$3,918]	-$9,700	[-$12,627, -$6,773]	[-$12,175, -$7,225]	$2,759	[$1,331, $4,187]	[$1,551, $3,967]
Hospitalizations	-713	[-1,049, -378]	[-997, -430]	-882	[-1,209, -555]	[-1,158, -605]	152	[57, 247]	[72, 232]
ED visits	139	[-209, 487]	[-155, 434]	156	[-179, 490]	[-127, 439]	-14	[-133, 104]	[-114, 86]
Per beneficiary month									
Total Medicaid expenditures	-$780	[-$1,165, -$395]	[-$1,106, -$454]	-$1,609	[-$2,095, -$1,124]	[-$2,020, -$1,199]	$1,064	[$513, $1,615]	[$598, $1,530]
Hospitalizations	-0.08	[-0.12, -0.04]	[-0.12, -0.05]	-0.15	[-0.20, -0.09]	[-0.19, -0.10]	0.06	[0.02, 0.10]	[0.03, 0.09]
ED visits	0.02	[-0.02, 0.06]	[-0.02, 0.05]	0.03	[-0.03, 0.08]	[-0.02, 0.07]	-0.01	[-0.05, 0.04]	[-0.04, 0.03]
Number of participants	537			401			136		
Mean number of intervention months per participant	16			15			19		
Approximate proportion of intervention population represented in analysis[a]	31.5%			n.a.			n.a.		
Intervention period				January 2013 through April 2016					

Source: Mathematica analysis of New York State Medicaid administrative data, January 2010–April 2016.

Note: Reported changes are regression-adjusted differences between baseline and intervention period means for the intervention group relative to the control group. Regression model controlled for age (linear and squared), gender, race/ethnicity, whether 12 months of baseline data were available, disability status, Chronic Illness and Disability Payment System condition indicators, calendar month and year of program enrollment, and diagnoses at enrollment. Analysis is limited to the subset of program enrollees who were observable in Medicaid claims data for six months before and following their enrollment in the intervention, and who were not also enrolled in Medicare. The confidence intervals for all outcome measures were derived based on bootstrap methods and were adjusted for multiple testing based on the generalized Tukey method. Results are limited to the subset of intervention group members included in the analysis (N=537, of which, only 349 had data at I2) and do not represent all program participants.

[a] We calculated the approximate proportion by dividing the number of intervention group members (537) in the analysis by the number of individuals who first received services from FPHNY's program between January 2013 and October 2015 (1,703).

CI = confidence interval; n.a. = not applicable.

3.   Limitations of the analysis

Several limitations of the analysis should be considered when interpreting the findings:

- **Small sample size.** A small sample size and high variability—particularly in total expenditures—limits our ability to precisely estimate program impacts.

- **Representativeness of sample.** The 537 individuals included in our analyses are under a third of the total population enrolled in Parachute NYC. The program may have had different effects on participants not included in the analyses.

- **Lack of information on site enrollment.** Data provided by FPHNY did not assign program enrollees to a given site; therefore, we could not control for unobservable differences within the intervention group that may have arisen because of differences in the way different sites implemented the program. Impacts may have been different from one site to the next. However, we likely would not have conducted site-specific analyses even if we had this information because further divisions of the analytic sample would have exacerbated the limitations imposed by small sample sizes.

- **Unobservable differences between intervention and comparison groups.** The matching methods we used to select the comparison group for this analysis may not have fully accounted for unobservable differences between the intervention and comparison groups, such as different resources available at different residential locations. These unobservable differences may bias impact estimates in unknown ways.

D. Conclusions

The quantitative analyses included in this report are based on an additional 10 months of claims and enrollment data relative to the data we used in the third annual report. In the third annual report we presented impact analysis results for 12 months following program enrollment. In the current chapter we were able to extend this period to 24 months following program enrollment. With this additional period of data, our overall conclusions about program impacts are consistent with those reported in the third annual report. Overall, results from our evaluation suggest that Parachute NYC helped lower rates of Medicaid-funded hospitalizations and Medicaid expenditures for the CRC participant subgroup. In contrast, we found that Medicaid-funded hospitalizations and expenditures rose for the NA-MCT subgroup. Because these findings pertain to under a third of all program participants, they may not be representative of the participant group as a whole.

III. KITSAP MENTAL HEALTH SERVICES (KMHS)

Findings from Mathematica's evaluation of the KMHS HCIA program

- We conducted a comprehensive evaluation of the KMHS Race to Health! program, including analyses of Medicare, Medicaid, and electronic health record data. We also analyzed information we obtained from site visits, telephone interviews, focus groups, and a workforce survey.

- Quantitative analyses reveal that Race to Health! may have succeeded in decreasing total expenditures and reducing the number of emergency department (ED) visits, hospitalizations, and office visits for some KMHS Medicare clients. For Medicaid clients, we found the program had no significant impacts on hospitalization, and it may have increased the number of ED visits.

- Quantitative findings also indicate the program was moderately successful in promoting screening for physical health conditions, targeting screening resources to patients with pressing needs, and improving clients' results on health status measures.

- KMHS staff attributed the successful outcomes of Race to Health! in part to their greater focus on and understanding of their clients' physical health conditions. In interviews and focus groups, KMHS staff and leaders also underscored the benefits of the program's emphasis on clients' wellness and self-management of their health conditions, and believed these features helped clients improve their health.

- Most staff needed a significant amount of training to implement Race to Health! Few of them had any background in coordinating physical health care with behavioral treatment, or in integrating the two. KMHS staff told us this training and the program's strong infrastructure provided a solid foundation for their work.

- As of April 2016, 10 months after HCIA funding ended, KMHS was sustaining all components of Race to Health!, but the awardee's leaders expressed uncertainty about whether they could sustain some of these components in the future.

A. Introduction

Staff at Kitsap Mental Health Services, a community mental health center in Kitsap County, Washington, used HCIA funding to implement Race to Health! This program was designed to improve behavioral and physical health care and outcomes and thereby reduce the cost of care for all clients—adults and children—who were receiving the awardee's outpatient services beginning January 1, 2013. HCIA funding for Race to Health! ended on June 30, 2015.

Race to Health! had two primary components:

- **Whole-health focus within KMHS.** Race to Health! was an organization-wide initiative to redesign KMHS' infrastructure and service delivery model and prepare staff to care for clients' whole health (that is, mental and physical health and substance use). Before the award, KMHS had reorganized its staff into multidisciplinary care teams to better integrate treatment of substance use disorders into clients' care plans and to improve coordination between KMHS staff and clients' physical health care providers. KMHS used the HCIA funding to train the care teams on substance use disorders, physical health conditions, and strategies for supporting clients' self-management of chronic diseases such as diabetes. In addition, KMHS expanded its electronic health record (EHR) system to include data on physical health, and hired new staff (medical assistants and healthy family coordinators) to

collect and monitor these data. The care teams used the data to better understand the full range of the clients' needs for health services and to improve coordination of primary care and behavioral health services. KMHS also used these data to identify clients who would benefit from more care coordination with key community stakeholders (for example, social service providers, health plans, law enforcement, and emergency medical service staff).

- **Integration of behavioral health and primary care in community settings.** As part of Race to Health! KMHS partnered with a community health clinic, Harrison Health Partners (HHP), with KMHS staff providing brief behavioral health interventions and referrals at four HHP primary care practices. KMHS also offered telephone and email psychiatric consultations to HHP's primary care providers and other primary care providers in the community.

In the third annual report, we presented evaluation findings based on qualitative and quantitative data available through July 2016 including information on KMHS's administrative context and progress through the phases of innovation. In this addendum, we present findings from quantitative analyses incorporating an additional three months of Medicaid data obtained after we completed the third annual report. In the lessons learned section, we describe the new Medicaid quantitative findings in the context of qualitative, workforce survey, and sustainability findings previously described in the third annual report.

1. Enrollment

KMHS did not define a specific enrollment target for Race to Health! because the program was designed to reach everyone who used KMHS' outpatient services. For our evaluation, and to comport with KMHS' implementation procedures, we define the target population of the program as all KMHS clients who received face-to-face outpatient services between January 1, 2013, and June 30, 2015—a total of 6,662 clients.

Although all KMHS clients who received outpatient services were included in the target population, the awardee periodically identified subgroups of clients, known as cohorts, with more severe health conditions. KMHS staff chose the adult cohorts by using information from the state's PRISM data system and KMHS' EHR. PRISM is a web-based application that integrates Medicaid enrollee data from multiple sources and provides risk assessment tools such as the chronic disability illness system, which assigns risk scores to Medicaid enrollees based on the severity of their health care needs. For the children's cohorts, staff asked providers for recommendations and then analyzed EHR data to search for comorbidities.

Staff made a special effort to ensure that the EHRs for members of the cohorts contained key data about their health status and use of health services. KMHS staff obtained this information by reaching out to clients' primary care providers and tapping into an Emergency Department Information Exchange data system that is available to providers in the state. KMHS used these more comprehensive EHR data to better understand the full range of clients' needs for health services and to improve coordination with primary care providers.

2. Clients' demographic characteristics

Because we had no single data source that covered the entire KMHS client population and yielded information on all the program's targeted outcomes, we conducted three sets of

quantitative analyses based on different data sources (Medicare, Medicaid, and EHR). Findings from these analyses may differ because they include different populations.

Specifically, the characteristics of the clients in the three data sets differ substantially (Table III.1). The Medicare analysis includes people enrolled in Medicare, either in Medicare alone (22.3 percent) or in both Medicare and Medicaid (77.7 percent). The Medicaid analysis includes people enrolled *solely* in Medicaid. The analysis of health status measures includes enrollees of all three types: Medicaid only (73.9 percent), Medicare only (2.4 percent), and dual enrollees (22.4 percent).

Children are included in the Medicaid analysis (making up 36.6 percent of that population) but they are not included in the analysis of Medicare and health status measures. Fewer than 11 people over age 64 are included in the Medicaid analysis, and only 4.5 percent of the individuals in the health status measure analysis are over 64. In contrast, 30.6 percent of the Medicare analysis population is over 64. The majority of people in the Medicaid, Medicare, and EHR analyses populations are female (56.1, 54.4, and 57.0 percent, respectively).

Over three-quarters (77.9 percent) of the Medicare sample was eligible for Medicare because of a disability, but less than half (42.9 percent) of the Medicaid sample was eligible for this reason. The Medicare and Medicaid groups also differed in the prevalence of specific mental health diagnoses (Table III.2). For example, 30.7 percent of the Medicare or dual enrollees have disorders related to schizophrenia, whereas among Medicaid enrollees, this figure is much lower (6.7 percent).

Table III.1. Demographic characteristics of groups included in analyses

	Medicare analysis		Medicaid analysis		EHR analysis (health status)	
	Number of clients	Percent of clients	Number of clients	Percent of clients	Number of clients	Percent of clients
Total population	846	100%	3,749	100%	2,640	100%
Medicaid, non-dual	0	0.0	3,749	100.0	1,950	73.9
Medicare, non-dual	189	22.3	0	0.0	64	2.4
Dual	657	77.7	0	0.0	592	22.4
Unknown	0	0.0	0	0.0	34	1.3
Age						
Under 18	0.0	0.0	1,371	36.6	0	0
18–34	138	16.3	1,169	31.2	1,147	43.4
35–44	142	16.8	515	13.7	523	19.8
45–54	173	20.5	461	12.3	546	20.7
55–64	134	15.8	233[a]	6.2[a]	305	11.6
65 or older	259	30.6	<11[a]	<11[a]	119	4.5
Gender						
Female	460	54.4	2,102	56.1	1,504	57.0
Male	386	45.6	1,647	43.9	1,136	43.0
Medicaid/Medicare eligible based on disability						
Yes	659	77.9	1,610	42.9	n.a.	n.a.

Source: The Medicare analysis is based on Medicare administrative data for July 2010–June 2015. The Medicaid analysis is based on Mathematica analysis of Medicaid Analytic Extract (MAX) and Alpha-MAX data for Washington State for July 2011–June 2014. The analysis of health status measures is based on EHR data for January 2014–June 2015, provided by KMHS.

Note: The Medicare analysis is limited to people who were not enrolled in Medicare Advantage, had Medicare as a primary payer and were enrolled in parts A & B, and received mental health treatment at KMHS or a comparison facility. The Medicaid analysis is limited to people with full benefits who were enrolled in Medicaid (with Medicaid as the first payer, and not dual enrolled in Medicare) for at least 6 months after beginning mental health treatment at a KMHS or other facility between the beginning of the program period and June 2014. The Medicaid analysis also excluded S-CHIP (State Children's Health Insurance Program) enrollees and people with missing enrollment records. The EHR analysis is limited to KMHS clients who had at least one face-to-face visit in 2014.

[a] For the Medicaid analysis, people aged 65 and older were included in the 55 to 64 age group because fewer than 11 of them were aged 65 or older.

EHR = electronic health record; n.a. = not applicable.

Table III.2. Diagnoses of KMHS clients

	Medicare analysis		Medicaid analysis	
	Number of clients	Percent of clients	Number of clients	Percent of clients
Diabetes	NA	NA	224	6.0
Hypertension	NA	NA	441	11.8
Drug abuse	NA	NA	343	9.1
Alcohol abuse	NA	NA	280	7.5
Schizophrenic disorder	260	30.7	251	6.7
Bipolar disorder	175	20.7	603	16.1
Depressive disorder	186	22.0	1,164	31.0
Dementia	76	9.0	<11	<11
Other psychotic disorder	55	6.5	133	3.5
Anxiety, dissociative, and somatoform disorder	20	2.4	794	21.2
Adjustment reaction disorder	65	7.7	1,077	28.7
Other mental health diagnosis	37	4.4	2,138	57.0

Source: The Medicare analysis is based on Medicare administrative data for July 2010–June 2015. The Medicaid analysis is based on Mathematica analysis of Medicaid Analytic Extract (MAX) and Alpha-MAX data for Washington State for July 2011–June 2014.

Note: The EHR analysis group is not included in this table because we had no data on their psychiatric diagnoses. The psychiatric diagnosis indicators (in the last eight rows of the table) for the Medicare analysis were created using ICD-9 (International Classification of Diseases, Ninth Revision) diagnosis codes found on any of the client's psychiatric services claims in the month during the program period in which the client was first attributed to a facility and the two months following. The diagnosis indicators for primary care and substance use (diabetes, hypertension, drugs, alcohol) for the Medicaid analysis were created using ICD-9 diagnosis codes found on any of the client's claims in the 12 months before the month during the program period in which the client first had a psychiatric services claim. The psychiatric diagnosis indicators (in the last eight rows of the table) for the Medicaid analysis were created using ICD-9 diagnosis codes found on any of the client's psychiatric services claims in the month during the program period in which the client first had a psychiatric services claim and the two months following.

NA = not available; EHR = electronic health record.

B. Methods

1. Quantitative methods

In this section, we describe the methods we used for the Medicaid and Medicare impact analyses. We used the same analytic approach for the analyses in the addendum as we used for the third annual report. The available data for the Medicare analysis was the same as that available for the third annual report; however we used three additional months of data for the Medicaid analysis.

Medicare impact analysis. For the Medicare sample (N = 846), we were able to conduct a rigorous impact analysis using a difference-in-differences model with a matched comparison group (N = 2,643). This analysis focused on four outcome measures:

1. Total expenditures

2. Hospitalizations

3. Emergency department (ED) visits

4.   Office visits[15]

Hospital readmissions were too infrequent for us to produce reliable impact estimates for the program.

Office visits may serve as a measure of the extent to which KMHS altered its clients' use of preventive and well care services. KMHS specifically endeavored to reduce use of acute care services by monitoring clients' physical health more often, promoting use of preventive services, and encouraging better self-care. Less use of acute care services (such as ED visits) may lead to lower expenditures.

We obtained Medicare data from the CMS Virtual Research Data Center (VRDC). We used Medicare data covering the period from July 2009 through June 2015.[16] In the dataset, we included claims for anyone with a Medicare claim for an outpatient mental health visit at KMHS between July 2010 and June 2015.

The pool of potential comparison group members included anyone with a claim for an outpatient mental health visit at a comparison mental health facility or a facility in the state of Washington that served clients with dementia. We used the Substance Abuse and Mental Health Services Administration's Treatment Finder to identify 16 mental health facilities in Washington State with characteristics similar to those of KMHS. Because these 16 facilities served a limited number of clients with dementia, they did not provide enough comparison clients to match with KMHS clients with dementia. As a result we also identified facilities in Washington that had at least 100 beneficiaries with Medicare administrative claims for dementia, and we included all clients from these facilities who had dementia in the potential comparison pool.

Both the intervention group and the potential comparison group were limited to clients who had Medicare as their primary payer, were enrolled in Medicare Parts A and B, and were not enrolled in Medicare Advantage.

We used propensity score matching to select the final comparison group. We matched up to five members of the comparison pool to each KMHS client in the Medicare analysis. With the matching algorithm, we sought to identify comparison group members who resembled the members of the intervention group on several key characteristics that are predictive of future Medicare service use and expenditures, including demographics, disability status, Hierarchical Condition Categories (HCC), dual Medicare/Medicaid enrollment status, and mental health diagnoses. The standardized differences between the KMHS clients and the comparison group were within 10 percent for all measures included in the matching analysis, indicating a strong match. Appendix A includes more details on the data processing and matching methods.

Medicaid impact analysis. We were also able to conduct a rigorous impact analysis for the Medicaid population (N = 3,749) using a difference-in-differences model with a matched

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[15] Office visits are evaluation and management services, including preventive services or well care provided to a new or established patient in a physician's office, nursing home, or patient home.

[16] Data for July 2009–June 2010 were only used to identify chronic conditions among individuals participating in mental health treatment at KMHS or a comparison facility in July 2010–June 2011.

comparison group (N = 15,979). The analysis includes Medicaid beneficiaries enrolled in both fee-for-service and managed care. Because of data limitations, the analysis for the Medicaid population focused on two outcome measures: hospitalizations and ED visits. We were unable to calculate total expenditures for the Medicaid population because many of the KMHS Medicaid-enrolled clients are enrolled in Medicaid managed care, and data on expenditures were unavailable for them. In addition, we did not analyze hospital readmissions because they were so rare that our estimates would have been unreliable.

We obtained the Medicaid administrative data for the analyses from the CMS VRDC. We used Medicaid Analytic Extract (MAX) and Alpha-MAX data for Washington State for the period from July 2011 through June 2014. [17] These data cover a more limited period than our Medicare analysis does. Our analyses were limited to this period because managed care reporting for 2009 and 2010 was not comparable to the reporting for 2011 to 2014. Also, at the time we extracted data for this analysis (January 2017), the VRDC did not have data available for Washington State for the last year of the program (July 2014 through June 2015).

To help us identify KMHS clients for this analysis, the awardee gave us a finder file drawn from its EHR data, and we used it to identify people who had an in-person visit recorded in the EHR on or after January 1, 2013. To be included in the analytic file, a person also had to have a Medicaid mental health service claim during 2013 or 2014. Unlike for the Medicare analysis, we could not create the comparison group by identifying facilities based on the Medicaid data. Instead, the comparison pool was defined as all people not in the treatment group who had a mental health service claim in the state's Medicaid data during 2013 or 2014 and did not have an in-person visit at KMHS in the EHR data after January 1, 2011. Anyone who was not eligible for full Medicaid benefits, who did not have Medicaid as the first payer, who was dual enrolled, who was an S-CHIP enrollee, who had missing enrollment records, or who had less than six months of enrollment in Medicaid after initiating treatment at KMHS or another facility during the program period through June 2014 was excluded from the analysis. The comparison population in this analysis therefore represents a broad range of people receiving mental health treatment from all types of providers throughout the state.

Just as we did for the Medicare analysis, we used propensity score matching to match up to five members of the comparison pool to each KMHS client in the Medicaid analysis. With the matching algorithm, we sought to identify comparison group members who resembled the members of the intervention group on several key characteristics that are predictive of future Medicaid service use, including demographics, disability status, Chronic Illness and Disability Payment System (CDPS) conditions,[18] and, to the extent feasible, the mental health diagnoses

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[17] The calendar year MAX data for 2011 through 2013 included nine months of runout following the end of the calendar period; however the Alpha-MAX data for January through June 2014 included only claims paid through December 2014.

[18] We calculated CDPS scores based on a risk adjustment model developed by the University of California, San Diego (UCSD), which some Medicaid programs use to adjust payments for beneficiaries who are disabled or on Temporary Assistance for Needy Families. Scores reflect the ratio of predicted health expenditures for a given beneficiary relative to average Medicaid per-person expenditures. Each beneficiary's CDPS scores are estimated based on diagnoses in the past 12 months of Medicaid claims data, as well as demographic characteristics. We created CDPS scores following UCSD's CDPS + MRx methodology. They were based on the conditions reported in Medicaid claims data in the 12-month period before the month the enrollee first had a claim corresponding to the

listed on the person's claims. Appendix A includes more details on the data processing and matching methods.

C. Summative findings

Below, we report the findings from our Medicare, Medicaid, and health status analyses.

1. Results of Medicare analyses

a. Descriptive analyses

Expenditures. During the baseline period (before the program began), expenditures for the comparison group went up, whereas expenditures for the intervention group went down (Figure III.1). Expenditures for both groups went down after the program began (the intervention period), with expenditures for the comparison group remaining higher than those for the intervention group. From the third intervention period to the fifth, the gap was significantly different from the average gap during the baseline period. This finding suggests that the program may have lowered expenditures for its clients relative to the experience of the comparison group.

Figure III.1. Total Medicare expenditures per client per 6-month period: Beginning of baseline to end of intervention

Source: Mathematica analysis of Medicare administrative data for July 2010–June 2015.

Note: Means are regression-adjusted. Time periods are measured in six-month increments. I1 = Months 1–6 of the KMHS program, I2 = Months 7–12, I3 = Months 13–18. The baseline time periods are measured similarly: B1 = Months 13–18 before the start of the program, B2 = Months 7–12, B3 = Months 1–6. Red points indicate that the difference between the intervention and comparison group mean in the intervention period is significantly different from the average difference that occurred in the baseline period. This analysis is based on 846 intervention group members and 2,643 comparison group members. Sample sizes varied from one period to another depending on the availability of data.

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conditions focused on in the program's goals. For people who had a mental health visit in January 2014, the score was calculated based on Medicaid data for January through December 2013.

Hospitalizations. Outside of one of the five baseline periods, B2, the average difference in hospitalization rates between the intervention and comparison groups in the baseline period was negligible (about .01). In Figure III.2, we show the extremely small gaps between the two groups for most of the baseline period. Presumably, in the absence of the program, the hospitalization rates of the two groups would have remained comparable over time. However, while the program was in progress (from periods I1 to I5), hospitalization rates were consistently higher in the comparison group than they were in the intervention group, and the between-group gap at each measurement point was significantly different from the average baseline difference of .01. This finding suggests that Race to Health! may have helped lower hospitalization rates for the intervention group.

Figure III.2. Hospitalizations per Medicare client per 6-month period: Beginning of baseline period to end of intervention period

Source: Mathematica analysis of Medicare administrative data for July 2010–June 2015.

Note: Means are regression-adjusted. Time periods are measured in six-month increments. I1 = Months 1–6 of the KMHS program, I2 = Months 7–12, I3 = Months 13–18. The baseline time periods are measured similarly: B1 = Months 13–18 before the start of the program, B2 = Months 7–12, B3 = Months 1–6. Red points indicate that the difference between the intervention and comparison group mean in the intervention period is significantly different from the average difference that occurred in the baseline period. This analysis is based on 846 intervention group members and 2,643 comparison group members. Sample sizes varied from one period to another depending on the availability of data.

Emergency department visits. During the baseline period, the ED visit rate was consistently higher for the intervention group than it was for the comparison group, but the difference between the groups was quite small (only about .12 visits per client; Figure III.3). Presumably, this difference would have persisted in the absence of the program.

However, as Figure III.3 shows, the comparison group's rate began trending upward after the program began, whereas the ED rate for the intervention group began trending downward. Even though the absolute value of the resulting gap was not very different, the direction was the reverse of the direction in the baseline period: by the I2 measurement point, the intervention group's rate was lower than the comparison group's rate, and the gap between the two groups

from I2 to I5 was significantly different from the average baseline gap, suggesting that the program reduced ED visits for the intervention group relative to the comparison group.

Figure III.3. Emergency department visits per Medicare client per 6-month period: Beginning of baseline period to end of intervention period

Source: Mathematica analysis of Medicare administrative data for July 2010–June 2015.

Note: Means are regression-adjusted. Time periods are measured in six-month increments. I1 = Months 1–6 of the KMHS program, I2 = Months 7–12, I3 = Months 13–18. The baseline time periods are measured similarly: B1 = Months 13–18 before the start of the program, B2 = Months 7–12, B3 = Months 1–6. Red points indicate that the difference between the intervention and comparison group mean in the intervention period is significantly different from the average difference that occurred in the baseline period. This analysis is based on 846 intervention group members and 2,643 comparison group members. Sample sizes varied from one period to another depending on the availability of data.

   Office visits. As Figure III.4 illustrates, office visits generally trended upward for both the intervention and the comparison groups during the baseline period. On average, from the first baseline period to the fifth, the mean number of visits for the intervention group exceeded the mean number of visits for the comparison group by 2.7 visits.

   During the intervention period, the number of office visits remained higher for the intervention group, but the difference between the two groups became smaller. In the first intervention period, the difference between the two groups was less than 1—significantly lower than the baseline average of 2.7. The differences also were significantly less at the third, fourth, and fifth intervention periods. The number of office visits decreased throughout the intervention period for both groups. These figures suggest that KMHS' program may have contributed to reducing the number of office visits over time relative to the comparison group; however, because trends in the comparison group's rate of office visits changed substantially at the start of the intervention period, these results should be interpreted with caution.

Figure III.4. Office visits per Medicare client per 6-month period: Beginning of baseline period to end of intervention period

Source: Mathematica analysis of Medicare administrative data for July 2010–June 2015.

Note: Means are regression-adjusted. Time periods are measured in six-month increments. I1 = Months 1–6 of the KMHS program, I2 = Months 7–12, I3 = Months 13–18. The baseline time periods are measured similarly: B1 = Months 13–18 before the start of the program, B2 = Months 7–12, B3 = Months 1–6. Red points indicate that the difference between the intervention and comparison group mean in the intervention period is significantly different from the average difference that occurred in the baseline period. This analysis is based on 846 intervention group members and 2,643 comparison group members. Sample sizes varied from one period to another depending on the availability of data.

b.   Impact analyses

      KMHS Medicare population. For the impact analysis, we conducted a difference-in-differences analysis to assess the difference in the intervention and control group outcomes before and after the program. The results of this analysis suggest that the program significantly reduced overall Medicare expenditures, hospitalizations, ED visits, and office visits for KMHS clients relative to the comparison group (Table III.3). Notable findings are as follows:

- During the study period, we estimated that Medicare expenditures decreased $266 per enrolled beneficiary month for the intervention group relative to the comparison group (p-value < 0.05). Overall, we estimated total savings of $5,144,000 for the 13 percent of KMHS clients who were Medicare beneficiaries.

- There were fewer hospitalizations and fewer ED visits for clients relative to the comparison group by 0.02 and 0.03 per enrolled month, respectively (p-value <0.01 for both estimates).

- The mean number of office visits decreased significantly during the intervention period relative to the baseline period for both the intervention and comparison groups but the relative decrease was greater for the intervention group (p-value < 0.05).

Table III.3. Medicare impacts attributable to KMHS's program

	Change	90% confidence interval	80% confidence interval
Aggregate results			
Total Medicare expenditures (in thousands of dollars)	-$5,144	[-$8,956 to -$1,331]	[-$8,420 to -$1,867]
Hospitalizations	-297	[-481 to -112]	[-455 to -138]
Emergency department visits	-546	[-937 to -156]	[-882 to -211]
Office visits	-2,560	[-4,526 to -593]	[-4,250 to -869]
Per beneficiary month			
Expenditures (in dollars)	-$266	[-$463 to -$69]	[-$435 to -$96]
Hospitalizations	-0.02	[-0.02 to -0.01]	[-0.02 to -0.01]
Emergency department visits	-0.03	[-0.05 to -0.01]	[-0.05 to -0.01]
Office visits	-0.13	[-0.23 to -0.03]	[-0.22 to -0.04]
Number of clients	846		
Mean number of intervention months per client	23		
Approximate proportion of intervention population represented in analysis[a]	13%		
Intervention period	January 1, 2013, to June 30, 2015		

Source: Mathematica analysis of fee-for-service Medicare administrative data for baseline and program periods, January 2010–June 2015. Data for calendar year 2009 were used to develop indicators of baseline health status.

Note: Impact estimates were derived from regression models controlling for age (linear and squared), gender, race/ethnicity, cohort participation, dual eligibility status, whether 12 months of baseline data were available, behavioral health diagnoses, length of time in mental health treatment, disability status, and HCC condition indicators. We derived the impact estimates in Stata using the margins command to compare the difference between the intervention and baseline period means for the treatment and comparison groups accounting for the nonlinear modeling approach. The confidence intervals for total expenditures, hospitalizations, ED visits, and office visits were derived based on bootstrap methods and were adjusted for multiple testing based on the generalized Tukey method. Readmissions were not included in the adjustment for multiple testing due to small sample size.

[a] We calculated the approximate proportion of the intervention population represented in the analysis by dividing the number of clients (846) in the Medicare analysis by the number of people who participated in KMHS' program between January 2013 and June 2015 (6,662).

HCC = Hierarchical Condition Category.

Analyses by cohort status. As noted, one component of Race to Health! involved periodically identifying and selecting groups of clients, known as cohorts, based on their physical comorbidities. Although all KMHS clients were exposed to the HCIA program because it was implemented throughout the agency's client population, KMHS staff specifically focused on collecting physical health data for members of the cohorts because of their high level of need. We conducted impact analyses to determine whether the effects of the Race to Health! were more prominent among these cohorts. Overall, we found no consistent evidence that the program had a greater or lesser benefit for the cohorts than it did for the overall client population. (Details of these analyses appear in Appendix A.)

c.   Analytic limitations of the Medicare analysis

The primary limitation of this analysis is its lack of generalizability, because it is limited to Medicare fee-for-service (FFS) enrollees. This is about 13 percent of the KMHS target population affected by the implementation of Race to Health! Anyone enrolled in Medicare

Advantage was excluded from this analysis. The choice to participate in Medicare Advantage is associated with particular health care needs,[19] and therefore the program may have different effects on Medicare Advantage beneficiaries than it does on beneficiaries in FFS Medicare. Out-of-pocket expenditures and services not covered by Medicare may have been affected by the program, but they were not addressed in this analysis. Overall, our findings are not generalizable to all KMHS clients and services.

2.   Results from Medicaid analyses

a.   Descriptive analyses

Before developing impact estimates for the Medicaid intervention and comparison group, we analyzed the trends in means for two outcome measures, hospitalizations and ED visits.

Hospitalizations. As Figure III.5 shows, in the baseline period (B1–B3) hospitalizations rates were similar for intervention and comparison group clients. Hospitalization rates shifted upward in parallel for both groups at the beginning of the intervention period (I1). Then, in the second intervention period, hospitalizations for the intervention group continued to trend upward, whereas those for the comparison group leveled off. However, the change in the difference between the groups relative to the baseline difference is not statistically significant. In the third intervention period, both groups had similar hospitalization rates.

These findings suggest that Race to Health! did not affect hospitalization rates for its Medicaid clients. Forces external to the intervention appear to have led to dramatic increases in hospitalization rates for both the intervention and comparison group at the start of the intervention period.

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[19] Biles, Brian, Giselle Casillas, and Stuart Guterman. "Variations in County-Level Costs Between Traditional Medicare and Medicare Advantage Have Implications for Premium Support." *Health Affairs*, vol. 34, no. 1, January 2015, pp. 56–63.

Figure III.5. Hospitalizations per Medicaid client per 6-month period: Beginning of baseline period to end of intervention period
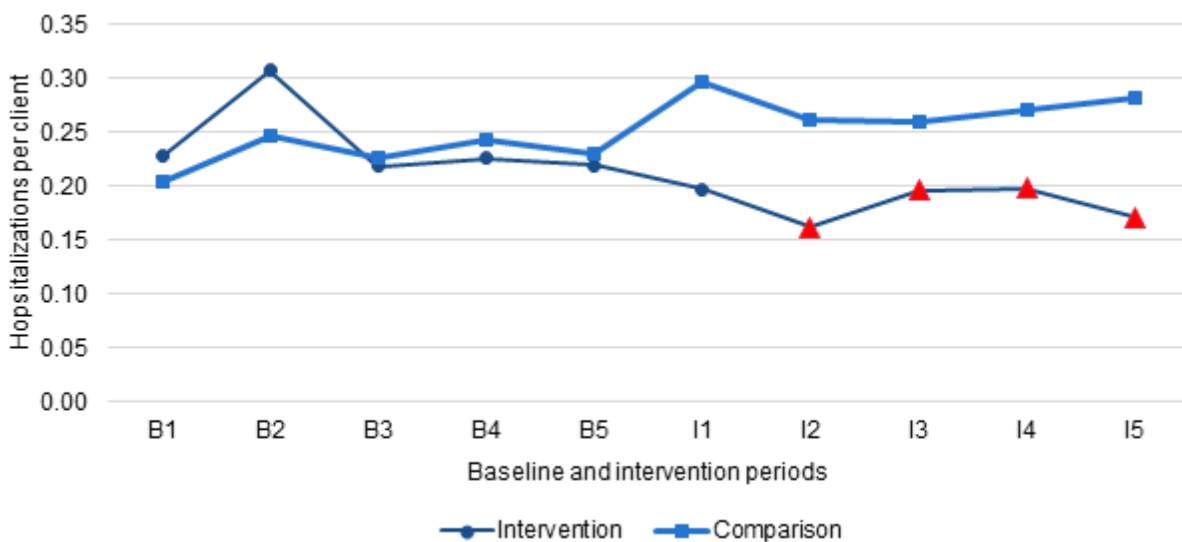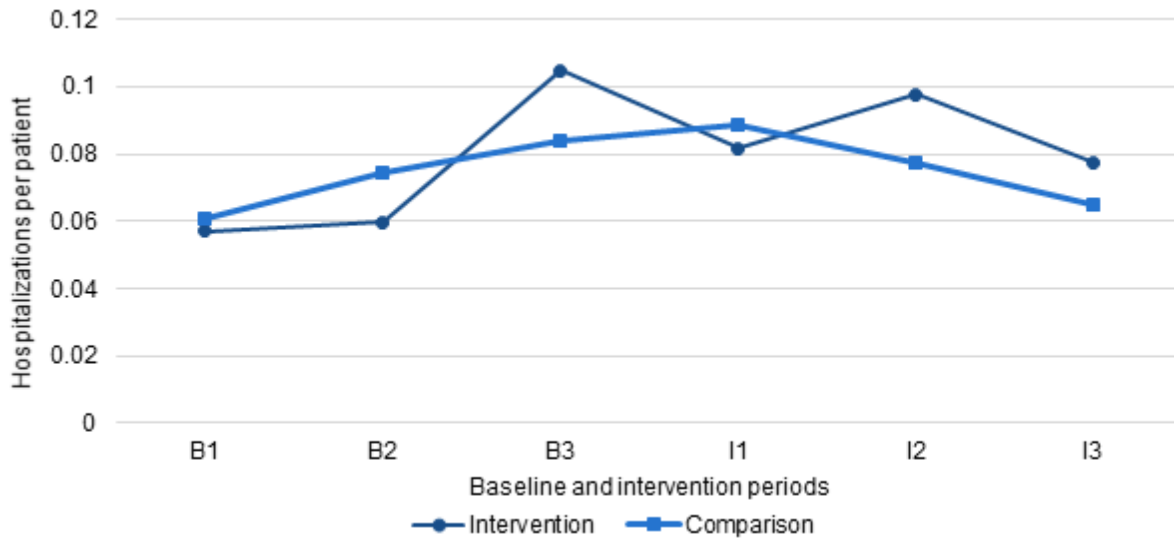

Source: Mathematica analysis of Medicaid administrative data for January 2011–June 2014.

Note: Means are regression-adjusted. None of the differences between the intervention and comparison group means in the intervention period are significantly different from the average difference that occurred in the baseline period. This analysis is based on 3,749 intervention group members and 15,929 comparison group members. Sample sizes varied from one period to another depending on data availability.

ED visits. As Figure III.6 illustrates, the ED visit rates for the intervention and comparison groups were similar during the baseline period. After the intervention started, the ED visit rate for the intervention group began an upward trend, whereas the rate for the comparison group remained stable. Consequently, the difference between the two groups at all three intervention periods was significantly greater than the average baseline difference. These findings suggest that the KMHS program may have contributed to increased ED visit rates for Medicaid beneficiaries.

Figure III.6. Emergency department visits per Medicaid client per 6-month period: Beginning of baseline period to end of intervention period

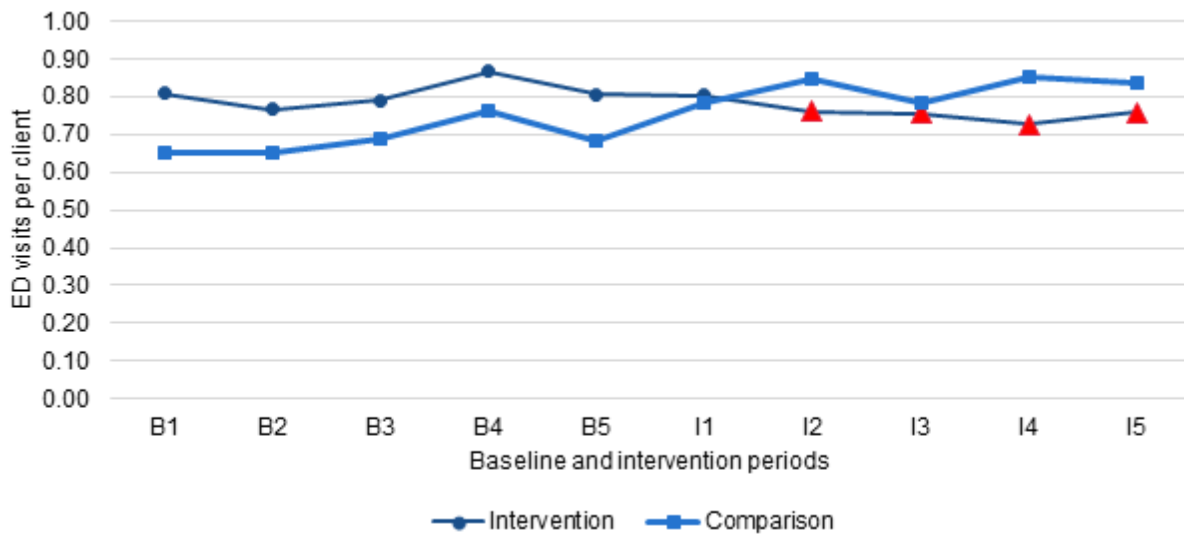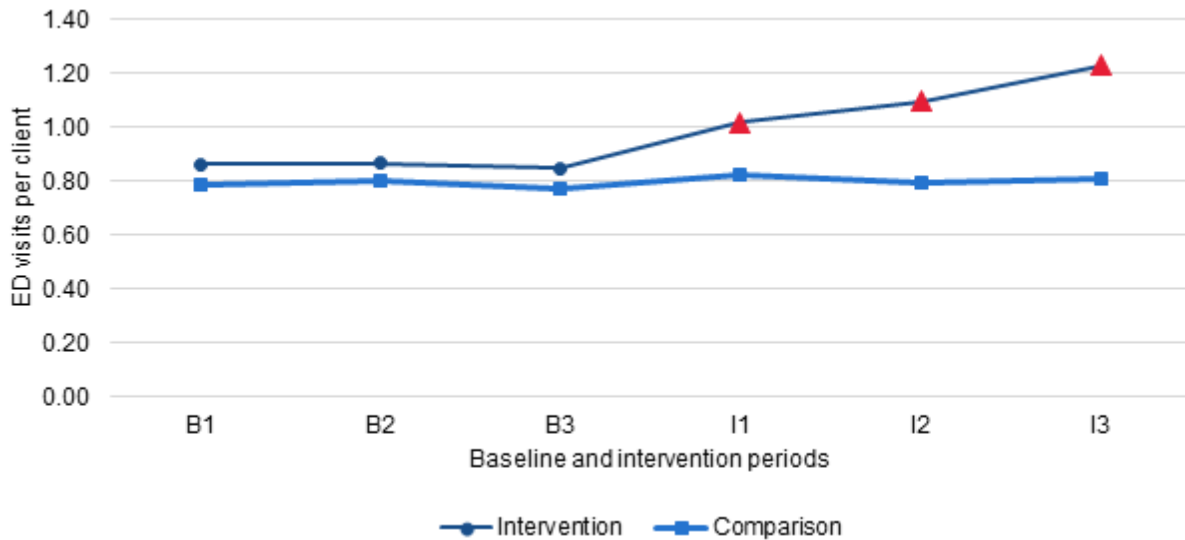Source: Mathematica analysis of Medicaid administrative data for January 2011-June 2014.

Note: Means are regression-adjusted. Red points indicate the difference between the intervention and comparison group mean in the intervention period is significantly different from the average difference that occurred in the baseline period. B1, B2, etc., indicate each 6-month period of the analysis before the intervention began, and I1, I2, etc., indicate each 6-month period of the analysis during the intervention period; 3,749 intervention group members and 15,979 comparison group members were included in this analysis. Sample sizes varied from one period to another, depending on data availability.

b.   Impact analysis

Results of the difference-in-differences analysis suggest that the program increased overall Medicaid ED visits for clients in the intervention group relative to the comparison group ($p < 0.01$) and had no effect on hospitalizations (Table III.4). As we found in the Medicare analysis, there was little evidence that the program had different effects for Medicaid beneficiaries in the cohorts.

Table III.4. Medicaid impacts attributable to KMHS' program

	All intervention group members		Cohort		Non-cohort	
	Change	90% and 80% confidence intervals	Change	90% and 80% confidence intervals	Change	90% and 80% confidence intervals
Aggregate results						
Hospitalizations	343	90% CI [-13,666 to 14,352] 80% CI [-11,288 to 11,974]	609	90% CI [276 to 942] 80% CI [332 to 885]	171	90% CI [-467 to 809] 80% CI [-359 to 701]
ED visits	2,211	90% CI [1,602 to 2,821] 80% CI [1,705 to 2,717]	-170	90% CI [-949 to 609] 80% CI [-817 to 476]	1,600	90% CI [1,095 to 2,105] 80% CI [1,181 to 2,019]
Per beneficiary month						
Hospitalizations	0.006	90% CI [-0.228 to 0.239] 80% CI [-0.188 to 0.200]	0.057	90% CI [0.026 to 0.089] 80% CI [0.031 to 0.083]	0.003	90% CI [-0.009 to 0.016] 80% CI [-0.007 to 0.014]
ED visits	0.037	90% CI [0.027 to 0.047] 80% CI [0.028 to 0.045]	-0.016	90% CI [-0.089 to 0.057] 80% CI [-0.077 to 0.045]	0.032	90% CI [0.022 to 0.043] 80% CI [0.024 to 0.041]
Number of clients	3,749		646		3,103	
Mean number of intervention months per client	16		16		16	
Approximate proportion of intervention population represented in analysis[a]	56%		n/a		n/a	
Intervention period	January 1, 2013, to June 30, 2014					

Source: Mathematica analysis of Medicaid administrative data for baseline and program periods January 2011–June 2014.

Note: Impact estimates were derived from regression models controlling for indicators of age, gender, race/ethnicity, cohort participation, dual eligibility status, availability of 12 months of baseline data, behavioral health diagnoses, disability status, and health conditions used in the CDPS (Chronic Illness and Disability Payment System) score. We derived the impact estimates in Stata using the margins command to compare the difference between the intervention and baseline period means for the treatment and comparison groups, accounting for the nonlinear modeling approach. The confidence intervals for hospitalizations and emergency department (ED) visits were derived based on bootstrap methods and were adjusted for multiple testing based on the generalized Tukey method. This analysis is based on 3,749 intervention group members and 15,979 comparison group members.

[a] We calculated the approximate proportion of the intervention population represented in the analysis by dividing the number of clients (3,749) in the Medicaid analysis by the number of people who participated in KMHS' program between January 2013 and June 2015 (6,662).

c. **Analytic limitations of the Medicaid analysis**

The results presented in this section have important limitations:

- The results reflect the intervention period (IY1) from January 2013 (the program start date) to June 2014. HCIA funding for the program continued through June 2015, and the program evolved throughout the intervention period. Consequently, our findings for this population may have been different if we had been able to analyze data from the entire intervention period.

- This analysis was limited to Medicaid enrollees and Medicaid-covered services. Therefore, the findings are not generalizable to all KMHS clients and services. The group of clients included in this analysis reflected 56 percent of the KMHS target population.

- We did not assess total expenditures in this analysis because most KMHS clients were enrolled in Medicaid managed care, and the encounter data we analyzed for this population did not include reliable information on expenditures.

- We did not report results on hospital readmissions, because there were so few that the results would have been unreliable.

- We were unable to identify specific mental health facilities in the Medicaid data available for this analysis. Thus, we were unable to limit the comparison population to individuals receiving mental health treatment at facilities similar to KMHS. The comparison population included in this analysis represents a broader population of individuals receiving mental health treatment at all types of providers throughout the state.

- Alpha-MAX data for January through June 2014 included claims paid through December 2014. The Alpha-MAX data for 2014 included four quarters of paid claims, whereas MAX files reflect seven quarters of payments. As a result, services provided through June 2014 will not be fully represented if payments for the services were not processed by December 2014. Differences in claim submission lags for KMHS client providers relative to comparison client providers may influence the findings, particularly for the third intervention period. For example, if providers who see KMHS clients tend to submit claims more promptly than providers who see comparison group clients do, our findings would undercount services provided to comparison group clients.

D. Conclusions

KMHS used HCIA funding to implement Race to Health!, a program designed to improve behavioral and physical health care and outcomes and thereby reduce the cost of care for all their clients. The program had two primary components. The first was a "whole-health" focus. KMHS aimed to redesign KMHS' infrastructure and service delivery model and prepare staff to care for a broad array of client needs in relation to mental and physical health and substance use. To accomplish this goal, KMHS trained care teams on substance use disorders, physical health conditions, and strategies for supporting clients' self-management of chronic diseases such as diabetes. The second component involved integrating behavioral health and primary care in community settings. As part of Race to Health! KMHS partnered with a community health clinic, Harrison Health Partners (HHP), with KMHS staff providing brief behavioral health interventions and referrals at four HHP primary care practices. KMHS also offered telephone and

email psychiatric consultations to HHP's primary care providers and other primary care providers in the community.

Analysis of qualitative data suggests that KMHS implemented the program largely as intended. The training program appeared to improve staff awareness of clients' physical health conditions, which enhanced their ability to discuss these issues with clients, advocate on clients' behalf, and help connect them to necessary medical care. Greater access to and use of physical health care data helped staff respond to client needs with more information in hand. For example, staff noted that ED visit alerts made them more aware of clients' ED visits and gave them the opportunity to talk to clients about the reasons for those visits. The program's attention to wellness activities, including health education and use of support groups to encourage self-management of chronic conditions, may have helped some clients to adopt healthier behaviors manage their own care more effectively.

Overall, robust evidence from our evaluation suggests that Race to Health! may have reduced Medicare expenses for its Medicare clients, possibly by cutting down on their ED visits, hospitalization rates, and office visits. Several aspects of the program that KMHS staff emphasized on our site visits could have been responsible for these outcomes, including (1) the heightened focus on physical health care in clients' interactions with their mental health and substance abuse treatment providers, (2) greater access to and use of physical health data within KMHS and in coordination with other providers, and (3) development and implementation of new groups to promote wellness and self-management of chronic disease. Overall, our analysis of health status measures suggests the program also achieved many of its goals pertaining to increased use of preventive services by clients.

In contrast, our analysis of data for Medicaid-enrolled KMHS clients found that the program had no effect on hospitalizations, and it increased ED visits. Heightened awareness of their physical health needs may have led these clients to seek more, rather than less, treatment in the ED.

However, it is unclear why this would happen for Medicaid beneficiaries, but not for Medicare beneficiaries. The Medicaid and Medicare populations differed substantially from each other in several important ways, most notably in their diagnoses, with the Medicare population having more diagnoses indicative of severe chronic psychiatric conditions including schizophrenia, bipolar disorder, and other psychotic disorders. On the other hand, the Medicaid population had more diagnoses indicative of disorders that were not as debilitating or chronic (such as adjustment and anxiety disorders), was less likely than the Medicare population to be disabled, and included a substantial number of children.

One possibility, therefore, is that the model is effective for adults with serious chronic psychiatric conditions, but less effective for children or people with less disabling conditions. Another possibility is that Medicaid beneficiaries have more trouble finding medical providers who accept Medicaid, and this might limit the model's effectiveness and prompt Medicaid beneficiaries to go to the emergency department with new health issues. Alternatively, however, the differences in results could be artifacts of anomalies in the Medicaid data, particularly those caused by the short runout of the 2014 data and the lack of data from the last 12 months of the program. Additionally, the awardee pointed out that caseloads for the intervention group

increased around January 2014 when Medicaid was expanded in the state. It is unclear if Medicaid expansion also impacted ED use data in the comparison group, but it is an important factor that should be considered.

Qualitative findings revealed that programs like Race to Health! may require significant investment in training and technology infrastructure, both highlighted by staff as an important foundation for their transition to this new model of care. Training may be particularly important to program implementation if, as with KMHS, few staff members have had exposure to integrated and coordinated care approaches.

Finally, our evaluation findings reveal that sustaining coordinated and integrated service delivery models like Race to Health! is possible with strong support from leaders, creative approaches to partnerships with community health and social service providers, and an upfront focus on building the infrastructure and staff capacity necessary to continue the program. However, such innovative service delivery models ultimately require innovative payment structures if they are to be sustained in the long term.

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IV. MAIMONIDES MEDICAL CENTER[20]

Findings from Mathematica's Evaluation of MMC's HCIA Program

- Impact analyses revealed that, on average, MMC's health homes program saved Medicaid $944 per beneficiary per month for program participants not also enrolled in Medicare Significantly fewer hospitalizations among program participants than members of the comparison group likely contributed substantially to Medicaid savings.

- We found no program impacts on Medicare expenditures or Medicare-funded hospitalizations, readmissions, or emergency department (ED) visits.

- MMC implemented most components of its program successfully. Almost all participants (94 percent) received care management services, and about three-fourths (74 percent) received care coordination services. Analyses of qualitative data revealed that care managers built strong and consistent relationships with participants, and played key roles in helping them find and maintain housing and connect with other social supports.

- MMC used an electronic care coordination platform (CCP) to give participants a virtual medical and mental health home. Primary and specialty care providers did not use it, however, as MMC staff expected they would. Instead, care management staff served as providers' primary conduit to the platform and entered new information as it became available. Nonetheless, the CCP still became a useful tool to support care coordination.

- MMC's experience with similar projects, its preexisting network of partners, and its creative use of the funding sources available through New York State's Medicaid agency all contributed to the awardee's successful implementation and sustainment of key program components.

A. Introduction

Maimonides Medical Center (MMC), a tertiary care center in southwest Brooklyn, New York, used HCIA funding to implement a program designed to achieve better care for people with serious mental illness (SMI) by giving them a virtual medical and mental health home. To implement the program, MMC partnered with members of the Brooklyn Care Coordination Consortium, a group of more than 20 social service agencies and medical institutions. MMC and its partners designed the program for people who lived or received care in selected zip codes in southwest Brooklyn and who had mood disorders (including depression and bipolar disorders), schizophrenia, or other psychotic disorders.

Program staff worked with participants' existing medical, mental health, and community service providers to create multidisciplinary care teams, who were supported by new HCIA-funded care management staff. Members of the care team shared information through an electronic care coordination platform (CCP) built to give participants a virtual medical and mental health home.

Before the HCIA funding, New York State granted MMC status as a Medicaid health home. MMC ultimately expected to provide its health home services to roughly 7,000 Medicaid enrollees. The HCIA award gave MMC (1) the capacity to provide care management to 500

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[20] We thank the New York State Department of Health (NYSDOH) for providing the data to support the Medicaid analyses in this chapter. The findings and conclusions presented are Mathematica's alone and do not reflect any findings, views, or conclusions of NYSDOH.

people with Medicare, commercial insurance, or no insurance (that is, people who were not eligible to receive services through the Medicaid health home payment model) and (2) funding to establish the technology and training infrastructure necessary to provide virtual health homes to the entire target population of 7,500 participants (that is, the 7,000 Medicaid beneficiaries and the 500 other participants).

In the third annual report, we presented evaluation findings based on qualitative and quantitative data available through July 2016, including information on MMC's administrative context and progress through the phases of innovation. In this addendum, we did not change the data and analytic approach for the Medicare impact analysis but we do provide supplemental analysis of service use for Medicare and Medicaid enrollees. In addition, we updated the Medicaid analyses based on new data we received after we completed the third annual report. The quantitative analyses reported for the Medicaid population in third annual report are pre-post analyses without a comparison group. For this addendum, for the Medicaid population, we report findings from a differences-in-differences analysis with a matched comparison group. We also provide more detailed on expenditures by service type for the Medicaid group. Finally, we discuss the new quantitative findings in the context of previously-reported qualitative and sustainability findings.

1. **Enrollment**

MMC reported detailed enrollment data on participants who were uninsured, had commercial insurance, or were enrolled in Medicare only to CMMI's technical assistance contractor. These participants received care management and outreach services, and also benefitted from HCIA funding used for the improved information technology (IT) infrastructure and training to support the care management services. By the end of the program's 12th quarter, MMC enrolled 635 participants in these insurance (Figure IV.1), well over its original projections of 500.

Figure IV.1. Percent of target enrollment achieved by quarter, Q1–Q12
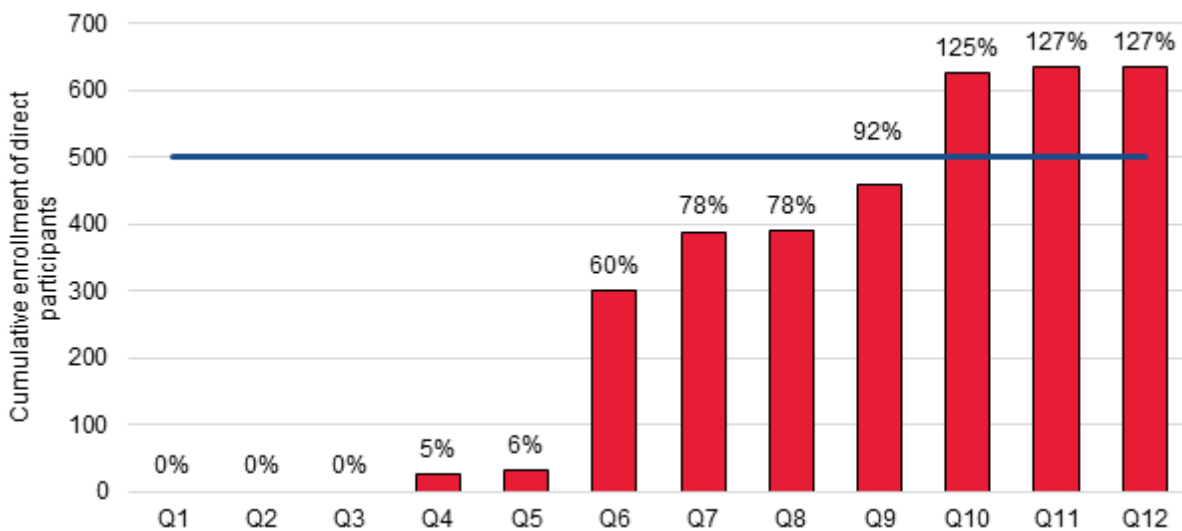
Source: Quarterly reports submitted to the website maintained by CMMI's technical assistance contractor (the Lewin Group).

Note: The blue horizontal line represents MMC's enrollment target of 500 unique participants.

MMC enrollees with Medicaid coverage, including dual Medicare-Medicaid enrollees, were excluded from enrollment counts reported to CMMI during the HCIA program period. They were excluded because New York's Medicaid program funded health home services and care management services for these participants. Participants with Medicaid coverage benefited only from the HCIA funding used for improving IT infrastructure and staff training. However, we were able to obtain data from MMC and New York State on individuals whom the program served in some way but who were not included in the enrollment counts reported to CMMI. Hence, the following analyses address a broader population than included in the enrollment counts. In light of the available data sources, we present analyses separately for (1) dual and non-dual Medicare enrollees and (2) Medicaid enrollees.

2.   Demographic characteristics

Table IV.1 summarizes the demographic characteristics of our Medicare and Medicaid analytic groups. At the time of their enrollment, more than two-thirds (69 percent) of the MMC Medicare participants were age 45 or older, with 48 percent between the ages of 45 and 64, and 21 percent aged 65 or older. Almost 9 in 10 participants were originally eligible for Medicare because of a disability (88 percent), and two-thirds were dual enrollees.

To participate in MMC's HCIA program, a person must have a diagnosis in at least one of the following five categories: schizophrenia and related disorders, bipolar disorders, depressive disorders, certain psychotic disorders, and childhood emotional disturbance.[21] More than half of MMC's FFS Medicare participants had a diagnosis of schizophrenia and related disorders and/or a diagnosis of bipolar disorder, and more than one-third had a diagnosis of depressive disorder.

The MMC Medicaid-only group was relatively young in comparison to the Medicare or dual eligible population; about three-quarters (74 percent) of Medicaid participants were younger than 55, compared with just over half (56 percent) of the Medicare population. Almost two-thirds (61 percent) of the Medicaid-only group had a disability, compared with almost 9 in 10 in the Medicare analytic population (88 percent).

We required participants in the Medicare analytic group to have a targeted diagnosis listed in their claims, but we did not require this for participants in the Medicaid analytic group (unless we included them in the impact analysis), although more than four in five of them (84 percent) did.[22] Almost half of all Medicaid participants had a diagnosis of bipolar disorder (46 percent), and slightly fewer had diagnoses of schizophrenia and related disorders and/or depressive disorders (36 percent and 40 percent, respectively). Comorbidities with physical (non-mental) illnesses were common in the Medicaid group. For example, among participants with 12 months of continuous Medicaid enrollment before their participation in MMC's program, 63 percent had

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[21] For more information about the ICD codes used to identify relevant diagnoses, please see Appendix C.

[22] All Medicare participants in our analyses were required to have at least one diagnosis in their claims records. However, this requirement was not initially applied to the Medicaid population. Because we initially could not construct a valid comparison group for the Medicaid analysis, there was no need to use diagnosis as a matching variable (and we did need to use this for the Medicare impact analysis). The Medicaid impact analysis in this report did, however, require the use of diagnosis as a matching variable. For this reason, we use the full Medicaid population of 4,010 enrollees for the descriptive service use and pre-post expenditures analyses; we use a subgroup of 3,371 enrollees (that is, people with a relevant diagnosis in their claims records) for the Medicaid impact analysis.

cardiovascular conditions, 50 percent had AIDS, 37 percent had substance use disorders, 43 percent had pulmonary conditions, and 31 percent had diabetes, based on the algorithm used in the Chronic Illness and Disability Payment System.[23]

Table IV.1. Demographic characteristics of MMC Medicare and Medicaid analytic groups

	Number of Medicare participants[a]	Percent of Medicare participants	Number of Medicaid participants[b, c]	Percent of Medicaid participants
Total	464	100.0	4,010	100.0
Age				
18–34	62	13.4	831	20.7
35–44	82	17.7	735	18.3
45–54	116	25.0	1,402	35.0
55–64	106	22.8	995	24.8
65 or older	98	21.1	47	1.2
Gender				
Female	220	47.4	2,164	54.0
Male	244	52.6	1,846	46.0
Eligibility status				
Disabled	410	88.4	2,443	60.9
Dual enrolled in Medicaid	315	67.9	-	-
Mental health diagnoses[d]				
Schizophrenia and related disorders	271	58.4	1,445	36.0
Bipolar disorders	239	51.5	1,824	45.5
Depressive disorders	170	36.6	1,608	40.1
Other psychotic disorders	<11	<2.4	154	3.8
Childhood emotional disturbance[e]	<11	<2.4	<11	<0.3

Source: Mathematica analysis of data for Medicaid beneficiaries, obtained from New York State Medicaid enrollment and claims data for October 2012–June 2015; and for Medicare beneficiaries, obtained from the Master Beneficiary Summary File, February 2013–June 2015.

Note: As noted in our third annual report, Coordinated Behavioral Care (CBC) and dual CBC/MMC enrolled participants were excluded from the Medicare and Medicaid analyses because they primarily received services outside the MMC health home in the analysis period. For the analysis reported here, we excluded an additional 1,508 individuals because they lacked 6-months of full-benefit Medicaid enrollment prior to and following program enrollment (see appendix page C.5). Results for cells with N<11 are not shown to protect patient privacy.

[a] Medicare participants include Medicare-only and dual Medicare-Medicaid enrollees.

[b] Note that this is the sample included in the pre-post analyses presented in Section C.4.

[c] The impact analyses described in Section C.3 include only 3,371 Medicaid-enrolled intervention group members; people who did not have an SMI diagnosis for schizophrenia, bipolar disorder, depression, and/or other psychotic disorder in the 24 months before they enrolled in a health home were excluded from the impact analyses because an SMI diagnosis was required to identify well-matched comparison group members Dual Medicare-Medicaid enrollees and enrollees with less than six months of full-benefit enrollment in Medicaid with Medicaid as their primary payer in both the baseline (pre-intervention) and intervention periods are excluded from all the analyses.

[d] Participants can have more than one diagnosis.

[e] We excluded participants with diagnoses of other psychotic disorders and childhood emotional disturbance from our Medicare analysis because they were too few; participants with these diagnoses were retained in the Medicaid analysis, for which the analytic population was larger.

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[23] The Chronic Illness and Disability Payment System is a diagnostic classification system that Medicaid programs can use to make health-based capitated payments for Medicaid beneficiaries who are disabled or on Temporary Assistance for Needy Families.

B. Methods

1.   Quantitative methods

Relative to the third annual report, this addendum includes new analyses of participant service use, adds an impact analysis for Medicaid enrollees and includes supplemental analysis of participant expenditures by type of service.

We analyzed participants' use of program services and the program's impact on four of CMMI's core outcome measures: total Medicare or Medicaid expenditures,[24] hospitalizations, readmissions,[25] and ED visits. These outcomes are appropriate to use for evaluating the MMC program because its care coordination and management strategies were expected to reduce participants' use of acute care services and thereby reduce expenditures.

By including both Medicare- and Medicaid-enrolled participants, we can analyze the impact of the health home and care management services funded by Medicaid and the HCIA, as well as the improved technology infrastructure and training funded solely by the HCIA, on (1) Medicaid costs and service utilization for the Medicaid-only population and (2) Medicare costs and service utilization for the full Medicare population, including dual Medicare-Medicaid enrollees.[26]

Analysis of program service use among Medicare and Medicaid enrollees. MMC provided data on participants' use of program services during the intervention period for both Medicare and Medicaid enrollees. Each record represented a single service and included information on the date of service, recipient, and service type. The service types corresponded with the state's recommended services for a Medicaid health home program. We summarized the service use data for each participant in six-month intervals before and after the participant's enrollment date in the MMC program. Then we conducted separate descriptive analyses for Medicare and Medicaid enrollees to examine patterns in service use over time by participants with different characteristics.

Analysis of the program's impact on Medicare enrollees (see Section C.2). To conduct the impact analysis for the FFS Medicare population, we constructed both an intervention group and a comparison group and used a difference-in-differences analytic model. For Medicare participants in the intervention and comparison groups, we included two years of baseline data and two years of data after the program began (the intervention period); these periods were measured in a total of eight six-month intervals. Because, as we report below, we did not find any significant overall impacts of the program for Medicare enrollees, we also conducted

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[24] Medicaid expenditures include both fee-for-service and managed care payments. When service-level payment information was not available for managed care-covered services, these payment amounts were estimated based on fee-for-service payment guidelines.

[25] We were unable to estimate readmissions for the Medicaid population for reasons related to the schedule for completing the report.

[26] Due to data limitations, Medicaid costs and service use for dual Medicare-Medicaid enrollees are not included in the analyses, even though dual enrollees are included in the Medicare analytic population. Although Medicare is the primary payer, the exclusion of Medicaid costs for dual enrollees means that specialized services for people with serious mental illness, which are covered under Medicaid options and waivers provided to dual enrollees, are not reflected in the analyses.

sensitivity tests to assess whether program impacts varied based on the quantity and types of program services used.

We defined the intervention group as FFS Medicare beneficiaries who enrolled in the MMC program between February 2013 and June 2015, and who had evidence in their Medicare claims of schizophrenia and related disorders, bipolar disorders, and/or depressive disorders.[27] In addition, we required:

- At least six months of FFS Medicare data in the year before enrolling in the program

- Six months of continuous FFS Medicare data around the enrollment month (three months before their enrollment month, the month of enrollment, two months after enrollment)

- Participant's physical location in the MMC service area in Brooklyn, New York, during the month of program enrollment

We selected a comparison group from Medicare enrollees with diagnoses of schizophrenia and related disorders, bipolar disorders, and/or depressive disorders who resided in three comparison cities: Philadelphia, Pennsylvania; Pittsburgh, Pennsylvania; and Chicago, Illinois. We selected these three sites based on a comprehensive analysis of the relevant demographic, socioeconomic, and health care characteristics of about 20 of the largest urban centers in the country that are located in states that did not implement a Medicaid health home program.

For each potential comparison group member, we created a pseudo-enrollment month that reflects the month when the member likely would have enrolled in the program if he or she had been in the intervention group. We identified months with visits to a primary care provider within the intervention time period (February 2013–June 2015), then randomly selected one of the months as the pseudo-enrollment month. We took this step to ensure that potential comparison group members had some engagement with the health care system, as measured by a primary care visit. The random selection process assigned weights to the potential enrollment months based on the proportion of intervention group members who enrolled in the same month. We required at least six months of FFS Medicare data in the year before the pseudo-enrollment month and six months of continuous FFS Medicare data around the pseudo-enrollment month for each potential comparison group member (three months before their enrollment month, the month of enrollment, two months after enrollment).

After defining the intervention group and the potential comparison pool, we used matching methods to select a narrower comparison group that was comparable to the intervention population in the baseline (pre-program) period. With the matching algorithm, we attempted to identify up to seven comparison group members who were similar to each intervention group member on several key characteristics that are predictive of future Medicare service use and expenditures. These characteristics included mental health diagnosis, disability status,

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[27] We included intervention and comparison group enrollees in this analysis if they had at least one hospitalization or two or more outpatient Medicare claims (not including prescription drugs) with the relevant diagnosis in the two years before enrollment (see Appendix C for more information about the ICD codes used to determine diagnoses and develop categories). Participants with diagnoses of other psychotic disorders or childhood emotional disturbance were excluded because they were too few to analyze.

demographics, chronic conditions, Medicaid enrollment status, service use, and expenditures. Matching diagnostic statistics indicated a strong match.

Analysis of the program's impact on Medicaid enrollees (see Section C.3). Using an approach like the one we used for Medicare enrollees, we constructed both an intervention group and a comparison group and used a difference-in-differences analytic model to conduct the impact analysis for the Medicaid population. We included two years of baseline data and two years of data after the program began (the intervention period).

We defined the intervention group as MMC Medicaid participants who were (1) enrolled in the MMC program between November 2012 and January 2015, (2) found in the New York State Medicaid data used for this analysis, (3) not dual Medicare enrollees, and (4) not CBC participants. We required participants to have evidence of schizophrenia and related disorders, bipolar disorders, depressive disorders, and/or other psychotic disorders in their Medicaid claims data.[28] We also required continuous enrollment in Medicaid with eligibility for full benefits for the six months before enrolling in the health home, the enrollment month, and the five months following the enrollment month.

We selected a comparison group from among Medicaid beneficiaries who enrolled with a non-MMC health home in New York City between January 2012 and January 2015 and met the same diagnostic criteria required of the intervention group. We excluded Medicaid enrollees from the comparison pool if they were also enrolled in Medicare or received health home services from CBC. For both program participants and comparison group members, we required continuous enrollment in Medicaid with eligibility for full benefits for the six months before enrolling in the health home, the enrollment month, and the five months following the enrollment month.

After defining the intervention group and the potential comparison pool, we used matching methods to select a narrower comparison group that was as similar as possible to the intervention population in the baseline period. Specifically, for each intervention group member, we attempted to identify up to five comparison group members who were similar to the intervention group member on key characteristics that are predictive of future Medicaid service use and expenditures. We required an exact match on mental health diagnosis and AIDS status. We used propensity score matching to ensure overall balance between the intervention and comparison group members on disability status, demographics, chronic conditions, dual Medicare enrollment, service use, and expenditures. Matching diagnostic statistics indicated a strong match.

Pre-post analysis of Medicaid expenditures by service type (see Section C.4). The analysis of Medicaid expenditures by service type was based on the same population of MMC participants in the Medicaid impact analysis, except that we did not require evidence of a mental health diagnosis in claims made before enrollment.[29] We developed analytic categories for type

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[28] We included intervention and comparison group enrollees in this analysis if they had at least one Medicaid claim with the relevant diagnosis in the two years before enrollment. See Appendix C for more information about the ICD codes used to determine diagnoses and develop categories.

[29] For the impact analysis, we included only participants with a mental health diagnosis reported in claims in the 24 months before enrollment, to ensure that intervention and comparison group members had similar mental health care

of service based on New York State Medicaid categories of service codes, National Drug Codes, and procedure codes (see Appendix C).

C. Summative findings

In this section, we present results of our four analyses:

1. Descriptive analyses of program service use

2. Analysis of the program impact for MMC Medicare-enrolled participants on the four core outcome measures: total expenditures, hospitalizations, readmissions, and ED visits[30]

3. Analysis of the program impact for MMC participants enrolled in Medicaid only for three of the four core outcome measures: total expenditures, hospitalizations, and ED visits

4. A pre-post analysis of Medicaid expenditures by type of service

Finally, we discuss the analytic limitations of our quantitative analyses.

1. Descriptive analysis of service use by Medicare and Medicaid participants

Table IV.2 lists the health home services provided through MMC's program and identifies the proportion of Medicare- and Medicaid-enrolled participants who received each type of service. Nearly all program participants (94 percent) received care management, and three-quarters received care coordination services (74 percent). Care management and care coordination services are central components of MMC's program. Each participant's virtual care team included a care manager and care navigator who worked together to help patients navigate the service system. The care manager worked directly with patients and care team providers to coordinate planning the patients' care, and the care navigator implemented the administrative aspects of care coordination, such as arranging patients' transportation to their medical appointments.

Three kinds of services were used by a minority of program participants: patient and family support (20 percent), community and social support (16 percent), and transitional care (7 percent). Program staff typically targeted these services to participants with specific needs. The only meaningful difference in service use between the Medicare and Medicaid populations was in the use of patient and family support: 30 percent of Medicare participants received patient and family support services, compared with 19 percent of Medicaid participants.

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needs. We did not apply this criterion for the analysis of expenditures by type of service because the analysis did not include a comparison group. Consequently, the pre-post analysis includes a larger group of MMC health home participants than the impact analysis.

[30] Each of these outcome measures includes both psychiatric and non-psychiatric services. Medicaid costs and service utilization for dual Medicare-Medicaid enrollees are not included, even though dual enrollees are included in the Medicare analytic population. Although Medicare is the primary payer, the exclusion of Medicaid costs for dual enrollees means that specialized services for people with serious mental illness that are covered under Medicaid options and waivers, are not reflected in the analyses.

Table IV.2. New York State Medicaid health home services

Service[a]	Description	Percent ever using service		
		Total	Medicare	Medicaid
Care management	Health home care managers are required to create, document, execute, and update an individualized, person-centered plan of care for each individual. Care management must be comprehensive, meeting physical, mental health, chemical dependency, and social service needs.	94%	94%	94%
Care coordination	Health home providers are required to assign each individual a dedicated care manager who is responsible for managing the individual's plan of care and accountable for engaging and retaining health home enrollees in care; coordinating and arranging for the provision of services; supporting adherence to treatment recommendations; and monitoring and evaluating an individual's needs for prevention and wellness services; medical, specialist, and behavioral health treatment; care transitions; and social and community services.	74%	70%	74%
Transitional care	The health home provider is required to have a system in place for the hospitals, residential/rehabilitation facilities, and local practitioners in its network to provide prompt notification of admissions; coordinated, safe transitions in care for individuals; and timely access to post-discharge follow-up.	7%	9%	6%
Patient and family support	Individualized care plans must be accessible to the individual and their families or other caregivers, and reflect individual and family or caregiver preferences, education and support for self-management, self-help recovery, and other resources as appropriate.	20%	30%	19%
Community and social support	Health home providers are responsible for identifying available community-based resources and actively managing appropriate referrals, access, engagement, follow-up and coordination of services.	16%	18%	16%

Source: Mathematica summaries of health home service descriptions in New York State Department of Health memo, "Health Home Standards and Requirements for Health Homes, Care Management Providers and Managed Care Organizations," October 5, 2015. Available at https://www.health.ny.gov/health_care/medicaid/program/medicaid_health_homes/docs/hh_mco_cm_standards.pdf. Proportion using services is from Mathematica's analysis of data on health home service use provided by MMC.

Notes: Coordinated Behavioral Care (CBC) and dual CBC/MMC enrolled participants were excluded from the analyses completed for this table because they received services primarily outside the MMC health home during the analysis period.

[a] Use of health information technology (HIT) to link services is also a required health home service; however, MMC incorporates HIT into all services through the electronic care coordination platform, so HIT use is not broken out separately here.

Table IV.3 shows basic information about overall service use for all participants. The median number of services participants received per month was one, and most participants used two different service types over the course of the program. Differences in service use between Medicare- and Medicaid-enrolled participants were negligible (not shown). We also examined variation in service use within the Medicare- and Medicaid-enrolled populations by demographic characteristics including age, gender, race/ethnicity, dual Medicare-Medicaid enrollment status, and mental health diagnosis, and found no meaningful variation (not shown).

Table IV.3. Summary of service use

	Median number of services per enrolled month	Average number of types of services received per month	Average number of types of services ever received	Count of people in category
All participants	1	0.9	2.1	4,474

Source: Mathematica analysis of data on health home service use during the intervention period, provided by MMC.

Note: Coordinated Behavioral Care (CBC) and dual CBC/MMC enrolled participants were excluded from this analysis because they primarily received services outside the MMC health home in the analysis period.

Next, we examined trends in the percentage of participants using different services over time (Figures IV.2–IV.3). The most striking trend is the steady decrease in the percentage of both the Medicare and Medicaid participants who were using care management. For the Medicaid participants, use of care coordination also decreased slightly over time.

Figure IV.2. Percentage of Medicare participants using different service types, by number of months enrolled
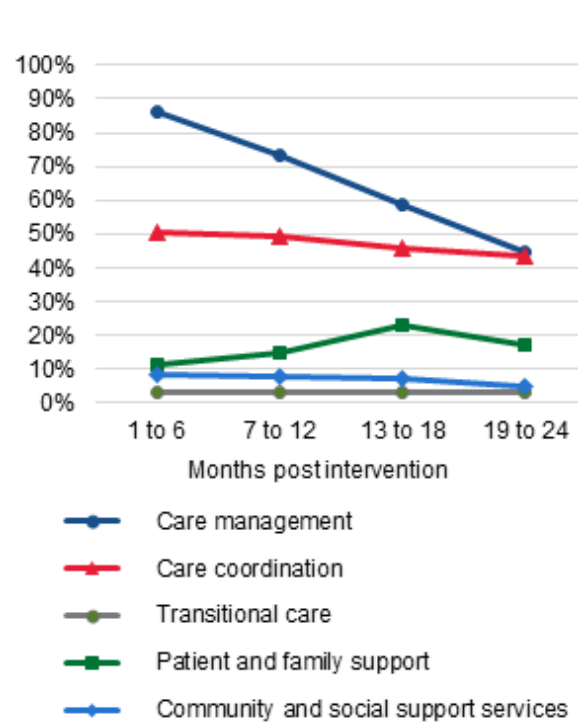
Figure IV.3. Percentage of Medicaid participants using different service types, by number of months enrolled
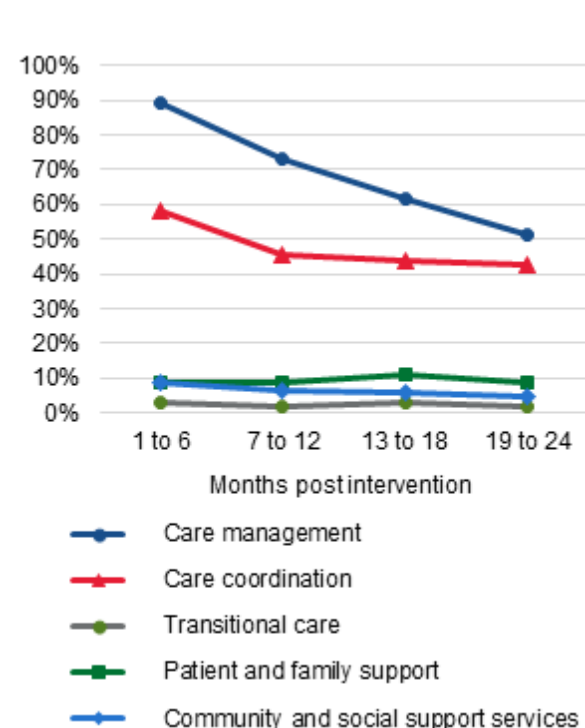
Source: Mathematica analysis of data on health home service use during the intervention period, provided by MMC.

Note: Coordinated Behavioral Care (CBC) and dual CBC/MMC enrolled participants were excluded from these analyses because they primarily received services outside the MMC health home in the analysis period.

We also conducted a series of analyses to examine differences in service use among several subgroups within the overall Medicare and Medicaid analytic groups:

- **Mental health diagnosis.** We examined patterns of service use for people with each of the three main mental health diagnoses: schizophrenia and related disorders, bipolar disorders, and depressive disorders. For both the Medicare and Medicaid participants, we found no substantial differences in service use by people with different mental health diagnoses.

- **AIDS status at baseline.** Half (50 percent) of Medicaid participants were living with AIDS, and we examined their service use. The only substantial difference we found was that people with AIDS were less likely to use patient and family support services (13 percent) than were other Medicaid participants (24 percent).

- **Hospitalizations at baseline.** To focus on service use by participants with significant needs, we analyzed the service use of participants who had a hospitalization in the six months before enrolling in the program and compared it to service use by those without a hospitalization in that period. Participants with a hospitalization were more likely to use transitional care services (17 percent for Medicare participants, 10 percent for Medicaid participants) than were participants without a previous hospitalization (5 percent for Medicare participants, 4 percent for Medicaid). This finding is consistent with expectations because transitional care services are often provided after discharge from the hospital to ensure proper follow-up care and prevent readmissions.

2. Impact estimates for CMMI's core measures: Medicare

Before developing the impact estimates for Medicare participants, we analyzed the trends in means for the Medicare intervention and comparison groups on the outcome measures. The findings from this analysis are depicted in Figures IV.4–IV.7, which offer a visual comparison of changes in outcomes over time. To understand the effects of MMC's program, we examined how the gap between the intervention and comparison groups at each point in the intervention period differed from the average gap between these groups during the baseline time period.

As these figures reveal, the trend lines for both groups follow similar paths during the baseline period (as expected) and, for the most part, during the intervention period. The only statistically significant difference (indicated by a red point) was for ED visits in the final six months of the intervention period (I4). We note the following findings for this set of figures:

- Expenditures were higher for the intervention group than the comparison group in every time period because Medicare spending in the comparison cities was, on average, lower than spending in Brooklyn.[31]

- In the final intervention time period (I4), only a small number of participants had four full periods of program enrollment. The sharp increase in readmissions per person in this final time period (Figure IV.6) may have happened because the characteristics of people who enrolled for four periods were different from the characteristics in the overall group.

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[31] Based on 2012 Hospital Service Area data. Source: *The Dartmouth Atlas of Health Care*, Dartmouth Institute for Health Policy and Clinical Practice, 2016. Available at http://www.dartmouthatlas.org/data/region/. Accessed August 24, 2016.

- • The difference between the intervention and comparison group participants in their number of ED visits increased significantly in the final six months of the program (I4) relative to the baseline average, suggesting that the program may have decreased participants' use of the emergency department. However, the number of participants whose data were available for analysis at this time period was small. Consequently, readers should interpret this finding with caution.

Figure IV.4. Total Medicare expenditures per patient per 6-month period: two years before and two years after program start

Source: Master Beneficiary Summary File for baseline and intervention periods, February 2011–June 2015.

Note: Means are regression-adjusted. Time periods are measured in six-month increments. I1 = months 1–6 of the MMC program, I2 = months 7–12, I3 = months 13–18, I4 = months 19–24. The baseline time periods are measured similarly: B1 = months 19–24 before the start of the program, B2 = months 13–18, B3 = months 7–12, and B4 = months 1–6.

Figure IV.5. Hospitalizations per Medicare patient per 6-month period: two years before and two years after program start

Source: Master Beneficiary Summary File for baseline and intervention periods, February 2011–June 2015.

Note: Means are regression-adjusted. Time periods are measured in six-month increments. I1 = months 1–6 of the MMC program, I2 = months 7–12, I3 = months 13–18, I4 = months 19–24. The baseline time periods are measured similarly: B1 = months 19–24 before the start of the program, B2 = months 13–18, B3 = months 7–12, and B4 = months 1–6.

Figure IV.6. Readmissions per Medicare patient per 6-month period: two years before and two years after program start

Source: Master Beneficiary Summary File for baseline and intervention periods, February 2011–June 2015.

Note: Means are regression-adjusted. Time periods are measured in six-month increments. I1 = months 1–6 of the MMC program, I2 = months 7–12, I3 = months 13–18, I4 = months 19–24. The baseline time periods are measured similarly: B1 = months 19–24 before the start of the program, B2 = months 13–18, B3 = months 7–12, and B4 = months 1–6.

Figure IV.7. Emergency department (ED) visits per Medicare patient per 6-month period: two years before and two years after program start

Source: Master Beneficiary Summary File for baseline and intervention periods, February 2011–June 2015.

Note: Means are regression-adjusted. Time periods are measured in six-month increments. I1 = months 1–6 of the MMC program, I2 = months 7–12, I3 = months 13–18, I4 = months 19–24. The baseline time periods are measured similarly: B1 = months 19–24 before the start of the program, B2 = months 13–18, B3 = months 7–12, and B4 = months 1–6. The red point indicates that the difference between the intervention and comparison group mean in the intervention period is significantly different (at the $p < .10$ level) from the average difference that occurred in the baseline period.

In addition to comparing the trends and differences in means over time, we also estimated impacts for each outcome for the overall intervention period. Impact estimates can reveal whether the MMC program as a whole had a statistically significant impact on participant outcomes. Our impact analysis for the Medicare participants revealed no statistically significant results (Table IV.4).

We also conducted sensitivity tests to assess program impacts among subgroups of participants. These subgroups included (1) people who used more services overall and (2) people who used community and social support services or individual and family support services, which targeted patients with specific needs. We did not find any statistically significant program impacts for these subgroups.

Table IV.4. Medicare impacts attributable to MMC's program

	Change	90% CI[a]	80% CI[a]
Aggregate results			
Expenditures (in thousands)	-$26	[-$2,877, $2,825]	[-$2,463, $2,411]
Hospitalizations	-39	[-197, 119]	[-174, 96]
Readmissions	-40	[-428, 347]	[-371, 291]
ED visits	-71	[-315, 174]	[-280, 139]
Per beneficiary per month[b]			
Expenditures	-$3.44	[-$383, $376]	[-$328, $321]
Hospitalizations	-0.01	[-0.03, 0.02]	[-0.02, 0.01]
Readmissions	-0.01	[-0.06, 0.05]	[-0.05, 0.04]
ED visits	-0.01	[-0.04, 0.02]	[-0.04, 0.02]
Number of participants	464		
Mean number of intervention months per participant	16		
Approximate proportion of participants fully-funded through HCIA award represented in analysis[c]	73%		
Intervention period	February 2013–June 2015		

Source: Mathematica analysis of FFS Medicare claims data for baseline and intervention periods, February 2011–June 2015.

Note: ED = emergency department. Regression model controlled for age, gender, race (white, black, Hispanic, unknown), enrollment date, SMI diagnoses (schizophrenia, bipolar, and/or depressive disorders), disability status, dual Medicare-Medicaid enrollment status, HCC condition indicators,[32] and geographic location. We derived the impact estimates in Stata using the margins command to compare differences between the intervention and baseline period means for the intervention and comparison groups, accounting for the nonlinearity of the model. This analysis is based on 464 intervention group members and 2,937 comparison group members.

[a] The confidence intervals were derived based on bootstrap methods and adjusted for multiple testing based on the generalized Tukey method. Because all the confidence intervals include zero, they show that none of the effects were statistically significant. Therefore, any observed effects may be due to chance and not to the program.

[b] The per-beneficiary per-month unit of measurement is different from the unit used in Figures IV.4 through IV.7, which is per beneficiary per 6-month period. The differences in the direction of effect between these estimates and the figures suggest that some of the apparent effects shown in the figures are due to covariates for which these statistical models controlled.

[c] We calculated the approximate proportion of the intervention population represented in the analysis by dividing the number of participants in our Medicare analysis (464) by the total number of MMC's participants reported to CMMI (635).

3.   Impact estimates for CMMI's core measures: Medicaid

Before developing the Medicaid impact estimates, we analyzed the trends in the means for the intervention and comparison populations on the outcome measures. The findings from this analysis are depicted in Figures IV.8–IV.10, which offer a visual comparison of changes in outcomes over time. We examined how the gap between the intervention and comparison groups at each intervention time point was different from the average gap between these groups during the phases of the baseline period.

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[32] HCC condition indicators are created as part of creating the HCC score. HCC score = Hierarchical Condition Category Score. The HCC model was developed to risk-adjust Medicare payments to Medicare Advantage plans by assessing expected expenditures of enrollees. The HCC score provides a proxy of overall health status, as sicker individuals are expected to cost more than healthier people.

As these figures reveal, the lines for the intervention and comparison groups followed roughly similar paths during the baseline periods and then diverged after the program began. Specifically, we found:

- Throughout the observation period, **total Medicaid expenditures** increased consistently. In the intervention period, however, expenditures increased less sharply for the intervention group than for the comparison group. At each intervention point (I1–I4), the difference between the two groups was significantly greater than the average difference between the groups throughout the baseline period ($p < .10$ level). (We examine this increase in expenditures in detail in Section C.4.)

- During the baseline period, **hospitalization rates** remained flat for both the intervention and comparison groups. In the second six months of the program (I2), rates began trending upward, with a somewhat greater upward trend in the comparison group. At the last three intervention points (I2–I4), differences between the groups were significantly greater than the average differences between the groups throughout the baseline period ($p < .10$ level).

- Throughout the observation period, **ED visit rates** were similar and generally flat. However, one year into the intervention (I3), the rate for the intervention group dipped relative to the rate for the comparison group, and the difference between the two groups was significantly greater than the average differences between the groups across the baseline period ($p < .10$ level). The difference was not statistically significant, however, in the final six months of the program (I4).

Figure IV.8. Total Medicaid expenditures per patient per 6-month period: two years before and two years after program start

Source: Mathematica analysis of Medicaid administrative data from New York State, January 2010–June 2015.

Note: Means are regression-adjusted and are given in thousands of dollars per person. The regression model controlled for age, gender, race/ethnicity, whether 12 months of baseline data were available, disability status, Chronic Illness & Disability Payment System condition indicators, calendar month and year of period initiation, and mental health diagnoses at enrollment. Red points indicate the difference between the intervention and comparison group mean in the intervention period is significantly different (at the $p < .10$ level) from the average difference that occurred in the baseline period. Time periods are measured in six-month increments. I1 = months 1–6 of health home participation, I2 = months 7–12, I3 = months 13–18, I4 = months 19–24. The baseline time periods are measured similarly: B1 = months 19–24 before health home participation, B2 = months 13–18, B3 = months 7–12, and B4 = months 1–6.

Figure IV.9. Hospitalizations per Medicaid patient per 6-month period: two years before and two years after program start
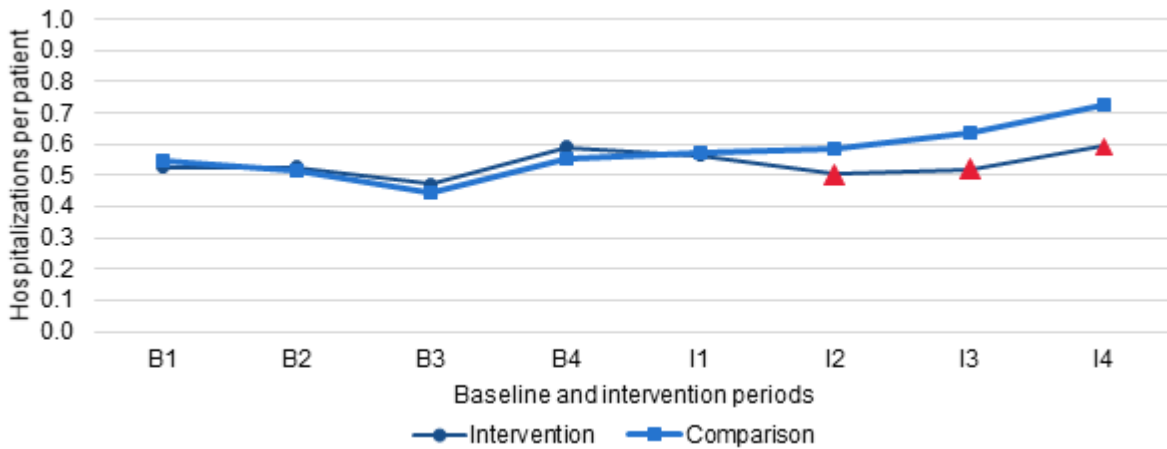
Source: Mathematica analysis of Medicaid administrative data from New York State, January 2010–June 2015.

Note: Means are regression-adjusted. The regression model controlled for age categories, gender, race/ethnicity, whether 12 months of baseline data were available, disability status, Chronic Illness & Disability Payment System condition indicators, calendar month and year of period initiation, and mental health diagnoses at enrollment. Red points indicate that the difference between the intervention and comparison group mean in the intervention period is significantly different (at the *p* < .10 level level) from the average difference that occurred in the baseline period. Time periods are measured in six-month increments. I1 = months 1–6 of health home participation, I2 = months 7–12, I3 = months 13–18, I4 = months 19–24. The baseline time periods are measured similarly: B1 = months 19–24 before health home participation, B2 = months 13–18, B3 = months 7–12, and B4 = months 1–6.

Figure IV.10. Emergency department (ED) visits per Medicaid patient per 6-month period: two years before and two years after program start

Source: Mathematica analysis of Medicaid administrative data from New York State, January 2010–June 2015.

Note: Means are regression-adjusted. The regression model controlled for age, gender, race/ethnicity, whether 12 months of baseline data were available, disability status, Chronic Illness & Disability Payment System condition indicators, calendar month and year of period initiation, and mental health diagnoses at enrollment. Red points indicate the difference between the intervention and comparison group mean in the intervention period is significantly different (at the *p* < .10 level) from the average difference that occurred in the baseline period. Time periods are measured in six-month increments. I1 = months 1–6 of health home participation, I2 = months 7–12, I3 = months 13–18, I4 = months 19–24. The baseline time periods are measured similarly: B1 = months 19–24 before health home participation, B2 = months 13–18, B3 = months 7–12, and B4 = months 1–6.

In addition to comparing the trends and differences in means over time, we also calculated the impact estimates for each outcome for the entire intervention period. These estimates can reveal statistically significant impacts of MMC's health home program, including investments in workforce training and the program's IT platform (the CCP), relative to other health home programs in New York City.[33] Our impact analysis for the Medicaid-only participants revealed a statistically significant decrease in total expenditures and hospitalizations associated with the program. In addition, the analysis indicated that the decrease in both was particularly large for participants living with AIDS (Table IV.5).

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[33] As noted, Medicaid covered MMC's health home services such as care management[Note: Medicaid did not cover any services that direct participants received through HCIA funding—it only covered services received by indirect participants]. Our Medicaid-focused evaluation only examines the impact of the HCIA funding that was used to improve IT infrastructure and offer more staff training (combined with unknown factors that may also distinguish MMC's health home program from comparison programs).

Table IV.5. Medicaid impacts attributable to MMC's program

	All intervention group members		People not living with AIDS		People living with AIDS	
	Change	90% and 80% confidence intervals[d]	Change	90% and 80% confidence intervals	Change	90% and 80% confidence intervals
Aggregate results						
Total expenditures (in thousands)	-$48,020	90% CI [-$61,599, -$34,441]	-$8,222	90% CI [-$15,594, -$850]	-$39,798	90% CI [-$50,662, -$28,935]
		80% CI [-$59,489, -$36,551]		80% CI [-$14,437, -$2,007]		80% CI [-$48,985, -$30,612]
Hospitalizations	-1,581	90% CI [-2506, -656]	-539	90% CI [-1,067, -11]	-1,042	90% CI [-1766, -319]
		80% CI [-2363, -800]		80% CI [-984, -94]		80% CI [-1654, -430]
ED visits	-84	90% CI [-1575, 1408]	-440	90% CI [-1288, 408]	356	90% CI [-811, 1524]
		80% CI [-1344, 1176]		80% CI [-1155, 275]		80% CI [-631, 1343]
Per beneficiary month[a]						
Total expenditures	-$944	90% CI [-$1,211, -$677]	-389	90% CI [-$738, -$40]	-$1,339	90% CI [-$1,704, -$973]
		80% CI [-$1170, -$719]		80% CI [-$683, -$95]		80% CI [-$1,648, -$1,030]
Hospitalizations	-0.031	90% CI [-0.050, -0.013]	-0.026	90% CI [-0.050, -0.001]	-0.035	90% CI [-0.059, -0.011]
		80% CI [-0.046, -0.016]		80% CI [-0.047, -0.004]		80% CI [-0.056, -0.014]
ED visits	-0.002	90% CI [-0.031, 0.028]	-0.021	90% CI [-0.061, 0.019]	0.012	90% CI [-0.027, 0.051]
		80% CI [-0.026, 0.023]		80% CI [-0.055, 0.013]		80% CI [-0.021, 0.045]
Number of patients[b]	3,371		1,387		1,984	
Mean number of intervention months per patient	15		15		15	
Approximate proportion of intervention population represented in analysis[c]	38%		n/a		n/a	
Intervention period	November 2012–June 2015					

Source: Mathematica analysis of Medicaid administrative data for New York State for baseline and intervention periods, January 2010–June 2015.

Note: Impact estimates were derived from regression models controlling for indicators of age, gender, race/ethnicity, AIDS status, disability status, availability of 12 months of baseline data, behavioral health diagnoses, and health conditions used in the CDPS score. We derived the impact estimates in Stata using the margins command to compare the difference between the intervention and baseline period means for the intervention and comparison groups, accounting for nonlinearity of the model. The confidence intervals for total expenditures, hospitalizations, and ED visits were derived based on bootstrap methods and were adjusted for multiple testing based on the generalized Tukey method. This analysis is based on 3,371 intervention group members and 10,944 comparison group members.

[a] The per-beneficiary per-month unit of measurement is different from the graphs in Figures IV.8 through IV.10, which are per beneficiary per 6-month period.

[b] Dual Medicare-Medicaid enrollees and enrollees with fewer than six months of full-benefit enrollment in Medicaid with Medicaid as their primary payer in both the baseline and intervention period were excluded. Also, people who did not have an SMI diagnosis of schizophrenia, bipolar disorder, depressive disorders and/or other psychotic disorders reported in claims in the 24 months before enrollment in the health home were excluded.

[c] We calculated the approximate proportion of the intervention population represented in the analysis by dividing the number of patients (3,371) in the Medicaid impact analysis by the number of Medicaid-enrolled people, including dually enrolled people, who participated in the MMC program between November 2012 and June 2015 (8,946).

[d] Confidence intervals that do not include zero show a statistically significant effect of the program on the participant population.

ED = emergency department.

4. Pre-post analysis of intervention group Medicaid expenditures by type of service

As we have noted, total Medicaid expenditures increased steadily for program participants and members of the comparison group during both the baseline and intervention periods (Figure IV.8). To examine this trend further, we disaggregated Medicaid expenditures into service categories for the program participants.[34] Our analyses yielded the following findings:

- **Total expenditures.** The primary driver of the increase in total expenditures during the post-intervention period was medication costs. Expenditures for hepatitis C medications, antiretroviral medications, and other medications associated with HIV increased substantially. As a result, per-participant medication costs increased by $3,769 for participants with AIDS compared with $1,455 for other participants.

- **Hospitalization expenditures.** The service category with the highest expenditures for program participants without AIDS was hospitalizations (48 percent) and these expenditures decreased $1,002 per participant in the post-intervention period. For individuals living with AIDS, baseline mean hospitalization expenditures were 31 percent lower than those for other participants. Hospitalization expenditures for individuals living with AIDS decreased by only $115 per participant in the post-intervention period. While hospitalizations for program participants declined, they continued to increase for members of the comparison group in the post intervention period (Figure IV.9).

- **Emergency department expenditures.** The care coordination and management strategies that MMC implemented in its program were expected to reduce participants' use of acute care services, including ED visits. The program may have had a slight effect on ED use (Figure IV.10), but overall, ED services represented less than 3 percent of total expenditures. As a result, reducing costs for this service category would have minor effects on total expenditures.

5. Analytic limitations

We note the following key limitations to our analyses:

- The Medicare intervention group remains relatively small (particularly in the second intervention year), making our analyses sensitive to outliers and model specifications.

- Medicaid costs and service utilization for dual Medicare-Medicaid enrollees are not included in the analyses, meaning that specialized SMI services covered under Medicaid options and waivers are not reflected in the analyses.

- We excluded participants with diagnoses of childhood emotional disturbance and psychotic disorders from our Medicare analysis because so few participants in the Medicare population had these diagnoses.

- Medicaid expenditures reported for managed care organizations may not reflect actual payments to providers if the plan was not able to report this information due to bundled or

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[34] The analyses in Section C.3 excluded individuals who did not have a claim for an SMI diagnosis in the 24 months before they enrolled in a health home because SMI diagnosis was required to find a well-matched comparison group. This restriction was not applied to the population included in the analysis in Section C.4 because we focus on the intervention group only.

capitated payments. If the plan could not report this information, we estimated payment amounts based on the amount that would have been paid for the claim services in the state FFS system.

- We selected Philadelphia, Pittsburgh, and Chicago as comparison sites for the Medicare analysis because (1) these cities appeared well matched to Brooklyn, (2) their states had not implemented a Medicaid health home program, and (3) we could not identify any major changes in behavioral health services covered under Medicaid in the analysis period. However, we were not able to control for all possible sources of differences in trends between these cities and Brooklyn.

D. Conclusions

In collaboration with the Brooklyn Care Coordination Consortium, MMC used HCIA funding for a program designed to improve the care of people with SMI by giving them a virtual medical and mental health home. Specifically, the program focused on people who had mood disorders (including depression and bipolar disorders), schizophrenia, or other psychotic disorders. Many program participants also were living with HIV.

Program staff worked with participants' service providers to create multidisciplinary care teams that were supported by new HCIA-funded care management staff. Members of the care teams shared information through the electronic care coordination platform (CCP) built to give participants a virtual medical and mental health home. Before the HCIA funding, New York State granted MMC status as a Medicaid health home, enabling MMC to provide health home services to roughly 7,000 Medicaid enrollees. The HCIA award allowed MMC to build on services it could provide as a state Medicaid health home by (1) providing care management to 500 people with Medicare, commercial insurance, or no insurance, and (2) establishing the CCP to support virtual health homes for the entire target population of 7,500 participants (that is, the 7,000 Medicaid beneficiaries and the 500 other participants).

Our evaluation of MMC's program provides evidence that MMC successfully implemented a program that improved participant outcomes of interest to CMMI. We note four key lessons learned, based on a synthesis of results from our quantitative and qualitative analyses.

First, our analysis of quantitative data provided by MMC and qualitative data gathered during site visits suggests that MMC was able to successfully implement key elements of its program as planned. Almost all program participants (94 percent) received care management services, and three-quarters of them (74 percent) received care coordination services—both central to the program's design. Analyses of qualitative data revealed that care managers built strong and consistent relationships with participants and played key roles in helping them find and maintain housing and other social supports. In addition, care management staff received standardized training to develop core competencies, and they generally found the trainings useful for their work. Despite some reports of high caseloads and frustration about limited resources at some partner organizations, most staff said they received support in their roles and were satisfied with their job.

Another key component of the program was the CCP. Although this platform was implemented to support virtual health homes for participants, many staff commented that it was

burdensome and lacked features that would make it more useful, such as a provider landing page. Moreover, the CCP by itself was not a mechanism for helping providers work together to coordinate services. Primary and specialty care providers did not use it the way MMC staff originally expected them to; instead, care management staff, were used by providers as the primary conduit to the platform, and care managers were the ones who entered new information as it became available. Nonetheless, the CCP has been a useful tool and, as a result of its continued enhancements, other health homes in the area have adopted it.

Second, our findings reveal that MMC's program resulted in savings for Medicaid-enrolled participants. Specifically, we found that the program saved about $944 per Medicaid participant per month during the program period, with an estimated total savings of about $48 million. (MMC staff noted that their internal analysis of Medicaid data showed estimated savings of $51.8 million over a three-year period.) A substantial proportion of these cost savings likely resulted from significantly fewer hospitalizations for program participants relative to the comparison group.

Our analyses of qualitative data supported the quantitative findings on expenditures and service use. MMC leaders and members of the workforce credited the program with (1) fewer hospitalizations and less unnecessary use of the emergency department and (2) focusing attention on the social determinants of participants' health, such as housing. Staff emphasized the role of care managers in improving participants' outcomes, noting that the strong and consistent relationships care managers built with participants helped the participants maintain accountability and investment in their own health and well-being. In addition, care management staff played a key role in improving participants' outcomes by coordinating with other providers and helping participants find and maintain housing and other social supports.

Finally, MMC's HCIA program benefited from the significant amount of work the organization had done to engage partners before receiving the awardee, thus allowing relatively smooth implementation of its program across a range of providers. As one program leader noted, MMC's history of learning from and understanding the perspectives of its partners gave it a head start at the outset of HCIA program implementation. MMC also offered its partners some flexibility in how they implemented the program, allowing them to fit the program into their own organizational structures.

MMC began sustainability efforts from the program's outset. These efforts, coupled with its ability to take advantage of state-level policy opportunities and changes, allowed MMC to use the HCIA as one piece of an ongoing financing strategy to sustain key program elements. In addition, leaders said that positive findings from internal program monitoring and financial modeling of outcomes—built into the program from its inception—allowed the organization to seek support for continuing their care management functions from the state and other funders. Despite some key methodological limitations, our findings are likely to provide further support for MMC's efforts.

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V. VALUEOPTIONS

Findings from Mathematica's Evaluation of the ValueOptions HCIA Program

- The ValueOptions program was associated with a significant decrease in total expenditures and emergency department visits. The analysis revealed no significant program impact on number of residential stays, days of intensive day treatment, or participants' initiation of and engagement with treatment; however, these results may reflect several analytic limitations.

- Most program staff believe the ValueOptions program had a positive effect on participants' health outcomes and quality of life. They also thought the program's workforce training, particularly on motivational interviewing, helped the staff do a better job and helped participants achieve better outcomes.

- The innovation's case-rate payment model allowed the program's recovery support navigators (RSNs) to provide more services to participants and sustain the services over time. However, RSNs needed time and additional training to adjust to and become comfortable with the new payment model.

- ValueOptions has sustained use of the case-rate payment model for services provided by RSNs. However, program leaders are waiting for more evidence of effectiveness before they sustain and expand the program in the long term.

A. Introduction

1. Program goals

The Massachusetts Behavioral Health Partnership (MBHP), a company owned by ValueOptions[35] that contracts with the Commonwealth of Massachusetts to manage behavioral health benefits for Medicaid beneficiaries, used funding from the Health Care Innovation Awards (HCIA) to test the effectiveness of three modifications to its Community Support Program (CSP). In this program, staff work with clients to help them access and coordinate medically necessary services and community-based support services. As part of the HCIA-funded program, a subset of the CSP staff received new training and responsibilities, and their position title was changed to recovery support navigator (RSN).

For the HCIA program, MBHP (1) trained the RSNs on evidence-based treatment for substance use disorders; readiness-to-change assessments; and motivational interviewing; (2) covered RSN services through a case-rate payment model (a fee-for-service model is used in the CSP); and (3) offered incentives (gift cards) to a subset of participants in the RSN program to encourage them to achieve goals related to their recovery. MBHP hypothesized that these changes to the existing CSP model would lower costs by cutting down on repeated use of detoxification services. To be a participant in the HCIA intervention, a client had to have at least two admissions to detoxifications facilities. The Brandeis University Institute for Behavioral Health partnered with MBHP to conduct a local evaluation of the program.[36]

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[35] ValueOptions and Beacon Health Strategies merged in 2015 to become Beacon Health Options. However, we refer to the company as ValueOptions (the name under which it undertook the HCIA project) throughout this report.

[36] MBHP received its HCIA award in July 2012 and began enrolling participants in early 2013. The awardee received a no-cost extension from CMMI through December 31, 2015, to conduct evaluation activities. The awardee

MBHP implemented the RSN program at four Massachusetts detoxification facilities that employ and supervise the RSNs: (1) Lahey Health Behavioral Services, (2) Stanley Street Treatment and Resources, (3) High Point Treatment Center, and (4) Spectrum Health Systems. When these facilities discharged patients, RSNs enrolled them in the RSN program and assigned them to one of two groups:

1. **RSN+I.** Participants in this group received RSN support. In addition, participants who achieved specific recovery goals received incentive payments.

2. **RSN only.** Participants in this group received RSN support, but no incentives.

MBHP staff used a midpoint crossover design at the facility level to assign eligible people to these groups.[37] For example, during the first half of the program period, all eligible persons discharged from the Lahey facility were assigned to the RSN+I group. During the second half of the program, people discharged from Lahey were assigned to the RSN-only group. At any point in time, eligible persons from two designated facilities were assigned to the RSN-only group, and eligible persons from the other two facilities were assigned to the RSN+I group.

In addition to the four facilities that were implementing the program, the MBHP system included nine other detoxification facilities at the time the HCIA program was implemented. All of these facilities provided the CSP as usual and were not implementing the HCIA program.[38]

In the short term, MBHP expected the RSN program to improve (1) participants' engagement with community-based supports and (2) participants' attitudes about recovery. In the long term, MBHP expected the program to diminish addictive behaviors, enhance overall health, and improve the participants' experience with the health care system.

In the third annual report, we presented evaluation findings based on qualitative and quantitative data available through July 2016, including information on ValueOptions's administrative context and progress through the phases of innovation. We were not able to include quantitative impact analysis in the third annual report for ValueOptions because MBHP was unable to provide complete data in time. MBHP was able to provide data to conduct impact analyses for this addendum. We report the findings from quantitative and impact analyses using these data below. In addition, we discuss lessons learned, integrating the new quantitative findings into the qualitative and sustainability findings previously described.

2   Enrollment

By the end of the 12th quarter (June 30, 2015), MBHP had enrolled 1,893 direct participants in the program—exceeding its original goal of 1,492 participants by over 25 percent (Figure

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also continued some program activities, including the case-rate payment model, the program incentives, and ongoing support to RSN staff, through December 31, 2015.

[37] Individuals were eligible to be enrolled as participants or as members of the comparison group if they (1) were between the ages of 18 and 64; (2) were enrolled in Medicaid; and (3) had been admitted to and discharged from a detoxification facility at least twice in the year before enrollment.

[38] A comparison group used for this study included individuals discharged from seven of the detoxification facilities that offered only the CSP.

V.1). Table V.1 provides demographic information about MBHP participants who were eligible for inclusion in the analysis of CMMI's core measures.

Figure V.1. Percent of target enrollment achieved by quarter, Q1–Q12
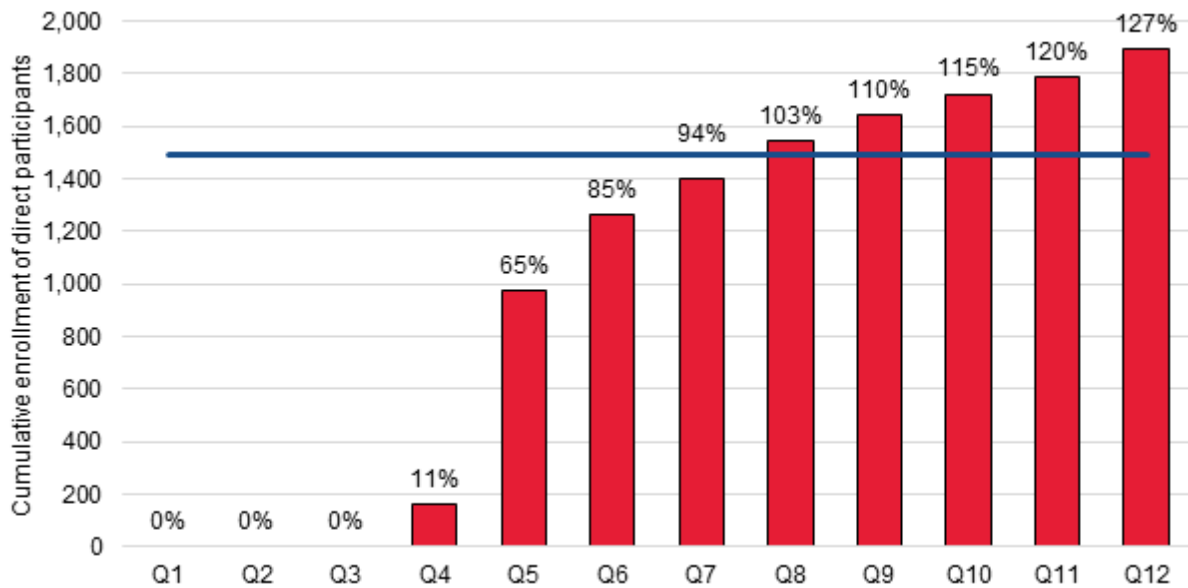
Source: Awardee's enrollment data reported to the website maintained by CMMI's technical assistance contractor (the Lewin Group).

Note: The blue horizontal line represents MBHP's enrollment target of 1,492 unique participants.

Table V.1. Demographic characteristics of MBHP participants and comparison group members, March 2013–December 2015

	RSN		RSN+I		CSP	
	Number	Percent	Number	Percent	Number	Percent
Total	684	100	587	100	347	100
Age						
18–34	324	47.4	321	54.7	158	45.5
35–44	180	26.3	134	22.8	82	23.6
45–54	134	19.6	110	18.7	83	23.9
55–64	46	6.7	22	3.7	24	6.9
Gender						
Female	250	36.5	203	34.6	111	32
Male	434	63.5	384	65.4	236	68

Source: Mathematica analysis of program enrollment data, March 2013–December 2015.

Note: This table includes participants (RSN and RSN+I) and comparison group (CSP) members who were eligible for the analysis of CMMI core measures and whose demographic data were available.

CSP = Community Support Program; RSN = Recovery Support Navigator program; RSN+I = Recovery Support Navigator with incentives.

B. Methods

1. Quantitative methods

We used a difference-in-differences model to analyze the following measures: (1) total expenditures, (2) emergency department (ED) visits, (3) short-term residential stays, (4) intensive day treatments, and (5) initiation of and engagement with treatment. The participant group included people who received RSN or RSN plus intervention services. The comparison group included people who met all eligibility criteria for the program, but who received treatment as usual from the CSP-only comparison sites.

We used the following data sources—all provided by MBHP—in our analysis:

- Program enrollment data on date of enrollment, age, and gender, which we used as control variables in our regression analysis of program impacts.

- Medicaid data, including eligibility information and claims for medical, pharmacy, and dental services, as well as encounters for all behavioral health services. We used these data to analyze four outcomes: total expenditures, ED visits, short-term residential stays, and days of intensive day treatment.[39] We also used these data sources to construct the dependent variables we used to analyze participants' initiation and engagement: likelihood of initiating treatment for a substance use disorder (a hospitalization, an outpatient visit, an intensive outpatient encounter, or a partial hospitalization) within 14 days of discharge from a detoxification facility; likelihood of engaging with this treatment within 30 days of initiating it; and likelihood of initiating medication use within 14 days of discharge from a detoxification facility.

To ensure that the participants had enough exposure to the program to examine impact, we limited our analyses of service use and expenditures to participants and members of the comparison group who were continuously enrolled in MBHP for at least 12 months after they first enrolled. Participants enrolled in the programs at different times, and consequently the dates of their post-program periods varied. In addition, our analyses included Medicaid claims and encounter data through December 2015, the latest period for which Medicaid data were available. Therefore, the analyses included participants and members of the comparison group who enrolled between March 2013 and December 2014, or 449 of the total 1,271 participants and 109 of the 347 comparison group members.[40] We examined impacts for this subgroup for up to 18 months of program participation.[41]

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[39] CMMI asked the HCIA evaluators to analyze four core quantitative measures of program effectiveness, if feasible and appropriate for a given award. As described in the text, we analyzed two of the CMMI core measures for ValueOptions: total Medicaid expenditures and ED visits. We did not analyze two CMMI core measures, hospitalizations and hospital readmissions, because ValueOptions program participants had few hospital stays.

[40] We considered for inclusion in our analysis the 1,271 participants and 347 comparison group members who were enrolled between March 2013 and December 2015 and were represented in the program enrollment data file obtained from MBHP.

[41] Some participants enrolled in the program later than others did; the average number of months of program participation was 17.3 months.

For the impact analysis on initiation of and engagement with treatment for substance use disorder, we used indicators that used the Initiation and Engagement of Alcohol and Other Drug Dependence Treatment measure specifications from the Healthcare Effectiveness Data and Information Set (HEDIS). We included in the analysis all participants and comparison group members who, in both the program and the baseline period, had 45 days of continuous MBHP eligibility after being discharged from a detoxification facility. The resulting analysis is based on data from 808 of the 1,271 participants and 210 of the 347 comparison group members.

More information on the analysis measures, the regressions used in the impact analyses, and the comparability of participants' characteristics and those of the comparison group appears in Appendix A.

C. Summative findings

In this section, we report quantitative findings on the effects of MBHP's program. Specifically, we present results from the following analyses:

- Descriptive analyses of expenditures and service use (total expenditures, ED visits, residential stays, and days of intensive day treatment)

- Impact analyses of these expenditures and service use outcomes

- Descriptive and impact analysis on initiation of and engagement in treatment

In addition, we discuss the limitations of our quantitative methods.

1. Descriptive analysis: service use and expenditures

Before developing the impact estimates for total expenditures, ED visits, residential stays, and days of intensive day treatment, we analyzed the trends in the regression-adjusted means for these measures for the participants and the comparison group. We first plotted the findings from this analysis in four line graphs to visually compare changes in each outcome measure over time (Figures V.2–V.5). For each measure, we examined whether and how the size of the gap between the participants and the comparison group differed at each post-intervention time point from the average gap between these groups during baseline time periods.

Medicaid expenditures. Figure V.2 reveals that average total expenditures were higher for the participants than for the comparison group during the baseline period (B1– B3). In contrast, during the first and third six-month periods of program enrollment (I1 and I3), average total expenditures were lower for the participants than they were for the comparison group. The red dots indicate that the gap between the comparison group and the participants' total expenditures was significantly different from the average gap between them during the baseline period.

Figure V.2. Total expenditures per patient per 6-month period: 18 months before and after start of RSN program

Source: Mathematica analysis of March 2012–December 2015 MBHP administrative claims and enrollment data.

Note: Time periods are measured in six-month increments. I1 = Months 1–6 of the ValueOptions program, I2 = Months 7–12, I3 = Months 13–18. The baseline time periods are measured similarly: B1 = Months 13–18 before the start of the program, B2 = Months 7–12, B3 = Months 1–6. Means are regression-adjusted and are given in thousands of dollars per person. The regression model controlled for age (linear and squared), gender, Chronic Illness & Disability Payment System condition indicators, and indicators for the calendar month and year of the initial month of each six-month time period. Red dots indicate significant difference-in-differences estimates for the given intervention period relative to the average over all baseline periods.

  ED visits. We observed similar trends in our analysis of ED visit rates. Figure V.3 shows that the average number of ED visits per patient was higher for the participants than the comparison group during the baseline period (B1–B3). However, during the first and third six-month periods of the program enrollment (I1 and I3), the rate of ED visits for the comparison group was higher than the rate of visits for the participants. In both I1 and I3, the gap between the two groups was significantly different from the average gap between them during the baseline period (as indicated by the red dots).

Figure V.3. Emergency department visits per patient per 6-month period: 18 months before and after start of program
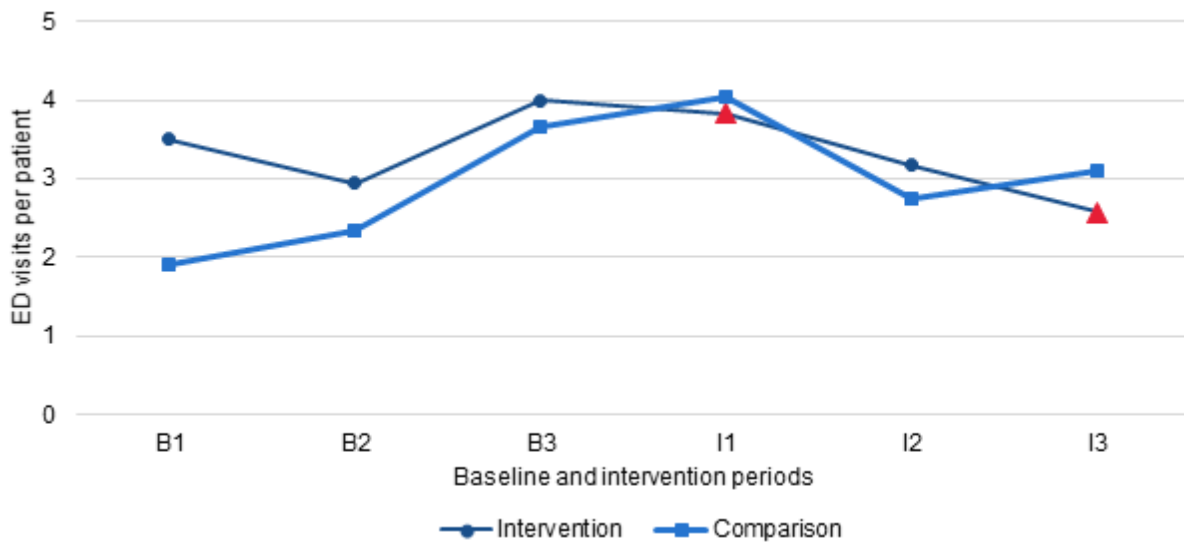
Source: Mathematica analysis of March 2012–December 2015 MBHP administrative claims and enrollment data.

Note: Time periods are measured in six-month increments. I1 = Months 1–6 of the ValueOptions program, I2 =
           Months 7–12, I3 = Months 13–18. The baseline time periods are measured similarly: B1 = Months 13–18
           before the start of the program, B2 = Months 7–12, and B3 = Months 1–6. Means are regression-adjusted
           and are given in number of ED visits per patient per 6-month period. The regression model controlled for
           age (linear and squared), gender, Chronic Illness & Disability Payment System condition indicators, and
           indicators for the calendar month and year of the initial month of each six-month time period. Red dots
           indicate significant difference-in-differences estimates for the given intervention period relative to the
           average over all baseline periods.

ED = emergency department.

　　　Residential stays. The trend lines for the participants and the comparison group closely parallel each other for residential stays (Figure V.4). The rate for both groups increased during the baseline period, peaked in the first six months of the program (I1), and declined thereafter. Although use of residential services was higher for the participants than the comparison group throughout the post-enrollment period, the differences from the baseline period were not significant.

Figure V.4. Residential stays per patient per 6-month period: 18 months before and after start of program

Note: Time periods are measured in six-month increments. I1 = Months 1–6 of the ValueOptions program, I2 = Months 7–12, I3 = Months 13–18. The baseline time periods are measured similarly: B1 = Months 13–18 before the start of the program, B2 = Months 7–12, and B3 = Months 1–6. Means are regression-adjusted and are given in number of residential stays per patient per 6-month period. The regression model controlled for age (linear and squared), gender, Chronic Illness & Disability Payment System condition indicators, and indicators for the calendar month and year of the initial month of each six-month time period. Red dots indicate significant difference-in-differences estimates for the given intervention period relative to the average over all baseline periods.

Intensive day treatment. The pattern for days of intensive day treatment was similar to that for residential stays: the rate increased for both groups during the baseline period and the first post-enrollment period, and declined in the second and third post-enrollment periods. Here too, observed differences in rates of service use between the two groups during the post-enrollment period were not significant.

Figure V.5. Days of intensive day treatment per patient per 6-month period: 18 months before and after start of program

Source: Mathematica analysis of March 2012–December 2015 MBHP administrative claims and enrollment data.

Note: Time periods are measured in six-month increments. I1 = Months 1–6 of the ValueOptions program, I2 = Months 7–12, I3 = Months 13–18. The baseline time periods are measured similarly: B1 = Months 13–18 before the start of the program, B2 = Months 7–12, and B3 = Months 1–6. Means are regression-adjusted and are given in number of days of intensive day treatment per patient per 6-month period. The regression model controlled for age (linear and squared), gender, Chronic Illness & Disability Payment System condition indicators, and indicators for the calendar month and year of the initial month of each six-month time period. Red dots indicate significant difference-in-differences estimates for the given intervention period relative to the average over all baseline periods.

2.   Impact analysis: service use and expenditures

Our impact analysis confirmed the findings of the descriptive analysis. The HCIA-funded innovations to MBHP's CSP program significantly reduced total expenditures and ED visits for participants in relation to the comparison group (Table V.2). Important findings are as follows:

- We estimated that during the first 18 months of the program, expenditures decreased by $632 per enrolled beneficiary month for participants in relation to the comparison group (p-value < 0.01). Overall, we estimated a total savings of $4.9 million for the 35.3 percent of participants who had one year of continuous MBHP enrollment after the start of the program.

- Participant beneficiaries visited the ED an average of 0.14 fewer times per month than beneficiaries in the comparison group did (p-value < 0.10).

Differences between the participants and the comparison group in their number of residential stays and days of intensive day treatment were not statistically significant.

Table V.2. Medicaid impacts attributable to ValueOptions' program

	All participants		
	Change	80% confidence interval	90% confidence interval
Aggregate results			
Total expenditures (in thousands of dollars)	-$4,907	[-7,945 to -$1,868]	[-8,514 to -$1,299]
ED visits	-1,098	[-2,139 to -56]	[-2,334 to -139]
Residential stays	97	[-240 to 435]	[-303 to 498]
Days of intensive day treatment	623	[-649 to 1,894]	[-1,011 to 2,256]
Per beneficiary month			
Total expenditures	-$632	[-1,023 to -241]	[-$1,096 to -$167]
ED visits	-0.14	[-0.28 to -0.01]	[-0.30 to 0.02]
Residential stays	0.01	[-0.03 to 0.06]	[-0.04 to 0.06]
Days of intensive day treatment	-0.08	[-0.08 to 0.24]	[-0.13 to 0.29]
Number of participants	449		
Mean number of program months per participant	17.3		
Proportion of program population represented in analysis[a]	35.3%		
Program period	March 2013 to December 2015		

Source: Mathematica analysis of March 2012–December 2015 MBHP administrative claims and enrollment data

Note: We derived impact estimates from regression models that controlled for age (linear and squared), gender, Chronic Illness and Disability Payment System condition indicators, and indicators for the calendar month and year corresponding to the first month of the 18-month intervention period. We derived the impact estimates in Stata using the margins command to compare the difference between the means for participants and the comparison group in the baseline and intervention period. We adjusted the confidence intervals for total expenditures, ED visits, and residential stays to account for testing for impacts on multiple outcomes following the generalized Tukey method. The confidence interval for days of intensive day treatment was not included in the adjustment because of the high percentage (70 percent) of zero days in the sample that led to high variability in the bootstrap samples needed to support estimation of the adjustment. A confidence interval that includes zero implies that the observed changes are not statistically significantly different from zero.

ED = emergency department.

[a] We calculated the proportion of the participant population represented in the analysis by dividing the number of participants in the analysis (449) by the number of people who participated in the ValueOptions program between March 2013 and December 2015 (1,271).

3.   Descriptive and impact analysis: initiation of and engagement with treatment

We also examined whether the ValueOptions program had an impact on participants' initiation of and engagement with treatment for substance use disorders, or on the initiation of medication use for substance use disorder.

The proportion of individuals who initiated treatment (as defined by a hospitalization for alcohol dependence or dependence on another substance, an outpatient visit, an intensive outpatient encounter, or a partial hospitalization) increased between the baseline and follow-up periods among both participants and comparison group members. Similarly, the proportion of individuals who engaged with treatment (defined as having two or more additional services after initiation) increased among members of both groups from baseline to follow-up. The rate of medication use for substance use disorder declined among members of both groups between

baseline and post-intervention. However, we found no significant differences between the participants and members of the comparison group for any of these outcomes (Table V.3).

Table V.3. Impact estimates for changes in initiation of and engagement with treatment

	Participants	Comparison group members	Estimated impact[a]		
			Value	Percent	*p*-value
Initiated treatment within 14 days of discharge from detoxification facility (percent)					
Baseline	51.9	45.9			
Intervention	87.2	84.4			
Average change in initiation from baseline	35.3	38.5	-3.2	-6.2	0.51
Engaged with treatment within 30 days of initiating it (percent)					
Baseline	45.9	39.3			
Intervention	77.7	73.9			
Average change in engagement from baseline	31.8	34.6	-2.8	-6.0	0.61
Initiated medication use for substance use disorder within 14 days of discharge from detoxification facility (percent)					
Baseline	18.5	19.1			
Intervention	15.3	15.6			
Average change in initiation from baseline	-3.2	-3.5	0.3	1.4	0.95
Number of observations	1616	420			
Number of unique patients	808	210			

Source: Mathematica analysis of March 2012–December 2015 MBHP administrative claims and enrollment data.

Note: We present group-level percentages. We do not adjust baseline percentages, but average changes from baseline are regression-adjusted. The estimated impact value shows the difference between the average change for the participants from baseline and the average change for the comparison group from baseline. For the estimated impact percent, we divided the estimated impact value by the baseline percentage for participants.

To be included in the analysis, members of both the participant and comparison groups must have had a discharge from a detoxification facility at enrollment and in the one year before enrollment, and must have been continuously eligible for MBHP for 45 days after discharge from each detoxification facility. All regression models control for age (linear and squared), gender, Chronic Illness and Disability Payment System flags, and indicators for the calendar month and year corresponding to the month of enrollment.

[a] We derived the impact estimates in Stata by using the margins command to compare the difference between the baseline and follow-up period percentages for the participant and comparison groups.

4.   Analytic limitations

Results from the analyses presented above have important limitations. Findings about the program's impact on service use and expenditures should be interpreted in the context of the following caveats:

- **Small sample size.** With just over 100 comparison group members (n = 109), the small sample limits our ability to detect potentially important differences between the participants and the comparison group.

- **Representativeness of sample.** The 449 individuals included in our analyses are those with at least 12 continuous months of coverage by MBHP after the start of the program; they represent just over one-third of all program participants. Therefore, findings may not be generalizable to other program participants, such as those with shorter or discontinuous enrollments in MBHP. Further, not all people included in the analysis had a full 18 months of coverage by MBHP corresponding to the full analysis period. We pro-rated estimates for people with less than 18 months of enrollment to reflect a full period of enrollment, and applied analysis weights to adjust for the proportion of the analysis period during which the person was observed. However, only a few members of either the participant or comparison group had a curtailed enrollment period, implying minimal bias, if any, to the impact estimates.[42]

- **Limited time frame.** We were able to obtain data for our sample and examine outcomes in the first 18 months after enrollment. Longer term impacts may differ.

- **Lack of information on site enrollment.** Data provided by MBHP did not identify the site from which participants received treatment; therefore, we could not control for unobservable differences within the participant group that may have arisen because of differences in the way sites implemented the program.

- **Unobservable differences between the participants and the comparison group.** The CSP-only sites from which we drew the comparison group for the analyses might differ from the RSN and RSN+I sites in unobservable ways that cannot be accounted for in the analyses. These unobservable differences may bias impact estimates in unknown directions.

Our analyses of people's initiation of and engagement with treatment for substance use disorder is based on data from nearly two-thirds of the participants, a relatively larger sample than the one used for our analyses of expenditures and service use. However, findings on treatment initiation and engagement should be interpreted in the context of our limited ability to control for potential differences in how different sites implemented the program and unobservable differences between the participants and members of the comparison group.

D. Conclusions

MBHP used its HCIA funding to strategically test an expansion of its standard approach to helping people avoid readmission to detoxification facilities. The program had three components: (1) workforce training on the use of evidence-based treatment methods for substance use disorders; (2) a shift to a case-rate payment model (from the fee-for-service model used in the CSP); and (3) program incentives for participants who achieved goals related to their recovery. By cutting down on repeat admissions to detoxification facilities, the awardee hoped to lower health care costs.

Our evaluation revealed that the program achieved some of its goals. Specifically, we found that MBHP significantly reduced ED visits and total expenditures for RSN program participants relative to the CSP comparison group, with the decreased use of ED services possibly contributing to the participants' lower total expenditures. In addition, site visit respondents and

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[42] On average, program participants were enrolled for 96 percent of the 18-month analysis period.

focus group members provided anecdotal evidence that the program positively affected the participants' health and quality of life.

Several factors may have contributed to these successes. Respondents believed the case-rate payment model allowed RSNs to spend more time with participants and to account for time they spent on career development. RSNs appreciated the training and ongoing coaching they received through the program, and believed it helped them better understand their role and support the participants in meeting recovery goals. This additional support from RSNs, as well as the new skills RSNs gained through training, may have helped participants avoid inappropriate use of emergency services, thus reducing the total costs of care for participants. These findings suggest that investing in additional training for a workforce that is minimally trained may help workers be more satisfied with their job and more effective in providing care to the participants.

We also found that the program did not achieve other goals. For example, on our site visits respondents told us the program's financial incentives component did not directly lead to better outcomes for most program participants, though some of them may have benefited from the structured nature of the incentives' goals. In addition, although we observed decreased use of day/residential treatment services and more initiation of and engagement with treatment between baseline and program enrollment, these changes were not significantly different from those observed in the comparison group. The trends observed for those indicators among both the participants and the comparison group may suggest that both programs were successful in connecting newly discharged participants with dedicated staff at a particularly vulnerable moment in the participants' recovery. However, we did not find that the program enhancements offered through the RSN program were a significant advantage over the CSP program when it came to diminishing use of residential and day treatment services and improving the participants' initiation into and engagement with treatment services.

Several analytic limitations must also be considered when interpreting these findings, including relatively small analysis groups for both participants and the comparison group, a limited time frame for examining program effects, and unobservable differences that may bias impact estimates.

For now, MBHP has maintained use of the case-rate payment model at the sites implementing the HCIA program. However, the awardee will wait for evidence of effectiveness before expanding use of the model at other sites or sustaining other program components. MBHP staff believe the state's Medicaid program would be interested in supporting payment reform if evidence for its positive effects were available. However, initial confusion among the RSNs about use of the case-rate model at the four program sites highlights the importance of investing time in workforce education, outreach, and buy-in for the alternate payment model. Nevertheless, our evaluation findings suggest that payers like MBHP are uniquely situated to both create and sustain programs because they can pursue innovations without having to secure outside funding.

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APPENDIX A:

FPHNY TECHNICAL METHODS

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A. Introduction

This chapter describes the methods for our analysis of Parachute NYC program impacts. We first describe the data sources (Section B) and methods for identifying the intervention group members (Section C). Then, we describe the methods for identifying the matched comparison group (Section D). Finally, we specify how we constructed outcome and control variables (Section E).

B. Description of data sources

We used two data sources for the impact analysis: program enrollment data provided by FPHNY and Medicaid administrative data provided by the New York State Department of Health (NYSDOH).

Program enrollment data. FPHNY provided data files containing Medicaid identifiers, demographic characteristics (date of birth, gender, insurance coverage), and beginning and ending service dates for program participants who first used services from January 2013 through May 2016.

Medicaid administrative data. We obtained claims and enrollment data for January 2009 through April 2016 from the NYSDOH Medicaid Data Warehouse. These data included intervention group members enrolled in Medicaid for whom FPHNY provided a valid Medicaid identifier. In addition, the data included a pool of potential comparison group members who lived in New York City for at least one month during this period and had at least one claim with a behavioral health diagnosis. The claims data provided information on FFS and managed care payment amounts, service utilization, procedures, and diagnoses. The enrollment data provided monthly demographic and Medicaid enrollment information.

C. Identification of intervention group

Mathematica identified intervention group members in the NYSDOH Medicaid data based on the Medicaid identifiers provided by FPHNY; however, these identifiers were missing for about one-third of intervention group members who were identified as Medicaid enrolled. We received Parachute NYC program administrative data for 1,231 intervention group members who were identified as having Medicaid-only coverage, and 170 intervention group members who were identified as having Medicaid coverage as well as at least one other type of coverage. Only 1,321 of those intervention group members had valid and unique[43] Medicaid identifiers.

Starting from the 1,321 individuals with valid Medicaid identifiers, we narrowed the analysis population to those for whom the Medicaid administrative files would likely provide a comprehensive view of service utilization, using the following restrictions:

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[43] We found evidence that in the FPHNY administrative data, 40 participants that matched to the NY Medicaid data appeared to have received a new identifier when re-enrolling in the program. In these cases, we found that FPHNY had the same MSIS identifier for two records, with matching gender and date of birth (or with a single small typo in either month, day, or year of birth—for example, "10/1/1986" versus "11/1/1986") but two different program identifiers and dates of initial service use. We de-duplicated these records by deleting the record corresponding to the "later" of the two duplicates—that is, with the later date of initial service use.

- **Full-benefit Medicaid coverage.** To ensure a consistent set of benefits were represented in the Medicaid administrative claims for the analysis population, we required full benefit Medicaid enrollment and no third party coverage. Individuals who were dually eligible for Medicare and Medicaid were excluded based on this restriction. This restriction excluded 482 individuals.

- **Observable in pre- and post- period.** To ensure observable data on the enrollee in the pre- and post-intervention analysis periods, we required Medicaid enrollment for at least six months prior and at least five months following the intervention enrollment month. We define the enrollment month as the first month during which the intervention group member used crisis respite center (CRC) or need-adjusted mobile crisis team (NA-MCT) services. This restriction excluded 279 individuals.

- **Behavioral health diagnosis.** Because we believe matching to comparison individuals with the same behavioral health conditions (Table A.1) is important to assure comparability between the intervention and comparison group we also excluded intervention group members for whom a behavioral health diagnosis was not identified in the claims data. This restriction excluded fewer than 11 individuals.

- **Service use within three months of intervention enrollment.** Since enrollment into the FPHNY program was hypothesized to be predicated by a behavioral health-related service use, we excluded intervention group members who did not use a hospitalization, emergency department (ED) visit, psychiatric service, or office visit within the three months prior to their enrollment month. This restriction excluded 15 individuals.

Application of these restrictions resulted in 537 intervention group members eligible for analysis.

Table A.1. ICD-9 behavioral health diagnosis codes

Diagnosis codes	Label
295.00 to 295.95	Schizophrenia spectrum disorders
296.00 to 296.06, 296.40 to 296.80, 296.89, 296.10 to 296.16, 296.81	Bipolar disorders
296.20 to 296.36, 296.82, 300.4, 311, 311.0	Depressive disorders
296.90, 296.99, 293.83, 300.9	Other mood disorders
305.1, 291.0-292.9, 303.0-303.9, 305.0-305.3, 292.0-292.9, 304.0-304.9, 305.2-305.9	Substance use Disorders (alcohol, tobacco, and other drug use)
300.00 to 300.11, 300.20 to 300.3, 309.81	Anxiety disorders
290.0-290.9, 294.1x	Dementia
297.0 to 298.9, V62.84, V62.85, E950, E951, E952, E953, E954, E955, E956, E957, E958, E959, 300.12 to 300.15, 300.6, 300.7 to 300.89, 301.0 to 301.9, 307.40 to 307.49, 312.0 to 312.23, 312.4 to 312.89, 313.81, 312.30 to 312.39, 302.0 to 302.9, 299.00 to 299.91, 307.1, 307.5, 307.51, 314.00 to 314.01, 307.20 to 307.3, 313.0 to 313.3, 313.82 to 316, 648.4, V65.2, V71.09, 780.09, V15.41, V15.42, V15,81, V17.0, V60.0, V62.29, V62.4, V62.81, V62.89 All other codes in the range of 290.0-299.91 and 300.00-316 (not specified above)	Other BH conditions not specified above (other psychotic disorders, suicidal or homicidal ideation, injury from suicide, dissociative disorders, somatoform disorders, personality disorders, sleep disorders, disruptive behavior disorders, impulse control behavior, sexual and gender identity disorders, ASD, eating disorders, ADHD, other disorder diagnoses in childhood, mental disorders in pregnancy, person feigning illness, observation for other suspected mental condition, other alteration of consciousness, social/contextual circumstances [violence]

Source: ICD-9 diagnosis codes, version 32
(https://www.cms.gov/medicare/coding/ICD9providerdiagnosticcodes/codes.html).

Note: For claims for which ICD-10 diagnosis codes were used instead of ICD-9 (as was required in New York starting in October 2015), we used the CMS General Equivalence Mappings (GEMs) to find all ICD-10 codes that were equivalent to the ICD-9 codes listed in the table.

ICD-9 = International Classification of Diseases, Ninth Revision; ICD-10: International Classification of Diseases, Tenth Revision; ASD = autism spectrum disorder; ADHD = attention-deficit/hyperactivity disorder.

D. Identification of comparison group

Propensity score matching and related matching methods are designed to create a comparison group that is similar in observable characteristics to the intervention group (Rosenbaum and Rubin 1983; Dehejia and Wahba 2002). In this section we describe how we developed a comparison pool and then applied matching methods to select the final comparison group. We also provide diagnostics to assess balance between the matched groups.

Step 1: Define comparison pool. We identified Medicaid enrollees in New York City who had at least one behavioral health-related diagnosis (Table A.1) between January 2013 and November 2015. We excluded individuals identified as intervention group members.[44] This resulted in a potential comparison pool of over 316,000 members.

For each potential comparison pool member, we created a pseudo-enrollment month in January 2013 through November 2015 that reflected the month when the member likely would have enrolled in the intervention if they had been an intervention group member. The pseudo-enrollment month allowed us to define the pre- and post-intervention periods for the analysis. For each person in the potential comparison pool, we identified all the months in which they had a claim, including a behavioral health diagnosis for one of four service types we hypothesized to lead to program participation: inpatient, ED visit, psychiatric visit, or office visit (Table A.2). Then, we randomly selected one of these months as their pseudo-enrollment month weighting the probability of selecting a given month for each potential comparison group member to assure that the distribution of enrollment or pseudo-enrollment months across the enrollment period would be similar for the intervention group and comparison population. To do this, we assigned each month in which a comparison person has an eligible service a weight equal to the proportion of intervention group members who enrolled in that month relative to the proportion of the comparison pool with an eligible service in that month. This gave greater weight to months in which there were relatively fewer comparison persons eligible relative to the proportion of participants who enrolled in that month.

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[44] We assume that everyone remaining in this pool were not receiving FPHNY services; however, we cannot ensure that this is the case, since we only received valid Medicaid identifiers for 1,321 out of 1,401 intervention group members that were identified as being enrolled in Medicaid.

Table A.2. Service use leading to program enrollment

Number	Variable name	Specification	Assign to month based on
1	Inpatient stay[a]	MMCOR_CD = 01, 04; SURS_SUBSYSTEM_COS_CD = 11; CLM_TYPE_CD = "I"	ADMIT_DT
2	ED visit	MMCOR_CD = 21; PROC_CD = 99281-99285; REV_CD_SUB = 0450, 0451, 0452, 0456, 0459, 0981	First SRV_DT on the claim
3	Psychiatric service	MMCOR_CD = 36, 37, 50, 55 PROC_CD = 90832-90834, 90836, 90846, 90849, 90853, 90791, 90882, G0396-G0397, T1006, H0001-H0002, H0004-H0005, H0014, H0020, H0038, H0049, H0050, H2001, H2036, H2034, S9480 RATE_CD = 1528, 1561, 1567, 1552, 1558, 1555, 1540, 1573, 1564, 1468, 1570, 1471, 4009-4010, 4526, 4520-4524, 4508, 4509, 4511, 4310-4312, 4316-4318, 4325, 4331, 4337, 4346, 4532, 4520-4527, 4510, 4357-4363, 4353-4359, 4349-4352, 4531-4534	SRV_DT
4	Office visit	MMCOR_CD = 24, 25, 48, 49 REV_CD_SUB = 51X, 52X PROC_CD = 99201-99205, 99211-99215, 99241-99245, 99381-99387, 99391-99397, 99401-99404, 99420, 99429, G0438, G0439	SRV_DT

Source: Current Procedural Terminology, Healthcare Common Procedure Coding System, Uniform Billing (UB-04), and data documentation provided by NYSDOH.

[a] We considered ED visits that led to an inpatient stay part of the inpatient stay.

MMCOR_CD = Medicaid Managed Care Operating Report code; SURS_SUBSYSTEM_COS_CD = Surveillance and Utilization Review system category of service code; CLM_TYPE_CD = eMedNY claim type code; PROC_CD = eMedNY procedure code; REV_CD_SUB = eMedNY revenue code; RATE_CD = eMedNY reimbursement rate code.

After a pseudo-enrollment month was selected for each potential comparison pool member, we excluded potential comparison individuals who did not have a sufficient Medicaid data to support analysis. In parallel to the exclusion for the participants, we required full benefit Medicaid enrollment with Medicaid as the primary payer for at least six months prior and at least five months following the pseudo-enrollment month, and excluded individuals who were dually enrolled in Medicaid and Medicare in this period. We also excluded potential comparison group members who did not fall within one of the strata defined by our exact match variables for the intervention group (described in the next step). After these exclusions, our final comparison pool included 100,727 Medicaid enrollees.

Step 2: Match intervention group members at the individual level. Next, we conducted individual level matching in two stages. In the first stage, the matching algorithm matched the intervention group members who first used CRCs to members of the comparison pool with an inpatient stay in their pseudo-enrollment month.[45] Then, the second stage used the remaining potential comparison pool members (excluding those beneficiaries who were matched to the

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[45] Intervention group members using CRC services at enrollment were matched to comparison pool individuals with an inpatient stay in their enrollment month because CRC services were provided to individuals who required out-of-home care substituting for hospitalization.

CRC intervention subgroup) and they were matched to intervention group members who first used the NA-MCT services.

The matching process used metrics of individual-level characteristics identified based on pre-period data to select a subset of comparison pool members who were as similar as possible to the intervention group on observable characteristics. First, the matching algorithm exact matched intervention to potential comparison members by assigning both to strata based on behavioral health diagnosis,[46] type of service used prior to enrollment (based on Table A.2), and whether the individual was enrolled in Medicaid for a full 12 months prior to the enrollment or pseudo-enrollment month. Then, within these strata, we used propensity score matching,[47] to match up to 20 comparison pool beneficiaries to each intervention group member. We used a nearest neighbor matching approach to select the closest comparison beneficiaries for each intervention group member.

The propensity score model used the following characteristics identified as of the enrollment (or pseudo-enrollment) month: calendar month and year of enrollment, age group (less than 18; 18–34; 35–44; 45–64), gender, race/ethnicity (African American, non-Hispanic, Hispanic, other), disability status, each of the Chronic Disability Payment System (CDPS) diagnosis flags,[48] and service use in the last 12 months (hospitalizations, ED visits, psychiatric visits, office visits, and total Medicaid expenditures).[49]

When this step was complete, the analysis population included 537 intervention group members and 4,133 matched comparison members.

Step 2: Assess the quality of the match. The following tests and procedures were used to verify that the intervention and matched comparison groups were similar, or balanced.

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[46] We created flags to represent a categorical variable indicating what we hypothesized to be a member's "most severe" diagnosis, ranked in the following order: (1) schizophrenic disorders; (2) bipolar disorders; (3) drug or alcohol-induced psychosis; (4) delusional disorder and other nonorganic psychosis; (5) suicide; (6) depressive, episodic mood disorder, or other depressive disorder; (7) anxiety, dissociative, somatoform, and adjustment reaction; and (8) other behavioral health-related diagnoses.

[47] A member's propensity score is the probability of belonging to the intervention group estimated based on a logistic regression model.

[48] The CDPS is a diagnosis-based risk adjustment model that was designed to allow Medicaid managed care organizations to adjust for health status capitation payments for Temporary Assistance for Needy Families (TANF) and disabled beneficiaries using administrative claims data. This is complemented by the Medicaid Rx (MRx) chronic disease classification, which uses National Drug Codes (NDCs) for prescription drugs. We used these complementary systems to create flags for chronic diseases and their expected level of expenditures.

[49] Instead of matching on continuous levels of use, we created categorical variables to represent the distribution of use. For hospitalizations, we created separate categories for: zero, one, two, and three or more hospitalizations. For ED visits, we created separate categories for: zero, one, two or three, and four or more ED visits. For each of psychiatric visits, office visits, and total Medicaid expenditures, we created categories ranking by the distribution of use (by percentile) among the intervention and potential comparison group members: zero use, those who used and were in the lowest 20 percent of use; between 20 and 40 percent of use, between 40 and 60 percent of use, between 60 and 80 percent of use, and between 80 and 100 percent of use.

Before matching, we examined the ratio of potential comparison group members to intervention group members by exact matching stratum in order to understand how difficult it would be to match at least one potential comparison member to every intervention member. For example, if many strata had a low ratio of potential comparison members to intervention members prior to matching, we might consider reducing the number of variables used for exact matching. However, due to the very large size of the comparison pool, we observed sufficient ratios in each stratum to proceed with our strata.

We then graphically compared the propensity score distributions for the intervention and potential comparison group members prior to matching, looking for overlap in the propensity scores for the two groups (Figures A.1.a and A.1.b). Though in both figures, propensity scores appear to be generally larger for the intervention group (rightmost box plot), we determined that the amount of overlap indicated a sufficient pool of comparison group members available for matching with propensity scores similar to those observed in the intervention group.

Figure A.1.a. Propensity score distributions (FPHNY, CRC subgroup)
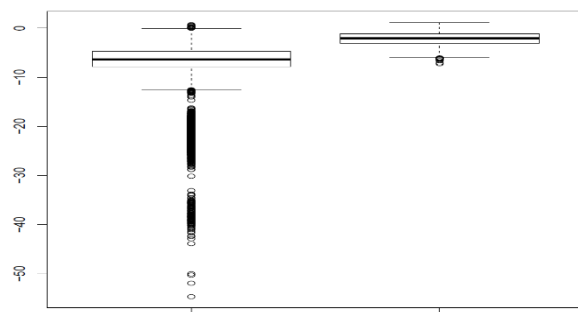
Figure A.1.b. Propensity score distributions (FPHNY, NA-MCT subgroup)
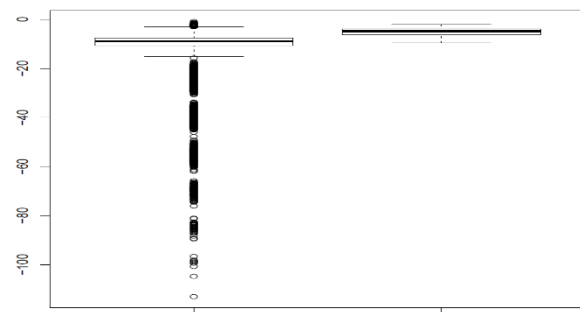
Source: Mathematica analysis of Medicaid administrative data, January 2012–November 2015.
Note: Figures present boxplots created using the estimated propensity scores for the comparison and intervention groups (the left and right boxes, respectively). The line in the middle of each box represents the median score for the group. The lower and upper bounds of the box indicate the first and third quartile.

After we conducted matching, we examined the number of comparison members matched to each intervention group member (Table A.3). A large number of 1:1 matches could indicate that the matching was problematic. The match ratios in this case do not present any issue, and again demonstrate the very large size of the potential comparison pool.

Table A.3. Frequency table of ratio of intervention to comparison group members for each matched set (FPHNY)

Ratio of intervention to comparison group members	1:1	1:2	1:5	1:10	1:20	0:1
Number of matched sets (CRC)	0	243	110	20	28	15,274
Number of matched sets (NA-MCT)	0	1	5	29	101	96,954

Source: Mathematica analysis of Medicaid administrative data, January 2012–November 2015.

Note: Each cell indicates the number of intervention group members matched to the number of comparison group members indicated for that column. The rightmost column shows the number of potential comparison group members that were not matched to an intervention group member.

To further investigate balance between the intervention and matched comparison groups, we evaluated how matching affected the balance on all matching variables (Figures A.2.a and A.2.b; Tables A.4.a and A.4.b) by comparing the absolute and standardized difference between the intervention and comparison groups for each variable before and after matching. The standardized difference measures the difference in means relative to the pooled standard deviation of intervention and comparison group members for each variable. The standardized difference measure is advantageous in that it allows us to compare all variables on the same scale. We compared the standardized differences using plots with dashed lines at +/- 0.10 standardized differences to visually inspect whether we obtained good balance for each variable, and with a balance table that shows both absolute and standardized differences between intervention and comparison groups before and after matching. In each instance, we found that all variables are within the 0.10 standardized difference limit after matching, indicating good performance of the match.

Step 3: Create analysis weights. Weights were developed for each member of the analysis population. Weights for intervention group members were set to one. Weights for comparison group members were set to one divided by the number of comparison group members assigned to the member's associated intervention group member. For example, for an intervention group member matched to 20 comparison group members, the intervention group member would have a weight equal to one, and each comparison group member's weight would equal 0.05.

In some pre- or post-intervention analysis months,[50] intervention or comparison group members might not have had sufficient Medicaid data to be included in the analysis, because they were not enrolled in Medicaid with full-benefits or Medicaid was not their primary payer. The weight for these individuals was set to zero in analysis months where they did not meet these Medicaid coverage criteria.

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[50] We required that each intervention and comparison group member be enrolled in Medicaid with full benefits and with Medicaid as their primary payer for six months prior to the enrollment month, during the enrollment month and for five months following the program enrollment month. In contrast, the analysis period included three years prior to and one year after program enrollment.

Figure A.2.a. Balance plots comparing the standardized difference for each matching variable before and after matching (FPHNY, CRC subgroup)
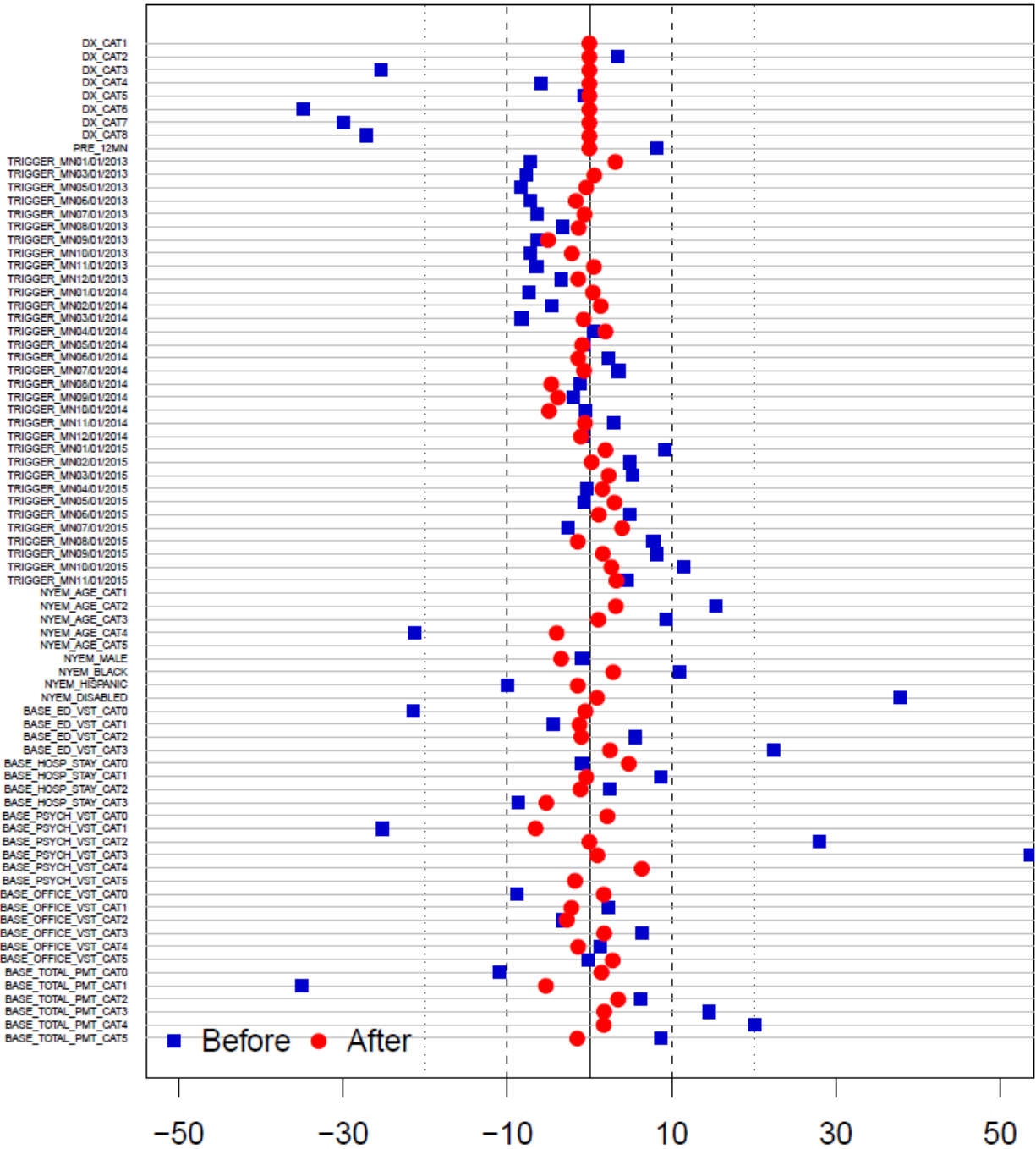
Source: Mathematica analysis of Medicaid administrative data, January 2012–November 2015.

Note: Blue markers show the standardized difference before matching; red markers show the standardized difference after exact matching and propensity score modeling. See Table A.4.a for descriptions of the variables included in this figure.

Figure A.2.a *(continued)*
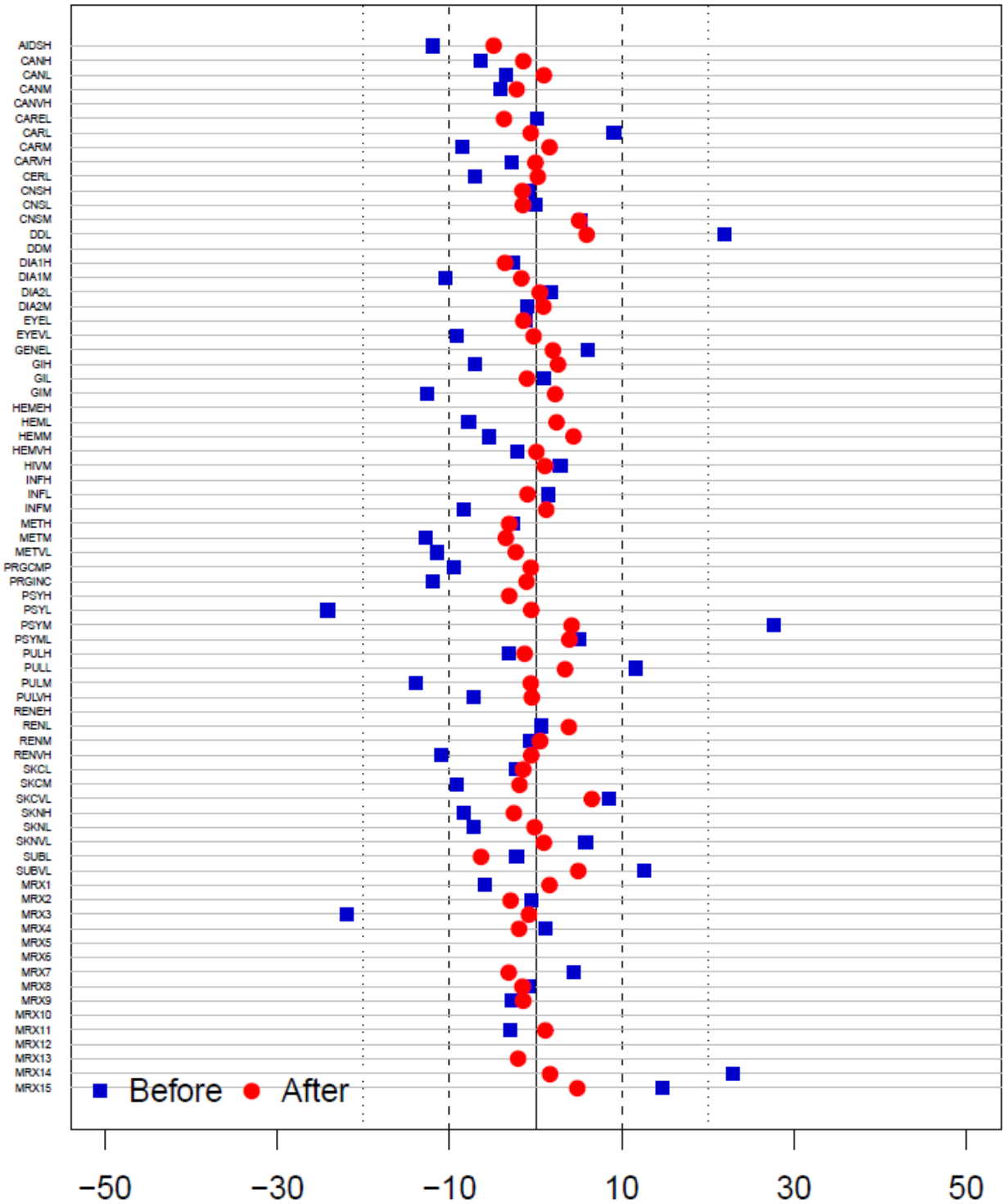
Source: Mathematica analysis of Medicaid administrative data, January 2012–November 2015.

Note: Blue markers show the standardized difference before matching; red markers show the standardized difference after exact matching and propensity score modeling. See Table A.4.a for descriptions of the variables included in this figure.

Figure A.2.b. Balance plots comparing the standardized difference for each matching variable before and after matching (FPHNY, NA-MCT subgroup)
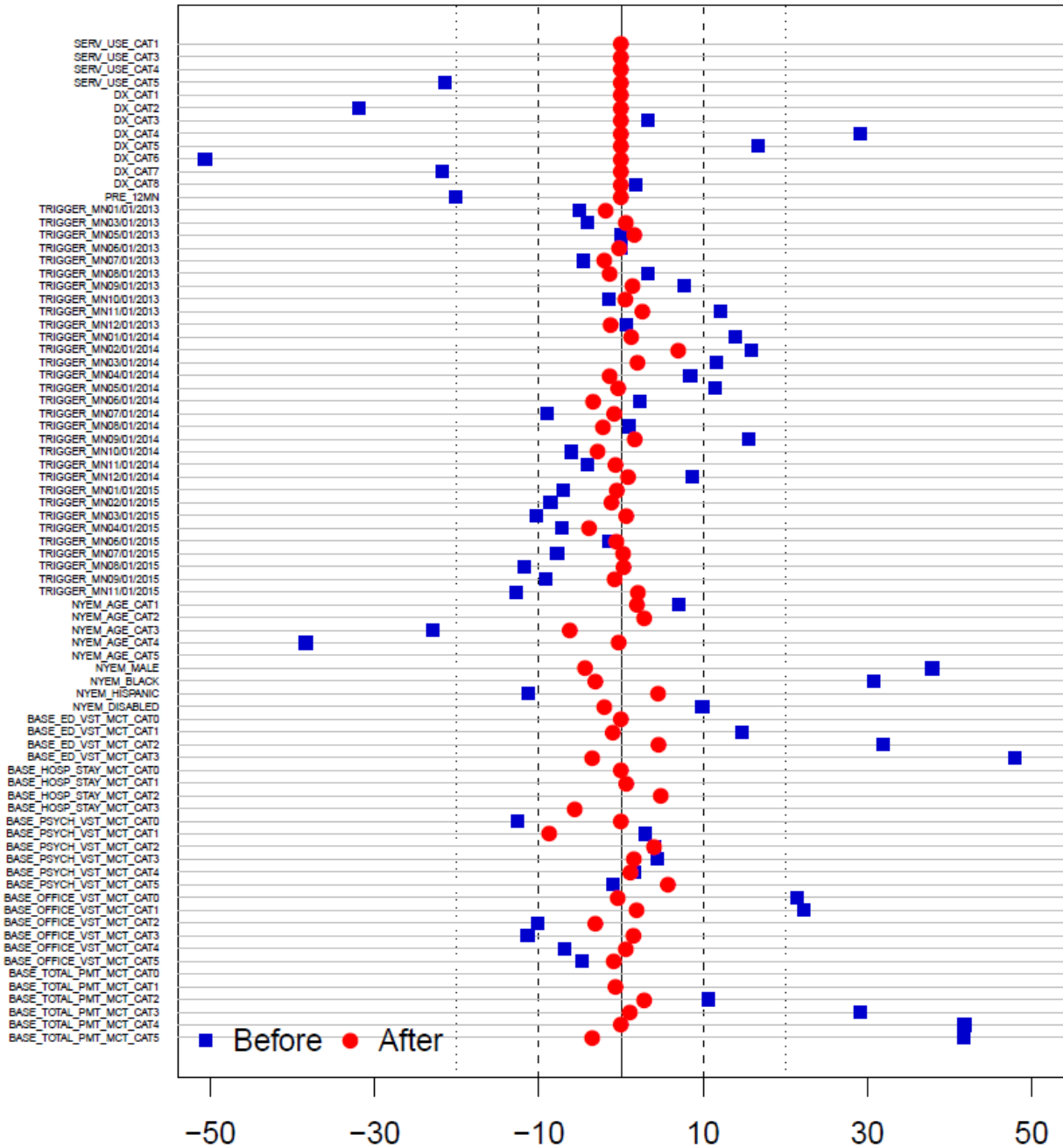
Source: Mathematica analysis of Medicaid administrative data, January 2012–November 2015.

Note: Blue markers show the standardized difference before matching; red markers show the standardized difference after exact matching and propensity score modeling. See Table A.4.b for descriptions of the variables included in this figure.

Figure A.2.b *(continued)*
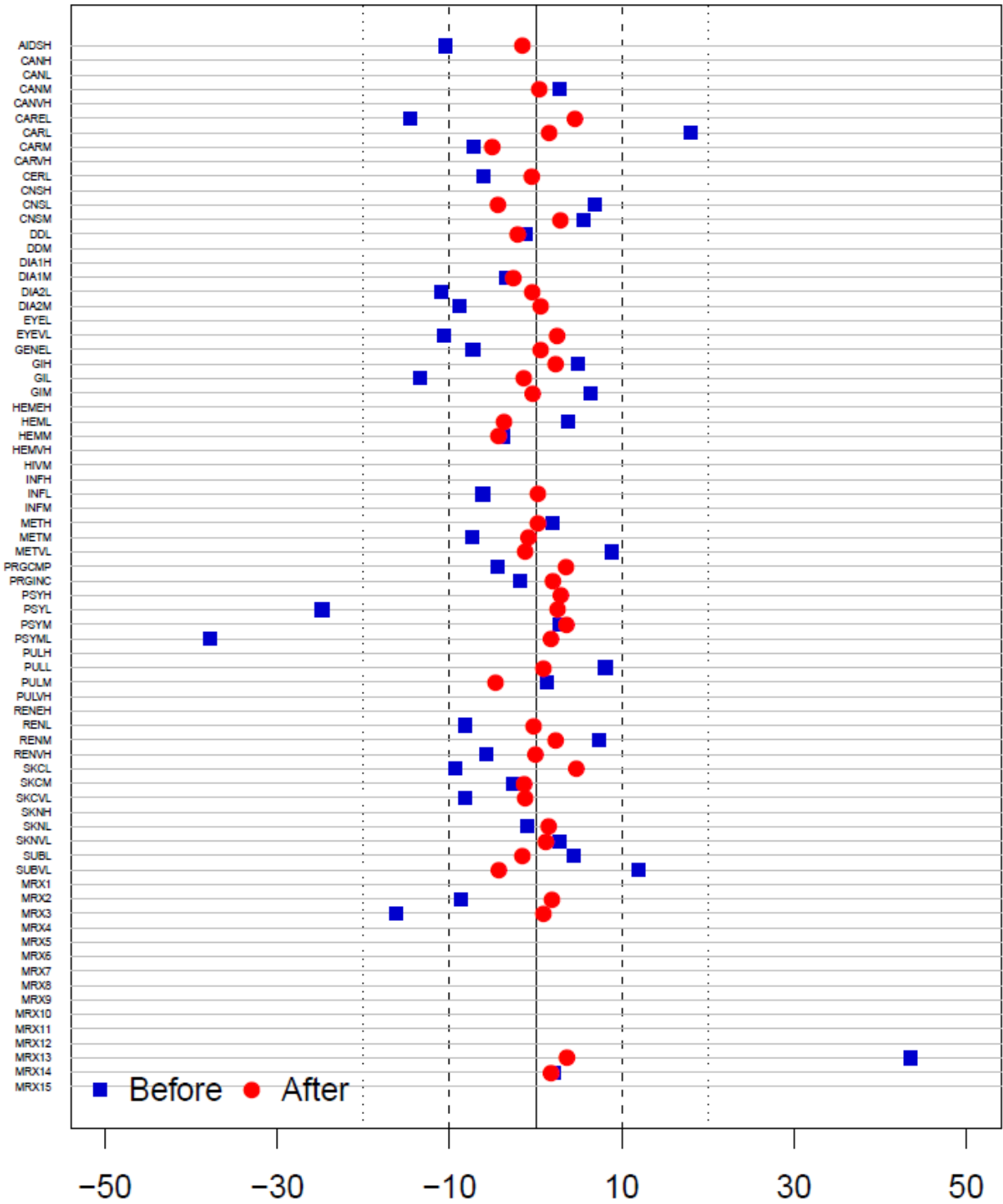
Source: Mathematica analysis of Medicaid administrative data, January 2012–November 2015.

Note: Blue markers show the standardized difference before matching; red markers show the standardized difference after exact matching and propensity score modeling. See Table A.4.b for descriptions of the variables included in this figure.

Table A.4.a. Balance table before and after matching (FPHNY, CRC subgroup)

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	P	Comparison	Intervention	adj.diff	std.diff	p
	Exact match variables										
	Hierarchical diagnosis code prior to program enrollment										
DX_CAT1	Schizophrenia	0.2557	0.6160	0.3603	0.8236	0.0000	0.6160	0.6160	0.0000	0.0000	1.0000
DX_CAT2	Bipolar	0.2470	0.2618	0.0148	0.0343	0.4971	0.2618	0.2618	0.0000	0.0000	1.0000
DX_CAT3	Drug/alcohol-induced psychosis	0.0681	0.0050	-0.0631	-0.2531	0.0000	0.0050	0.0050	0.0000	0.0000	1.0000
DX_CAT4	Other nonorganic psychosis	0.0300	0.0200	-0.0100	-0.0591	0.2420	0.0200	0.0200	0.0000	0.0000	1.0000
DX_CAT5	Suicidal	0.0131	0.0125	-0.0007	-0.0057	0.9094	0.0125	0.0125	0.0000	0.0000	1.0000
DX_CAT6	Depression	0.2079	0.0673	-0.1405	-0.3488	0.0000	0.0673	0.0673	0.0000	0.0000	1.0000
DX_CAT7	Anxiety/adjustment	0.1063	0.0150	-0.0914	-0.2993	0.0000	0.0150	0.0150	0.0000	0.0000	1.0000
DX_CAT8	Other behavioral health diagnosis	0.0719	0.0025	-0.0694	-0.2718	0.0000	0.0025	0.0025	0.0000	0.0000	1.0000
PRE_12MN	12 months of continuous baseline enrollment	0.8926	0.9177	0.0251	0.0812	0.1079	0.9177	0.9177	0.0000	0.0000	1.0000
	Propensity score variables										
	Program enrollment month										
TRIGGER_MN 01/01/2013	01/2013	0.0094	0.0025	-0.0069	-0.0724	0.1519	0.0010	0.0025	0.0015	0.0314	0.5271
TRIGGER_MN 03/01/2013	03/2013	0.0101	0.0025	-0.0076	-0.0766	0.1296	0.0022	0.0025	0.0002	0.0058	0.9326
TRIGGER_MN 05/01/2013	05/2013	0.0186	0.0075	-0.0111	-0.0830	0.1004	0.0079	0.0075	-0.0004	-0.004	0.9441
TRIGGER_MN 06/01/2013	06/2013	0.0167	0.0075	-0.0092	-0.0724	0.1520	0.0090	0.0075	-0.0015	-0.0162	0.7808
TRIGGER_MN 07/01/2013	07/2013	0.0216	0.0125	-0.0091	-0.0632	0.2109	0.0132	0.0125	-0.0007	-0.0062	0.9103
TRIGGER_MN 08/01/2013	08/2013	0.0278	0.0224	-0.0054	-0.0328	0.5162	0.0246	0.0224	-0.0021	-0.0131	0.8153
TRIGGER_MN 09/01/2013	09/2013	0.0249	0.0150	-0.0099	-0.0640	0.2049	0.0217	0.0150	-0.0067	-0.0503	0.4236
TRIGGER_MN 10/01/2013	10/2013	0.0094	0.0025	-0.0069	-0.0724	0.1519	0.0036	0.0025	-0.0011	-0.0215	0.7261
TRIGGER_MN 11/01/2013	11/2013	0.0187	0.0100	-0.0087	-0.0647	0.2005	0.0094	0.0100	0.0006	0.0057	0.9122
TRIGGER_MN 12/01/2013	12/2013	0.0281	0.0224	-0.0056	-0.0341	0.4999	0.0244	0.0224	-0.002	-0.0138	0.8245
TRIGGER_MN 01/01/2014	01/2014	0.0269	0.0150	-0.0119	-0.0741	0.1425	0.0145	0.0150	0.0005	0.0041	0.9405
TRIGGER_MN 02/01/2014	02/2014	0.0215	0.0150	-0.0065	-0.0452	0.3707	0.0133	0.0150	0.0016	0.0135	0.8165
TRIGGER_MN 03/01/2014	03/2014	0.0220	0.0100	-0.0121	-0.0826	0.1020	0.0106	0.0100	-0.0006	-0.0069	0.9139
TRIGGER_MN 04/01/2014	04/2014	0.0340	0.0349	0.0009	0.0052	0.9187	0.0313	0.0349	0.0036	0.0198	0.7281

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	P	Comparison	Intervention	adj.diff	std.diff	p
TRIGGER_MN 05/01/2014	05/2014	0.0312	0.0299	-0.0012	-0.0071	0.8876	0.0313	0.0299	-0.0014	-0.0086	0.8938
TRIGGER_MN 06/01/2014	06/2014	0.0357	0.0399	0.0042	0.0227	0.6526	0.0426	0.0399	-0.0027	-0.0137	0.8165
TRIGGER_MN 07/01/2014	07/2014	0.0313	0.0374	0.0061	0.0351	0.4872	0.0387	0.0374	-0.0012	-0.0064	0.913
TRIGGER_MN 08/01/2014	08/2014	0.0346	0.0324	-0.0022	-0.0121	0.8113	0.0414	0.0324	-0.009	-0.0463	0.4289
TRIGGER_MN 09/01/2014	09/2014	0.0335	0.0299	-0.0035	-0.0196	0.6976	0.0368	0.0299	-0.0069	-0.038	0.5132
TRIGGER_MN 10/01/2014	10/2014	0.0357	0.0349	-0.0008	-0.0044	0.9301	0.0448	0.0349	-0.0099	-0.0492	0.4099
TRIGGER_MN 11/01/2014	11/2014	0.0368	0.0424	0.0055	0.0294	0.5608	0.0435	0.0424	-0.0011	-0.0056	0.9229
TRIGGER_MN 12/01/2014	12/2014	0.0289	0.0274	-0.0014	-0.0087	0.8639	0.0292	0.0274	-0.0017	-0.0105	0.8474
TRIGGER_MN 01/01/2015	01/2015	0.0353	0.0524	0.0170	0.0918	0.0691	0.0483	0.0524	0.0041	0.0197	0.7393
TRIGGER_MN 02/01/2015	02/2015	0.0314	0.0399	0.0085	0.0486	0.3361	0.0394	0.0399	0.0005	0.0027	0.9641
TRIGGER_MN 03/01/2015	03/2015	0.0395	0.0499	0.0103	0.0529	0.2954	0.0451	0.0499	0.0047	0.0235	0.6985
TRIGGER_MN 04/01/2015	04/2015	0.0431	0.0424	-0.0007	-0.0033	0.9484	0.0392	0.0424	0.0032	0.0156	0.7757
TRIGGER_MN 05/01/2015	05/2015	0.0388	0.0374	-0.0014	-0.0071	0.8879	0.0317	0.0374	0.0057	0.0302	0.5884
TRIGGER_MN 06/01/2015	06/2015	0.0424	0.0524	0.0100	0.0493	0.3294	0.0499	0.0524	0.0025	0.0113	0.8419
TRIGGER_MN 07/01/2015	07/2015	0.0400	0.0349	-0.0051	-0.0261	0.6061	0.0278	0.0349	0.0071	0.0399	0.4718
TRIGGER_MN 08/01/2015	08/2015	0.0482	0.0648	0.0167	0.0776	0.1244	0.0685	0.0648	-0.0036	-0.0142	0.8075
TRIGGER_MN 09/01/2015	09/2015	0.0432	0.0599	0.0167	0.0817	0.1059	0.0561	0.0599	0.0037	0.0163	0.7781
TRIGGER_MN 10/01/2015	10/2015	0.0398	0.0623	0.0226	0.1148	0.0231	0.0560	0.0623	0.0064	0.0267	0.6445
TRIGGER_MN 11/01/2015	11/2015	0.0409	0.0499	0.0089	0.0449	0.3738	0.0433	0.0499	0.0066	0.0325	0.5898
NYEM_AGE_CAT1	Age group <18	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
NYEM_AGE_CAT2	18-34	0.2893	0.3591	0.0698	0.1536	0.0024	0.3439	0.3591	0.0152	0.0320	0.5775
NYEM_AGE_CAT3	34-45	0.1832	0.2195	0.0363	0.0936	0.0640	0.2150	0.2195	0.0045	0.0110	0.8508

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	P	Comparison	Intervention	adj.diff	std.diff	p
NYEM_AGE_CAT4	45-64	0.5275	0.4214	-0.1060	-0.2124	0.0000	0.4411	0.4214	-0.0197	-0.0397	0.4781
NYEM_AGE_CAT5	65+	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
NYEM_MALE	Male	0.4983	0.4938	-0.0045	-0.0091	0.8575	0.5108	0.4938	-0.0171	-0.0342	0.5540
NYEM_BLACK	Race/ethnicity African American, not Hispanic	0.3465	0.3990	0.0525	0.1102	0.0291	0.3852	0.3990	0.0138	0.0289	0.6237
NYEM_HISPANIC	Hispanic	0.2998	0.2544	-0.0455	-0.0993	0.0493	0.2606	0.2544	-0.0062	-0.0141	0.8056
NYEM_DISABLED	Disabled	0.4172	0.6035	0.1863	0.3779	0.0000	0.5989	0.6035	0.0046	0.0093	0.8565
BASE_ED_VST_CAT0	Number of ED visits in 12 months prior to program enrollment 0	0.3352	0.2344	-0.1008	-0.2140	0.0000	0.2367	0.2344	-0.0022	-0.0051	0.9278
BASE_ED_VST_CAT1	1	0.2103	0.1920	-0.0182	-0.0448	0.3755	0.1970	0.1920	-0.0050	-0.0121	0.8314
BASE_ED_VST_CAT2	2-3	0.2163	0.2394	0.0231	0.0561	0.2669	0.2435	0.2394	-0.0041	-0.0097	0.8703
BASE_ED_VST_CAT3	4+	0.2383	0.3342	0.0959	0.2245	0.0000	0.3228	0.3342	0.0113	0.0249	0.6802
BASE_HOSP_STAY_CAT0	Number of hospitalizations in 12 months prior to program enrollment 0	0.5057	0.5012	-0.0045	-0.0090	0.8588	0.4776	0.5012	0.0237	0.0477	0.4002
BASE_HOSP_STAY_CAT1	1	0.1834	0.2170	0.0336	0.0867	0.0862	0.2185	0.2170	-0.0015	-0.0037	0.9509
BASE_HOSP_STAY_CAT2	2	0.0928	0.0998	0.0070	0.0240	0.6354	0.1029	0.0998	-0.0031	-0.0112	0.8611
BASE_HOSP_STAY_CAT3	3+	0.2181	0.1820	-0.0361	-0.0874	0.0835	0.2011	0.1820	-0.0191	-0.0523	0.3911
BASE_PSYCH_VST_CAT0	Relative number of psychiatric visits in 12 months prior to program enrollment[a] 0	0.4927	0.0623	-0.4304	-0.8685	0.0000	0.0556	0.0623	0.0067	0.0217	0.5174
BASE_PSYCH_VST_CAT1	Up to 20%	0.2331	0.1272	-0.1059	-0.2516	0.0000	0.1545	0.1272	-0.0273	-0.0654	0.1281
BASE_PSYCH_VST_CAT2	20-40%	0.0946	0.1771	0.0825	0.2797	0.0000	0.1771	0.1771	0.0000	0.0000	1.0000
BASE_PSYCH_VST_CAT3	40-60%	0.0674	0.2045	0.1371	0.5369	0.0000	0.2007	0.2045	0.0037	0.0098	0.8691
BASE_PSYCH_VST_CAT4	60-80%	0.0528	0.2120	0.1592	0.6935	0.0000	0.1884	0.2120	0.0236	0.0639	0.2789

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	P	Comparison	Intervention	adj.diff	std.diff	p
BASE_PSYCH_VST_CAT5	80-100%	0.0594	0.2170	0.1576	0.6514	0.0000	0.2237	0.2170	-0.0067	-0.0174	0.7701
	Relative number of office visits in 12 months prior to program enrollment[a]										
BASE_OFFICE_VST_CAT0	0	0.0841	0.0599	-0.0243	-0.0877	0.0825	0.0559	0.0599	0.0040	0.0173	0.7649
BASE_OFFICE_VST_CAT1	Up to 20%	0.1125	0.1197	0.0072	0.0228	0.6511	0.1267	0.1197	-0.0070	-0.0219	0.7224
BASE_OFFICE_VST_CAT2	20-40%	0.1900	0.1771	-0.0130	-0.0331	0.5122	0.1877	0.1771	-0.0106	-0.0275	0.6386
BASE_OFFICE_VST_CAT3	40-60%	0.1917	0.2170	0.0253	0.0641	0.2042	0.2096	0.2170	0.0074	0.0180	0.7514
BASE_OFFICE_VST_CAT4	60-80%	0.1967	0.2020	0.0053	0.0133	0.7928	0.2075	0.2020	-0.0055	-0.0134	0.8173
BASE_OFFICE_VST_CAT5	80-100%	0.2250	0.2244	-0.0005	-0.0012	0.9804	0.2127	0.2244	0.0117	0.0282	0.6272
	Relative total Medicaid expenditures in 12 months prior to program enrollment[a]										
BASE_TOTAL_PMT_CAT0	0	0.0162	0.0025	-0.0137	-0.1095	0.0302	0.0016	0.0025	0.0009	0.0145	0.7441
BASE_TOTAL_PMT_CAT1	Up to 20%	0.3367	0.1721	-0.1647	-0.3499	0.0000	0.1950	0.1721	-0.0229	-0.0531	0.2720
BASE_TOTAL_PMT_CAT2	20-40%	0.1808	0.2045	0.0237	0.0615	0.2233	0.1904	0.2045	0.0141	0.0347	0.5285
BASE_TOTAL_PMT_CAT3	40-60%	0.1390	0.1895	0.0505	0.1455	0.0040	0.1827	0.1895	0.0069	0.0181	0.7642
BASE_TOTAL_PMT_CAT4	60-80%	0.1414	0.2120	0.0706	0.2016	0.0001	0.2052	0.2120	0.0067	0.0175	0.7792
BASE_TOTAL_PMT_CAT5	80-100%	0.1859	0.2195	0.0336	0.0862	0.0881	0.2251	0.2195	-0.0056	-0.0145	0.8133
	CDPS condition flags										
AIDSH	AIDS, High	0.1804	0.1347	-0.0458	-0.1193	0.0182	0.1520	0.1347	-0.0173	-0.0486	0.3929
CANH	Cancer, High	0.0081	0.0025	-0.0056	-0.0634	0.2098	0.0032	0.0025	-0.0007	-0.0143	0.8231
CANL	Cancer, Low	0.0141	0.0100	-0.0041	-0.0348	0.4908	0.0090	0.0100	0.0010	0.0098	0.8657
CANM	Cancer, Medium	0.0087	0.0050	-0.0037	-0.0404	0.4237	0.0066	0.0050	-0.0016	-0.0220	0.7225
CANVH	Cancer, Very High	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
CAREL	Cardiovascular, Extra Low	0.1513	0.1521	0.0008	0.0022	0.9647	0.1651	0.1521	-0.0130	-0.0368	0.5478
CARL	Cardiovascular, Low	0.2216	0.2594	0.0378	0.0909	0.0721	0.2617	0.2594	-0.0024	-0.0055	0.9265
CARM	Cardiovascular, Medium	0.1227	0.0948	-0.0279	-0.0853	0.0915	0.0900	0.0948	0.0047	0.0162	0.7818
CARVH	Cardiovascular, Very High	0.0043	0.0025	-0.0018	-0.0274	0.5869	0.0025	0.0025	0.0000	0.0000	1.0000
CERL	Cerebrovascular, Low	0.0444	0.0299	-0.0145	-0.0705	0.1626	0.0294	0.0299	0.0005	0.0029	0.9599
CNSH	Nervous System, High	0.0056	0.0050	-0.0006	-0.0078	0.8777	0.0062	0.0050	-0.0012	-0.0151	0.7893
CNSL	Nervous System, Low	0.1920	0.1920	0.0000	0.0000	0.9995	0.1978	0.1920	-0.0057	-0.0150	0.8044

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	P	Comparison	Intervention	adj.diff	std.diff	p
CNSM	Nervous System, Medium	0.0395	0.0499	0.0103	0.0529	0.2954	0.0393	0.0499	0.0106	0.0508	0.3752
DDL	Developmental Disability, Low	0.0179	0.0474	0.0295	0.2189	0.0000	0.0374	0.0474	0.0100	0.0594	0.3968
DDM	Developmental Disability, Medium	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
DIA1H	Diabetes, Type 1 High	0.0042	0.0025	-0.0017	-0.0267	0.5968	0.0045	0.0025	-0.0020	-0.0354	0.5716
DIA1M	Diabetes, Type 1 Low	0.0438	0.0224	-0.0214	-0.1050	0.0377	0.0248	0.0224	-0.0024	-0.0165	0.7946
DIA2L	Diabetes, Type 2 High	0.1434	0.1496	0.0063	0.0179	0.7231	0.1480	0.1496	0.0016	0.0047	0.9379
DIA2M	Diabetes, Type 2 Low	0.0521	0.0499	-0.0022	-0.0099	0.8442	0.0478	0.0499	0.0021	0.0094	0.8666
EYEL	Eye, Low	0.0138	0.0125	-0.0013	-0.0112	0.8253	0.0141	0.0125	-0.0016	-0.0140	0.8030
EYEVL	Eye, Very Low	0.0467	0.0274	-0.0193	-0.0917	0.0695	0.0278	0.0274	-0.0004	-0.0022	0.9692
GENEL	Genital, Extra Low	0.0944	0.1122	0.0178	0.0607	0.2296	0.1057	0.1122	0.0065	0.0201	0.7227
GIH	Gastrointestinal, High	0.0092	0.0025	-0.0067	-0.0708	0.1610	0.0012	0.0025	0.0012	0.0262	0.6171
GIL	Gastrointestinal, Low	0.1757	0.1796	0.0038	0.0100	0.8432	0.1832	0.1796	-0.0036	-0.0097	0.8745
GIM	Gastrointestinal, Medium	0.0998	0.0623	-0.0375	-0.1255	0.0130	0.0566	0.0623	0.0057	0.0227	0.6680
HEMEH	Hematological, Extra High	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
HEML	Hematological, Low	0.0401	0.0249	-0.0152	-0.0777	0.1239	0.0214	0.0249	0.0035	0.0244	0.6683
HEMM	Hematological, Medium	0.0349	0.0249	-0.0099	-0.0542	0.2829	0.0191	0.0249	0.0059	0.0444	0.4712
HEMVH	Hematological, Very High	0.0096	0.0075	-0.0021	-0.0219	0.6654	0.0074	0.0075	0.0001	0.0012	0.9809
HIVM	HIV, Medium	0.0075	0.0100	0.0025	0.0286	0.5713	0.0090	0.0100	0.0010	0.0108	0.8601
INFH	Infectious, High	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
INFL	Infectious, Low	0.0564	0.0599	0.0034	0.0149	0.7683	0.0620	0.0599	-0.0021	-0.0091	0.8801
INFM	Infectious, Medium	0.0222	0.0100	-0.0122	-0.0835	0.0984	0.0087	0.0100	0.0012	0.0122	0.8311
METH	Metabolic, High	0.0213	0.0175	-0.0038	-0.0265	0.6005	0.0216	0.0175	-0.0041	-0.0304	0.6153
METM	Metabolic, Medium	0.0698	0.0374	-0.0324	-0.1277	0.0115	0.0444	0.0374	-0.0070	-0.0345	0.5573
METVL	Metabolic, Very Low	0.0593	0.0324	-0.0269	-0.1145	0.0234	0.0367	0.0324	-0.0042	-0.0232	0.6959
PRGCMP	Pregnancy, Complete	0.0347	0.0175	-0.0173	-0.0949	0.0603	0.0183	0.0175	-0.0009	-0.0057	0.9118
PRGINC	Pregnancy, Incomplete	0.0264	0.0075	-0.0189	-0.1188	0.0187	0.0086	0.0075	-0.0011	-0.0106	0.8284
PSYH	Psychiatric, High	0.1540	0.4988	0.3447	0.9451	0.0000	0.5125	0.4988	-0.0137	-0.0307	0.4607
PSYL	Psychiatric, Low	0.0914	0.0224	-0.0690	-0.2414	0.0000	0.0236	0.0224	-0.0011	-0.0050	0.8831
PSYM	Psychiatric, Medium	0.1062	0.1920	0.0858	0.2765	0.0000	0.1752	0.1920	0.0168	0.0418	0.3874
PSYML	Psychiatric, Medium Low	0.1611	0.1796	0.0184	0.0501	0.3211	0.1626	0.1796	0.0170	0.0392	0.3499
PULH	Pulmonary, High	0.0107	0.0075	-0.0032	-0.0311	0.5385	0.0087	0.0075	-0.0012	-0.0125	0.8099
PULL	Pulmonary, Low	0.2492	0.2993	0.0501	0.1157	0.0221	0.2839	0.2993	0.0153	0.0343	0.5636
PULM	Pulmonary, Medium	0.0954	0.0549	-0.0406	-0.1387	0.0061	0.0561	0.0549	-0.0012	-0.0053	0.9270
PULVH	Pulmonary, Very High	0.0094	0.0025	-0.0069	-0.0724	0.1519	0.0027	0.0025	-0.0002	-0.0041	0.9370
RENEH	Renal, Extra High	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
RENL	Renal, Low	0.0559	0.0574	0.0014	0.0061	0.9033	0.0489	0.0574	0.0085	0.0387	0.5241
RENM	Renal, Medium	0.0080	0.0075	-0.0005	-0.0061	0.9038	0.0070	0.0075	0.0005	0.0055	0.9201
RENVH	Renal, Very High	0.0514	0.0274	-0.0240	-0.1092	0.0306	0.0283	0.0274	-0.0009	-0.0050	0.9291
SKCL	Skeletal and Connective, Low	0.1017	0.0948	-0.0069	-0.0230	0.6495	0.0991	0.0948	-0.0044	-0.0140	0.7934
SKCM	Skeletal and Connective, Medium	0.0996	0.0723	-0.0273	-0.0915	0.0701	0.0773	0.0723	-0.0050	-0.0185	0.7465
SKCVL	Skeletal and Connective, Very Low	0.0948	0.1197	0.0249	0.0848	0.0931	0.0995	0.1197	0.0202	0.0653	0.2628
SKNH	Skin, High	0.0112	0.0025	-0.0087	-0.0834	0.0988	0.0041	0.0025	-0.0016	-0.0254	0.6576
SKNL	Skin, Low	0.0295	0.0175	-0.0120	-0.0713	0.1579	0.0176	0.0175	-0.0001	-0.0010	0.9866
SKNVL	Skin, Very Low	0.1090	0.1272	0.0182	0.0582	0.2496	0.1241	0.1272	0.0031	0.0097	0.8706
SUBL	Substance Abuse, Low	0.2742	0.2643	-0.0099	-0.0222	0.6609	0.2919	0.2643	-0.0276	-0.0631	0.2764
SUBVL	Substance Abuse, Very Low	0.0742	0.1072	0.0330	0.1253	0.0131	0.0930	0.1072	0.0142	0.0498	0.4156

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	P	Comparison	Intervention	adj.diff	std.diff	p
	Medicaid Rx categories										
MRX1	Anti-coagulants	0.0176	0.0100	-0.0077	-0.0585	0.2471	0.0084	0.0100	0.0016	0.0163	0.7783
MRX2	Cardiac	0.0231	0.0224	-0.0007	-0.0046	0.9270	0.0268	0.0224	-0.0044	-0.0287	0.6238
MRX3	Psychosis/Bipolar/Depression	0.0584	0.0075	-0.0509	-0.2193	0.0000	0.0084	0.0075	-0.0009	-0.0078	0.8506
MRX4	Diabetes	0.0066	0.0075	0.0009	0.0114	0.8218	0.0091	0.0075	-0.0016	-0.0191	0.7525
MRX5	ESRD/Renal	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
MRX6	Hemophilia/von Willebrands	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
MRX7	Hepatitis	0.0027	0.0050	0.0023	0.0438	0.3860	0.0074	0.0050	-0.0024	-0.0309	0.6324
MRX8	HIV	0.0030	0.0025	-0.0005	-0.0091	0.8576	0.0034	0.0025	-0.0009	-0.0155	0.7674
MRX9	Infections, high	0.0043	0.0025	-0.0018	-0.0274	0.5869	0.0032	0.0025	-0.0007	-0.0143	0.8065
MRX10	Inflammatory/Autoimmune	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
MRX11	Malignancies	0.0133	0.0100	-0.0033	-0.0291	0.5647	0.0086	0.0100	0.0014	0.0113	0.8080
MRX12	Multiple Sclerosis/Paralysis	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
MRX13	Parkinson's/tremor	0.0347	0.1446	0.1099	0.5824	0.0000	0.1504	0.1446	-0.0057	-0.0201	0.7697
MRX14	Seizure disorders	0.0316	0.0723	0.0407	0.2293	0.0000	0.0682	0.0723	0.0041	0.0168	0.7833
MRX15	Tuberculosis	0.0025	0.0100	0.0075	0.1467	0.0037	0.0057	0.0100	0.0042	0.0484	0.3597

Source: Mathematica analysis of Medicaid administrative data, January 2012–November 2015.

[a] For each of office visits, psychiatric visits, and total Medicaid expenditures, we created categories ranking by the distribution of use (by percentile) among the intervention and potential comparison group members.

ED = emergency department; CDPS = Chronic Illness and Disability Payment System; AIDS = acquired immune deficiency syndrome; ESRD = end-stage renal disease; HIV = human immunodeficiency virus. adj.diff = The adjusted mean difference (adj. diff.) is the difference between weight-adjusted means for the treatment and comparison groups. 'Before matching' each treatment and comparison group member has equal weights in the mean calculation for their group. 'After matching' the members of the treatment group still have equal weight in their group mean, but the individuals in the comparison group are weighted based on one divided by the number of treatment group member to whom they are matched. Comparison group members who are not matched to a treatment group member are given a weight of zero; std.diff = The standardized difference (std. diff.) is the difference in weight-adjusted means between the treatment and comparison groups divided by the pooled standard deviation of treatment and matched comparison groups of the variable. This method places the mean difference between the treatment and comparison groups on the same scale (percentage) as the variance for each variable.

Table A.4.b. Balance table before and after matching (FPHNY, NA-MCT subgroup)

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	P	Comparison	Intervention	adj.diff	std.diff	p
Exact match variables											
	Service use category prior to program enrollment										
SERV_USE_CAT1	Hospitalization or ED visit leading to hospitalization	0.0523	0.3088	0.2565	1.1490	0.0000	0.3088	0.3088	0.0000	0.0000	1.0000
SERV_USE_CAT3	ED visit not leading to hospitalization	0.0458	0.1691	0.1233	0.5892	0.0000	0.1691	0.1691	0.0000	0.0000	1.0000
SERV_USE_CAT4	Psychiatric visit	0.6889	0.3971	-0.2919	-0.6304	0.0000	0.3971	0.3971	0.0000	0.0000	1.0000
SERV_USE_CAT5	Office visit	0.2130	0.1250	-0.0880	-0.2149	0.0123	0.1250	0.1250	0.0000	0.0000	1.0000
	Hierarchical diagnosis code prior to program enrollment										
DX_CAT1	Schizophrenia	0.3111	0.6985	0.3875	0.8370	0.0000	0.6985	0.6985	0.0000	0.0000	1.0000
DX_CAT2	Bipolar	0.3009	0.1544	-0.1465	-0.3194	0.0002	0.1544	0.1544	0.0000	0.0000	1.0000
DX_CAT3	Drug/alcohol-induced psychosis	0.0050	0.0074	0.0023	0.0329	0.7011	0.0074	0.0074	0.0000	0.0000	1.0000
DX_CAT4	Other nonorganic psychosis	0.0121	0.0441	0.0320	0.2913	0.0007	0.0441	0.0441	0.0000	0.0000	1.0000
DX_CAT5	Suicidal	0.0041	0.0147	0.0106	0.1670	0.0516	0.0147	0.0147	0.0000	0.0000	1.0000
DX_CAT6	Depression	0.2685	0.0441	-0.2244	-0.5065	0.0000	0.0441	0.0441	0.0000	0.0000	1.0000
DX_CAT7	Anxiety/adjustment	0.0924	0.0294	-0.0630	-0.2177	0.0112	0.0294	0.0294	0.0000	0.0000	1.0000
DX_CAT8	Other behavioral health diagnosis	0.0059	0.0074	0.0014	0.0186	0.8281	0.0074	0.0074	0.0000	0.0000	1.0000
PRE_12MN	12 months of continuous baseline enrollment	0.9539	0.9118	-0.0422	-0.2011	0.0191	0.9118	0.9118	0.0000	0.0000	1.0000
Propensity score variables											
	Program enrollment month										
TRIGGER_MN 01/01/2013	01/2013	0.0132	0.0074	-0.0059	-0.0514	0.5492	0.0092	0.0074	-0.0018	-0.0187	0.8255
TRIGGER_MN 03/01/2013	03/2013	0.0205	0.0147	-0.0058	-0.0408	0.6347	0.0140	0.0147	0.0007	0.0062	0.9433
TRIGGER_MN 05/01/2013	05/2013	0.0294	0.0294	0.0001	0.0003	0.9968	0.0268	0.0294	0.0026	0.0165	0.8571
TRIGGER_MN 06/01/2013	06/2013	0.0221	0.0221	-0.0001	-0.0005	0.9951	0.0224	0.0221	-0.0004	-0.0025	0.9775
TRIGGER_MN 07/01/2013	07/2013	0.0213	0.0147	-0.0066	-0.0456	0.5951	0.0173	0.0147	-0.0026	-0.0201	0.8282
TRIGGER_MN 08/01/2013	08/2013	0.0311	0.0368	0.0057	0.0329	0.7017	0.0393	0.0368	-0.0026	-0.0135	0.8814
TRIGGER_MN 09/01/2013	09/2013	0.0307	0.0441	0.0134	0.0775	0.3665	0.0412	0.0441	0.0029	0.0144	0.8664
TRIGGER_MN 10/01/2013	10/2013	0.0244	0.0221	-0.0024	-0.0152	0.8590	0.0213	0.0221	0.0007	0.0053	0.9539

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	P	Comparison	Intervention	adj.diff	std.diff	p
TRIGGER_MN 11/01/2013	11/2013	0.0251	0.0441	0.0190	0.1211	0.1582	0.0390	0.0441	0.0051	0.0264	0.7631
TRIGGER_MN 12/01/2013	12/2013	0.0284	0.0294	0.0010	0.0060	0.9442	0.0316	0.0294	-0.0022	-0.0127	0.8848
TRIGGER_MN 01/01/2014	01/2014	0.0337	0.0588	0.0251	0.1392	0.1049	0.0559	0.0588	0.0029	0.0126	0.8886
TRIGGER_MN 02/01/2014	02/2014	0.0262	0.0515	0.0253	0.1583	0.0651	0.0379	0.0515	0.0136	0.0701	0.4205
TRIGGER_MN 03/01/2014	03/2014	0.0313	0.0515	0.0201	0.1156	0.1779	0.0471	0.0515	0.0044	0.0204	0.8144
TRIGGER_MN 04/01/2014	04/2014	0.0419	0.0588	0.0169	0.0843	0.3257	0.0621	0.0588	-0.0033	-0.0136	0.8764
TRIGGER_MN 05/01/2014	05/2014	0.0372	0.0588	0.0216	0.1142	0.1834	0.0596	0.0588	-0.0007	-0.0031	0.9718
TRIGGER_MN 06/01/2014	06/2014	0.0397	0.0441	0.0044	0.0227	0.7913	0.0515	0.0441	-0.0074	-0.0337	0.7038
TRIGGER_MN 07/01/2014	07/2014	0.0200	0.0074	-0.0126	-0.0902	0.2932	0.0081	0.0074	-0.0007	-0.0084	0.9254
TRIGGER_MN 08/01/2014	08/2014	0.0350	0.0368	0.0017	0.0094	0.9127	0.0412	0.0368	-0.0044	-0.0220	0.8000
TRIGGER_MN 09/01/2014	09/2014	0.0369	0.0662	0.0293	0.1551	0.0707	0.0621	0.0662	0.0040	0.0169	0.8498
TRIGGER_MN 10/01/2014	10/2014	0.0330	0.0221	-0.0109	-0.0611	0.4762	0.0265	0.0221	-0.0044	-0.0282	0.7549
TRIGGER_MN 11/01/2014	11/2014	0.0373	0.0294	-0.0078	-0.0414	0.6292	0.0305	0.0294	-0.0011	-0.0063	0.9419
TRIGGER_MN 12/01/2014	12/2014	0.0295	0.0441	0.0146	0.0861	0.3157	0.0423	0.0441	0.0018	0.0090	0.9171
TRIGGER_MN 01/01/2015	01/2015	0.0351	0.0221	-0.0130	-0.0708	0.4092	0.0228	0.0221	-0.0007	-0.0050	0.9551
TRIGGER_MN 02/01/2015	02/2015	0.0292	0.0147	-0.0145	-0.0860	0.3163	0.0162	0.0147	-0.0015	-0.0115	0.8943
TRIGGER_MN 03/01/2015	03/2015	0.0332	0.0147	-0.0184	-0.1031	0.2296	0.0140	0.0147	0.0007	0.0064	0.9431
TRIGGER_MN 04/01/2015	04/2015	0.0442	0.0294	-0.0148	-0.0719	0.4021	0.0368	0.0294	-0.0074	-0.0386	0.6546
TRIGGER_MN 06/01/2015	06/2015	0.0471	0.0441	-0.0030	-0.0142	0.8683	0.0452	0.0441	-0.0011	-0.0055	0.9522
TRIGGER_MN 07/01/2015	07/2015	0.0367	0.0221	-0.0146	-0.0778	0.3648	0.0217	0.0221	0.0004	0.0025	0.9780
TRIGGER_MN 08/01/2015	08/2015	0.0369	0.0147	-0.0222	-0.1178	0.1698	0.0143	0.0147	0.0004	0.0031	0.9726
TRIGGER_MN 09/01/2015	09/2015	0.0399	0.0221	-0.0178	-0.0910	0.2887	0.0232	0.0221	-0.0011	-0.0074	0.9337
TRIGGER_MN 11/01/2015	11/2015	0.0499	0.0221	-0.0278	-0.1279	0.1362	0.0191	0.0221	0.0029	0.0205	0.8101

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	P	Comparison	Intervention	adj.diff	std.diff	p
NYEM_AGE_CAT1	Age group <18	0.0704	0.0882	0.0179	0.0699	0.4155	0.0827	0.0882	0.0055	0.0197	0.8105
NYEM_AGE_CAT2	18-34	0.3308	0.5882	0.2574	0.5470	0.0000	0.5743	0.5882	0.0140	0.0283	0.7239
NYEM_AGE_CAT3	34-45	0.1661	0.0809	-0.0852	-0.2291	0.0076	0.0993	0.0809	-0.0184	-0.0624	0.4716
NYEM_AGE_CAT4	45-64	0.4327	0.2426	-0.1900	-0.3836	0.0000	0.2438	0.2426	-0.0011	-0.0026	0.9750
NYEM_AGE_CAT5	65+	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
NYEM_MALE	Male	0.4231	0.6103	0.1872	0.3788	0.0000	0.6316	0.6103	-0.0213	-0.0437	0.5995
NYEM_BLACK	Race/ethnicity African American, not Hispanic	0.2557	0.3897	0.1340	0.3072	0.0003	0.4048	0.3897	-0.0151	-0.0309	0.7251
NYEM_HISPANIC	Hispanic	0.3555	0.3015	-0.0540	-0.1129	0.1882	0.2809	0.3015	0.0206	0.0454	0.6027
NYEM_DISABLED	Disabled	0.3785	0.4265	0.0480	0.0990	0.2487	0.4364	0.4265	-0.0099	-0.0200	0.8035
BASE_ED_VST_CAT0	Number of ED visits in 12 months prior to program enrollment 0	0.5992	0.2868	-0.3125	-0.6377	0.0000	0.2868	0.2868	0.0000	0.0000	1.0000
BASE_ED_VST_CAT1	1	0.1531	0.2059	0.0528	0.1467	0.0874	0.2099	0.2059	-0.0040	-0.0099	0.9037
BASE_ED_VST_CAT2	2-3	0.1395	0.2500	0.1105	0.3189	0.0002	0.2305	0.2500	0.0195	0.0459	0.5787
BASE_ED_VST_CAT3	4+	0.1082	0.2574	0.1491	0.4797	0.0000	0.2728	0.2574	-0.0154	-0.0349	0.6636
BASE_HOSP_STAY_CAT0	Number of hospitalizations in 12 months prior to program enrollment 0	0.7835	0.2721	-0.5115	-1.2417	0.0000	0.2721	0.2721	0.0000	0.0000	1.0000
BASE_HOSP_STAY_CAT1	1	0.1117	0.3088	0.1971	0.6250	0.0000	0.3059	0.3088	0.0029	0.0064	0.9323
BASE_HOSP_STAY_CAT2	2	0.0453	0.2206	0.1753	0.8408	0.0000	0.2015	0.2206	0.0191	0.0482	0.5673
BASE_HOSP_STAY_CAT3	3+	0.0594	0.1985	0.1391	0.5877	0.0000	0.2206	0.1985	-0.0221	-0.0561	0.4933
BASE_PSYCH_VST_CAT0	Relative number of psychiatric visits in 12 months prior to program enrollment[a] 0	0.1727	0.1250	-0.0477	-0.1262	0.1414	0.1250	0.1250	0.0000	0.0000	1.0000

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	P	Comparison	Intervention	adj.diff	std.diff	p
BASE_PSYCH _VST_CAT1	Up to 20%	0.2880	0.3015	0.0135	0.0297	0.7288	0.3426	0.3015	-0.0412	-0.0874	0.2676
BASE_PSYCH _VST_CAT2	20-40%	0.1969	0.2132	0.0164	0.0412	0.6312	0.1971	0.2132	0.0162	0.0404	0.6372
BASE_PSYCH _VST_CAT3	40-60%	0.1463	0.1618	0.0155	0.0437	0.6104	0.1559	0.1618	0.0059	0.0161	0.8513
BASE_PSYCH _VST_CAT4	60-80%	0.1051	0.1103	0.0052	0.0170	0.8430	0.1066	0.1103	0.0037	0.0117	0.8908
BASE_PSYCH _VST_CAT5	80-100%	0.0911	0.0882	-0.0028	-0.0098	0.9091	0.0728	0.0882	0.0154	0.0573	0.4925
	Relative number of office visits in 12 months prior to program enrollment[a]										
BASE_OFFICE _VST_CAT0	0	0.0491	0.0956	0.0464	0.2147	0.0123	0.0967	0.0956	-0.0011	-0.0038	0.9652
BASE_OFFICE _VST_CAT1	Up to 20%	0.1791	0.2647	0.0856	0.2231	0.0093	0.2562	0.2647	0.0085	0.0192	0.8228
BASE_OFFICE _VST_CAT2	20-40%	0.2263	0.1838	-0.0425	-0.1015	0.2367	0.1960	0.1838	-0.0121	-0.0309	0.7245
BASE_OFFICE _VST_CAT3	40-60%	0.1999	0.1544	-0.0455	-0.1138	0.1847	0.1489	0.1544	0.0055	0.0152	0.8605
BASE_OFFICE _VST_CAT4	60-80%	0.2041	0.1765	-0.0276	-0.0685	0.4248	0.1743	0.1765	0.0022	0.0058	0.9472
BASE_OFFICE _VST_CAT5	80-100%	0.1414	0.1250	-0.0164	-0.0471	0.5828	0.1279	0.1250	-0.0029	-0.0088	0.9170
	Relative total Medicaid expenditures in 12 months prior to program enrollment[a]										
BASE_TOTAL_ PMT_CAT0	0	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
BASE_TOTAL_ PMT_CAT1	Up to 20%	0.5747	0.2279	-0.3468	-0.7015	0.0000	0.2309	0.2279	-0.0029	-0.0067	0.9146
BASE_TOTAL_ PMT_CAT2	20-40%	0.1730	0.2132	0.0402	0.1064	0.2150	0.2018	0.2132	0.0114	0.0282	0.7459
BASE_TOTAL_ PMT_CAT3	40-60%	0.1080	0.1985	0.0905	0.2916	0.0007	0.1941	0.1985	0.0044	0.0111	0.8971
BASE_TOTAL_ PMT_CAT4	60-80%	0.0786	0.1912	0.1126	0.4182	0.0000	0.1912	0.1912	0.0000	0.0000	1.0000
BASE_TOTAL_ PMT_CAT5	80-100%	0.0658	0.1691	0.1034	0.4166	0.0000	0.1820	0.1691	-0.0129	-0.0347	0.6931
	CDPS condition flags										
AIDSH	AIDS, High	0.1059	0.0735	-0.0323	-0.1051	0.2205	0.0776	0.0735	-0.0040	-0.0152	0.8618
CANH	Cancer, High	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
CANL	Cancer, Low	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
CANM	Cancer, Medium	0.0054	0.0074	0.0020	0.0272	0.7515	0.0070	0.0074	0.0004	0.0046	0.9600

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	P	Comparison	Intervention	adj.diff	std.diff	p
CANVH	Cancer, Very High	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
CAREL	Cardiovascular, Extra Low	0.1725	0.1176	-0.0548	-0.1452	0.0906	0.1037	0.1176	0.0140	0.0455	0.6007
CARL	Cardiovascular, Low	0.1492	0.2132	0.0641	0.1798	0.0361	0.2070	0.2132	0.0062	0.0156	0.8575
CARM	Cardiovascular, Medium	0.0353	0.0221	-0.0133	-0.0719	0.4021	0.0305	0.0221	-0.0085	-0.0499	0.5598
CARVH	Cardiovascular, Very High	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
CERL	Cerebrovascular, Low	0.0147	0.0074	-0.0073	-0.0609	0.4782	0.0077	0.0074	-0.0004	-0.0043	0.9616
CNSH	Nervous System, High	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
CNSL	Nervous System, Low	0.1042	0.1250	0.0208	0.0682	0.4270	0.1397	0.1250	-0.0147	-0.0435	0.6203
CNSM	Nervous System, Medium	0.0276	0.0368	0.0092	0.0563	0.5121	0.0316	0.0368	0.0051	0.0289	0.7449
DDL	Developmental Disability, Low	0.0238	0.0221	-0.0018	-0.0115	0.8932	0.0254	0.0221	-0.0033	-0.0210	0.8099
DDM	Developmental Disability, Medium	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
DIA1H	Diabetes, Type 1 High	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
DIA1M	Diabetes, Type 1 Low	0.0193	0.0147	-0.0046	-0.0337	0.6945	0.0180	0.0147	-0.0033	-0.0256	0.7724
DIA2L	Diabetes, Type 2 High	0.1158	0.0809	-0.0349	-0.1091	0.2035	0.0820	0.0809	-0.0011	-0.0040	0.9631
DIA2M	Diabetes, Type 2 Low	0.0297	0.0147	-0.0150	-0.0883	0.3035	0.0140	0.0147	0.0007	0.0061	0.9429
EYEL	Eye, Low	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
EYEVL	Eye, Very Low	0.0535	0.0294	-0.0240	-0.1069	0.2127	0.0254	0.0294	0.0040	0.0251	0.7699
GENEL	Genital, Extra Low	0.0866	0.0662	-0.0204	-0.0727	0.3968	0.0647	0.0662	0.0015	0.0058	0.9466
GIH	Gastrointestinal, High	0.0042	0.0074	0.0032	0.0497	0.5624	0.0055	0.0074	0.0018	0.0237	0.7778
GIL	Gastrointestinal, Low	0.1422	0.0956	-0.0467	-0.1336	0.1195	0.0996	0.0956	-0.0040	-0.0134	0.8778
GIM	Gastrointestinal, Medium	0.0456	0.0588	0.0132	0.0632	0.4612	0.0596	0.0588	-0.0007	-0.0032	0.9715
HEMEH	Hematological, Extra High	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
HEML	Hematological, Low	0.0172	0.0221	0.0049	0.0374	0.6628	0.0279	0.0221	-0.0059	-0.0368	0.6860
HEMM	Hematological, Medium	0.0113	0.0074	-0.0040	-0.0375	0.6620	0.0118	0.0074	-0.0044	-0.0432	0.6358
HEMVH	Hematological, Very High	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
HIVM	HIV, Medium	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
INFH	Infectious, High	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
INFL	Infectious, Low	0.0330	0.0221	-0.0110	-0.0614	0.4745	0.0217	0.0221	0.0004	0.0025	0.9766
INFM	Infectious, Medium	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
METH	Metabolic, High	0.0125	0.0147	0.0022	0.0198	0.8174	0.0143	0.0147	0.0004	0.0029	0.9719
METM	Metabolic, Medium	0.0167	0.0074	-0.0094	-0.0730	0.3948	0.0081	0.0074	-0.0007	-0.0084	0.9244
METVL	Metabolic, Very Low	0.0234	0.0368	0.0134	0.0883	0.3035	0.0390	0.0368	-0.0022	-0.0118	0.8971
PRGCMP	Pregnancy, Complete	0.0296	0.0221	-0.0076	-0.0447	0.6020	0.0173	0.0221	0.0048	0.0354	0.6866
PRGINC	Pregnancy, Incomplete	0.0090	0.0074	-0.0017	-0.0175	0.8384	0.0059	0.0074	0.0015	0.0203	0.8278
PSYH	Psychiatric, High	0.2042	0.5735	0.3693	0.9157	0.0000	0.5588	0.5735	0.0147	0.0295	0.5778
PSYL	Psychiatric, Low	0.0945	0.0221	-0.0725	-0.2478	0.0039	0.0184	0.0221	0.0037	0.0256	0.7479
PSYM	Psychiatric, Medium	0.1162	0.1250	0.0088	0.0274	0.7496	0.1132	0.1250	0.0118	0.0359	0.6264
PSYML	Psychiatric, Medium Low	0.2712	0.1029	-0.1682	-0.3786	0.0000	0.0974	0.1029	0.0055	0.0178	0.8121
PULH	Pulmonary, High	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
PULL	Pulmonary, Low	0.2097	0.2426	0.0329	0.0809	0.3457	0.2386	0.2426	0.0040	0.0094	0.9133
PULM	Pulmonary, Medium	0.0274	0.0294	0.0020	0.0124	0.8854	0.0379	0.0294	-0.0085	-0.0467	0.6027
PULVH	Pulmonary, Very High	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
RENEH	Renal, Extra High	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
RENL	Renal, Low	0.0376	0.0221	-0.0156	-0.0818	0.3404	0.0224	0.0221	-0.0004	-0.0024	0.9774
RENM	Renal, Medium	0.0032	0.0074	0.0042	0.0742	0.3870	0.0055	0.0074	0.0018	0.0237	0.7785
RENVH	Renal, Very High	0.0142	0.0074	-0.0068	-0.0576	0.5022	0.0074	0.0074	0.0000	0.0000	1.0000

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	P	Comparison	Intervention	adj.diff	std.diff	p
SKCL	Skeletal and Connective, Low	0.0935	0.0662	-0.0273	-0.0939	0.2738	0.0551	0.0662	0.0110	0.0475	0.5807
SKCM	Skeletal and Connective, Medium	0.0575	0.0515	-0.0060	-0.0258	0.7641	0.0544	0.0515	-0.0029	-0.0130	0.8831
SKCVL	Skeletal and Connective, Very Low	0.0811	0.0588	-0.0223	-0.0817	0.3410	0.0618	0.0588	-0.0029	-0.0122	0.8883
SKNH	Skin, High	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
SKNL	Skin, Low	0.0082	0.0074	-0.0008	-0.0094	0.9131	0.0062	0.0074	0.0011	0.0152	0.8744
SKNVL	Skin, Very Low	0.0806	0.0882	0.0076	0.0281	0.7435	0.0849	0.0882	0.0033	0.0118	0.8923
SUBL	Substance Abuse, Low	0.1464	0.1618	0.0154	0.0436	0.6114	0.1673	0.1618	-0.0055	-0.0152	0.8556
SUBVL	Substance Abuse, Very Low	0.0365	0.0588	0.0223	0.1189	0.1658	0.0695	0.0588	-0.0107	-0.0424	0.6292
	Medicaid Rx categories										
MRX1	Anti-coagulants	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
MRX2	Cardiac	0.0192	0.0074	-0.0119	-0.0864	0.3140	0.0059	0.0074	0.0015	0.0189	0.8268
MRX3	Psychosis/bipolar/depression	0.0501	0.0147	-0.0354	-0.1624	0.0584	0.0136	0.0147	0.0011	0.0092	0.9136
MRX4	Diabetes	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
MRX5	ESRD/Renal	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
MRX6	Hemophilia/von Willebrands	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
MRX7	Hepatitis	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
MRX8	HIV	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
MRX9	Infections, high	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
MRX10	Inflammatory/Autoimmune	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
MRX11	Malignancies	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
MRX12	Multiple Sclerosis/Paralysis	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000
MRX13	Parkinson's/Tremor	0.0550	0.1544	0.0995	0.4359	0.0000	0.1415	0.1544	0.0129	0.0364	0.6662
MRX14	Seizure disorders	0.0400	0.0441	0.0041	0.0209	0.8074	0.0404	0.0441	0.0037	0.0181	0.8321
MRX15	Tuberculosis	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000

Source: Mathematica analysis of Medicaid administrative data, January 2012–November 2015.

[a] For each of office visits, psychiatric visits, and total Medicaid expenditures, we created categories ranking by the distribution of use (by percentile) among the intervention and potential comparison group members.

ED = emergency department; CDPS = Chronic Illness and Disability Payment System; AIDS = acquired immune deficiency syndrome; ESRD = end-stage renal disease; HIV = human immunodeficiency virus. adj.diff = The adjusted mean difference (adj. diff.) is the difference between weight-adjusted means for the treatment and comparison groups. 'Before matching' each treatment and comparison group member has equal weights in the mean calculation for their group. 'After matching' the members of the treatment group still have equal weight in their group mean, but the individuals in the comparison group are weighted based on one divided by the number of treatment group member to whom they are matched. Comparison group members who are not matched to a treatment group member are given a weight of zero; std.diff = The standardized difference (std. diff.) is the difference in weight-adjusted means between the treatment and comparison groups divided by the pooled standard deviation of treatment and matched comparison groups of the variable. This method places the mean difference between the treatment and comparison groups on the same scale (percentage) as the variance for each variable.

E. Specifications of measures

CMMI requested that we calculate four standardized outcome measures for all awardees to the extent feasible. These measures are: total Medicare and/or Medicaid expenditures, inpatient hospitalizations, hospital readmissions, and ED visits. If it was possible to calculate these core measures identified by CMS, and if the measures were appropriate to the intervention, we used them. Our specifications for these measures in Medicare and Medicaid administrative data are described in Section E.1 below. Our analyses used several other types of measures as control variables, described in Section E.2.

1. Core measures

For FPHNY, we were able to develop monthly measures for three of the standardized outcomes: total Medicaid expenditures, inpatient hospitalizations, and ED visits. We determined that our sample size was too small to detect effects in readmissions, and therefore we did not include the measure in our analysis.

We first describe how we identified observation periods, then describe how each of these three outcome measures were constructed for each period.

a. Identifying observation periods

Baseline and intervention periods were defined for each intervention or comparison group member relative to their program enrollment (or pseudo-enrollment) month. The first intervention period was defined as the enrollment month and the five months[51] following that month. Where applicable, the second intervention period was the six months following the first intervention period. The first baseline period was the six months prior to the program enrollment or start month and additional baseline periods were identified by moving backward six months from the first baseline period. For each individual included in the analysis, the proportion of each baseline and intervention period for which the individual was eligible for the analysis was calculated. This proportion was used to pro-rate the expenditure and utilization measures for individuals enrolled for less than the full analysis period. It was also used to weight observations in the regression analysis.

b. Calculating total Medicaid expenditures

All claims in the NY Medicaid administrative data were considered for inclusion in the analysis; however, duplicate and denied claims were excluded. The total cost of care was based on the total amount paid to the provider for the approved claim. For claims with services spanning more than one day, all expenditures were counted on the first date of service. These expenditures include both fee-for-service and managed care payments, but do not include capitated payments. When service level payment information was not available for managed care covered services, these payment amounts were estimated based on fee-for-service payment guidelines.

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[51] For brevity, we only discuss the six-month baseline and intervention periods created for the analysis of trends in regression-adjusted means. We also defined a second set of baseline and intervention periods and weights corresponding to years from program enrollment, used in the impact and total savings table in the report (Table V.2).

c.   Calculating hospitalizations

The specifications for hospitalization counts were developed to align with the CMMI priority all-cause admissions per patient measure. We describe the steps to develop these counts here.

Step 1: Identify hospitalization claims. Inpatient hospital claims were identified by using the Medicaid Managed Care Operating Report code (MMCOR_CD) values of 01 ("Inpatient Psych, Acute Detox Subabuse") or 04 ("Medical/surgical"), Surveillance and Utilization Review System Category of Service code (SURS_SUBSYSTEM_COS_CD) value of 11 ("Inpatient"), and the eMedNY claim type code (CLAIM_TYPE_CD) value of "I" ("Inpatient").

Step 2: Eliminate duplicate or denied claims. We identified claims with the same information in all fields and only kept one of these claims. We also excluded denied claims from our analysis.

Step 3: Combine claims that represent the same stay and combine transfer stays with initial stays. We identified and combined initial and interim claims into one discharge. Interim claims had (1) the same admission date as the initial claim; (2) an admission date that was equal to the discharge date from the initial or another interim claim and the status on the other (previous) claim was "still a patient"; or (3) a claim with an admission date that was equal to one day after the discharge date of the initial or another interim claim and the status on the other previous claim was "still a patient." Such claims were combined to count as a single stay.

Next, we identified and combined claims associated with a transfer into a single stay. We identified claims indicating that the patient was transferred to either another short-term hospital, a Critical Access Hospital (CAH), another type institution for inpatient care, a federal hospital, or a psychiatric hospital or unit. Then we combined these claims with claims for the same beneficiary at a different facility where the admission date fell within one day of the discharge date of the first claim.

Step 4: Sum the number of discharges in each month. Once claims representing a single stay were combined, we summed the number of unique discharges for each enrollee for each month. Inpatient stays were counted in the month of the discharge date.

d.   ED visits

Outpatient ED visit utilization is reflected in CMMI priority measure 62. This measure includes ED visits and observation stays that do not lead to an inpatient stay.

We reviewed claims not identified as inpatient and considered them as ED visits if the procedure code, cost center revenue code, or managed care operating report code indicated ED visit.

ED visits that led to inpatient stays (i.e., ones that overlapped with or were adjacent to an inpatient stay) were excluded. If two or more ED visits or observation stays had the same patient identifier and beginning date of service, we counted them as one visit.

2.   Other measures

The control variables included in the FPHNY regression models are listed in Table A.5 along with the specifications for the variables.

Table A.5. Impact analysis model control variable specifications—FPHNY

Variable name	Specification
Intervention period	Categorical variable indicating time period of assessment. Categories include each six- or twelve-month baseline or intervention period prior to and after program enrollment.
Treatment indicator	Categorical variable indicating treatment status. Categories include: control group member (reference); participant
Entry indicator	Categorical variable indicating first type of service used at entry. Categories include use of CRC and NA-MCT
Interaction between intervention period and treatment	Interaction between intervention period and treatment indicator variables.
Interaction between intervention period and entry	Interaction between intervention period and entry indicator variables
Interaction between treatment and entry	Interaction between treatment indicator and entry indicator variables
Interaction between intervention period, treatment, and entry	Interaction between intervention period, treatment indicator, and entry indicator variables
Intervention period begin date	Categorical variable for member's first observed month and year in a given intervention period. Dates span between January 2010 (reference – three years prior to earliest enrollment date) and April 2016
Age	Continuous variable indicating age on the begin date of the intervention period
Age squared	Continuous variable measuring age as defined above squared
Sex	Categorical variable of member's sex. Categories include: female (reference); male
Disabled	Categorical variable indicating whether member was eligible for Medicaid based on disability
Race	Categorical variable of member's race. Categories include: White or other (reference), African American, or Hispanic
CDPS score	Continuous variable measuring member's CDPS score
AIDS, high	Categorical variable indicating whether member had AIDS, pneumocystis pneumonia, cryptococcosis, or Kaposi's sarcoma
Cardiovascular, extra low	Categorical variable indicating whether member had hypertension
Cardiovascular, low	Categorical variable indicating whether member had endocardial disease, myocardial infarction, angina, coronary atherosclerosis, or dysrhythmias
Nervous system, low	Categorical variable indicating whether member had epilepsy, Parkinson's disease, cerebral palsy, migraine, or cerebral degeneration
Genital, extra low	Categorical variable indicating whether member had uterine and pelvic inflammatory disease, endometriosis, or hyperplasia of prostate
Gastrointestinal, low	Categorical variable indicating whether member had ulcer, hernia, GI hemorrhage, intestinal infectious disease, or intestinal obstruction
Folate deficiency	Categorical variable indicating whether member had folate deficiency
Psychiatric, high	Categorical variable indicating whether member had schizophrenia
Psychiatric, medium	Categorical variable indicating whether member had bipolar affective disorder
Psychiatric, low	Categorical variable indicating whether member had other depression, panic disorder, or phobic disorder
Pulmonary, low	Categorical variable indicating whether member had viral pneumonias, chronic bronchitis, asthma, COPD, or emphysema

Variable name	Specification
Skeletal, low	Categorical variable indicating whether member had rheumatoid arthritis, osteomyelitis, systemic lupus, or traumatic amputation of foot or leg
Substance abuse, low	Categorical variable indicating whether member had opioid, barbiturate, cocaine, or amphetamine abuse or dependence, or drug psychoses
Diagnosis category	Hierarchical categorical variable indicating most "important" diagnosis category, based on ICD-9 and ICD-10 diagnosis codes, in the following order: (1) schizophrenic disorders; (2) bipolar disorders; (3) drug or alcohol-induced psychosis; (4) delusional disorder and other nonorganic psychosis; (5) suicide; (6) depressive, episodic mood disorder, or other depressive disorder; (7) anxiety, dissociative, somatoform, and adjustment reaction; (8) other behavioral health-related diagnoses
Adjustment reaction	Categorical variable indicating whether member had ICD-9 or ICD-10 diagnosis code of adjustment reaction
Anxiety	Categorical variable indicating whether member had ICD-9 OR ICD-10 diagnosis code of anxiety, dissociative, and somatoform
Bipolar	Categorical variable indicating whether member had ICD-9 OR ICD-10 diagnosis code of bipolar disorders
Delusional disorder	Categorical variable indicating whether member had ICD-9 OR ICD-10 diagnosis code of delusional disorder and other nonorganic psychosis
Dementia	Categorical variable indicating whether member had ICD-9 OR ICD-10 diagnosis code of dementia
Depressive	Categorical variable indicating whether member had ICD-9 OR ICD-10 diagnosis code of episodic mood disorder, depressive
Drug or alcohol psychosis	Categorical variable indicating whether member had ICD-9 OR ICD-10 diagnosis code of drug or alcohol psychosis
Drug and alcohol	Categorical variable indicating whether member had ICD-9 OR ICD-10 diagnosis code of drug or alcohol-related disorders
Other depressive	Categorical variable indicating whether member had ICD-9 OR ICD-10 diagnosis code of other depressive disorder
Other psychosis	Categorical variable indicating whether member had ICD-9 OR ICD-10 diagnosis code of other psychoses not listed in other categories
Other nonpsychotic mental disorders	Categorical variable indicating whether member had ICD-9 OR ICD-10 diagnosis code of other nonpsychotic mental disorders listed in other categories
Persistent mental disorders	Categorical variable indicating whether member had ICD-9 OR ICD-10 diagnosis code of persistent mental disorders due to conditions classified elsewhere
Schizophrenia	Categorical variable indicating whether member had ICD-9 OR ICD-10 diagnosis code of schizophrenic disorders
Suicide	Categorical variable indicating whether member had ICD-9 OR ICD-10 diagnosis code related to suicide

CRC = crisis respite center; NA-MCT = need-adjusted mobile crisis team; CDPS = Chronic Illness and Disability Payment System; AIDS = acquired immunodeficiency syndrome; COPD = chronic obstructive pulmonary disease; ICD-9 = International Classification of Diseases, Ninth Revision; ICD-10: International Classification of Diseases, Tenth Revision.

F. Supplemental results

In addition to the overall impact estimates presented in Section II.C.3, we also separately examined impacts for each of the two years of the intervention period. Across all intervention group members, we found significant reductions in hospitalizations and total Medicaid expenditures in the first intervention year (Table A.6) but not the second (Table A.7), but the effects of time differed for the CRC and NA-MCT subgroups. In particular:

- For the CRC subgroup, we found significant reductions in hospitalizations and total Medicaid expenditures in the first intervention year but not the second.

- For the NA-MCT subgroup, we found significant increases in hospitalizations and total Medicaid expenditures in both intervention years, although the increases were diminished in the second year.

- Consistent with the main impact analysis, we found no significant impacts of the program on ED use for either subgroup in either intervention year.

Table A.6. Impacts attributable to the FPHNY program in year 1

	All intervention group members			CRC only			NA-MCT only		
	Change	90% CI	80% CI	Change	90% CI	80% CI	Change	90% CI	80% CI
Aggregate results									
Total Medicaid expenditures (in thousands)	-$6,080	[-$9,022, -$3,138]	[-$8,569, -$3,591]	-$9,135	[-$11,601, -$6,668]	[-$11,222, -$7,047]	$2,164	[$762, $3,566]	[$977, $3,352]
Hospitalizations	-793	[-1,147, -430]	[-1,092, -485]	-1,042	[-1,406, -677]	[-1,350, -733]	165	[52, 278]	[69, 260]
ED visits	86	[-178, 349]	[-138, 309]	103	[-156, 363]	[-116, 323]	-10	[-99, 79]	[-86, 65]
Per beneficiary month									
Total Medicaid expenditures	-$1,043	[-$1,548, -$538]	[-$1,471, -$616]	-$2,138	[-$2,716, -$1,561]	[-$2,627, -$1,650]	$1,392	[$490, $2,293]	[$628, $2,155]
Hospitalizations	-0.14	[-0.20, -0.07]	[-0.19, -0.08]	-0.24	[-0.33, -0.16]	[-0.32, -0.17]	0.11	[0.03, 0.18]	[0.04, 0.17]
ED visits	0.01	[-0.03, 0.06]	[-0.02, 0.05]	0.02	[-0.04, 0.08]	[-0.03, 0.08]	-0.01	[-0.06, 0.05]	[-0.06, 0.04]
Number of participants		537			401			136	
Mean number of intervention months per participant		10.85			10.65			11.43	
Intervention period				January 2013 through April 2016					

Source: Mathematica analysis of New York State Medicaid administrative data, January 2010–April 2016.

Note: Reported changes are regression-adjusted differences between baseline and first intervention period means for the intervention group relative to the control group. Regression model controlled for age (linear and squared), gender, race/ethnicity, whether 12 months of baseline data were available, disability status, Chronic Illness and Disability Payment System condition indicators, calendar month and year of program enrollment, and diagnoses at enrollment. Analysis is limited to the subset of program enrollees who were observable in Medicaid claims data for six months before and following their enrollment in the intervention, and who were not also enrolled in Medicare. The confidence intervals for all outcome measures were derived based on bootstrap methods and were adjusted for multiple testing based on the generalized Tukey method. Results are limited to the subset of intervention group members included in the analysis in the first intervention year (N=537) and do not represent all program participants.

CI = confidence interval.

Table A.7. Impacts attributable to the FPHNY program in year 2

	All intervention group members			CRC only			NA-MCT only		
	Change	90% CI	80% CI	Change	90% CI	80% CI	Change	90% CI	80% CI
Aggregate results									
Total Medicaid expenditures (in thousands)	$1,581	[-$134, $3,296]	[$127, $3,034]	$433	[-$1,047, $1,912]	[-$821, $1,687]	$1,325	[$579, $2,070]	[$697, $1,952]
Hospitalizations	96	[-16, 207]	[1, 190]	40	[-55, 134]	[-40, 120]	62	[11, 114]	[19, 106]
ED visits	150	[-62, 361]	[-29, 329]	124	[-59, 308]	[-31, 280]	16	[-54, 86]	[-43, 75]
Per beneficiary month									
Total Medicaid expenditures	$566	[-$48, $1,180]	[$46, $1,086]	$246	[-$596, $1,089]	[-$468, $960]	$1,276	[$558, $1,994]	[$672, $1,880]
Hospitalizations	0.03	[-0.01, 0.07]	[0.00, 0.07]	0.02	[-0.03, 0.08]	[-0.02, 0.07]	0.06	[0.01, 0.11]	[0.02, 0.10]
ED visits	0.05	[-0.02, 0.13]	[-0.01, 0.12]	0.07	[-0.03, 0.18]	[-0.02, 0.16]	0.02	[-0.05, 0.08]	[-0.04, 0.07]
Number of participants	349			237			112		
Mean number of intervention months per participant	8.01			7.41			9.27		
Intervention period	January 2013 through April 2016								

Source: Mathematica analysis of New York State Medicaid administrative data, January 2010–April 2016.

Note: Reported changes are regression-adjusted differences between baseline and first intervention period means for the intervention group relative to the control group. Regression model controlled for age (linear and squared), gender, race/ethnicity, whether 12 months of baseline data were available, disability status, Chronic Illness and Disability Payment System condition indicators, calendar month and year of program enrollment, and diagnoses at enrollment. Analysis is limited to the subset of program enrollees who were observable in Medicaid claims data for six months before and following their enrollment in the intervention, and who were not also enrolled in Medicare. The confidence intervals for all outcome measures were derived based on bootstrap methods and were adjusted for multiple testing based on the generalized Tukey method. Results are limited to the subset of intervention group members included in the analysis in the second intervention year (N=349) and do not represent all program participants.

CI = confidence interval.

APPENDIX B:

KMHS TECHNICAL METHODS

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A. Introduction

This appendix provides supplemental information on the data sources and methods for the quantitative analyses presented in Chapter III of the report. Here, we also present findings from supplemental analyses for KMHS. In the next sections, we describe the data sources (Section B) and approach to selecting the analytic intervention and comparison populations for our analyses (Section C). Then, we specify how we constructed outcome and control variables (Section D).

B. Description of data sources

In this section, we provide a general overview of the data sources used in the analyses for this awardee. In later sections of the appendix we provide more detail on how the data were used in the analyses.

1. CMS Medicare administrative data

Our analysis of impacts on Medicare utilization and expenditures used CMS Medicare administrative data. We obtained data files through the CMS's VRDC. We extracted all final action claims with dates of service from January 2009 through June 2015[52] for all individuals with a mental health visit billed by KMHS or by a comparison mental health provider (see Section C). We extracted standard analytic base and revenue-center/line-item claims datasets for the following claim types: carrier, durable medical equipment (DME), home health, hospice, inpatient, outpatient, and skilled nursing facility. To obtain information on beneficiary Medicare enrollment spans we used the Master Beneficiary Summary File (MBSF). The MBSF includes information on date of birth, gender, most recent county of residence, enrollment in MA, and third party insurance coverage.

2. MAX and Alpha-MAX data for Washington state

Our analysis of impacts on Medicaid utilization used CMS Medicaid administrative data. We obtained data files through the CMS VRDC. We extracted all final action claims with dates of service from January 2009 through June 2014[53] for all individuals in the Washington state files. We extracted standard analytic MAX (2009–2012) and Alpha-MAX (2013–2014) datasets for enrollment (PS files) and claim/encounter data including the following types: IP, LT, OT, and RX (inpatient, long-term care, other services, and prescription drug files, respectively).[54] The Medicaid enrollment data included information on date of birth, gender, race and ethnicity, most recent county of residence, third party insurance coverage, and reason for eligibility.

Because Washington State has high managed care penetration, conducting our analysis required use of the managed care encounter data in the MAX and Alpha-MAX files. The quality and completeness of these data had not been validated, so the first step in our analysis was to examine the usability of the encounter data in detail. First, we analyzed managed care enrollment

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[52] Claims were extracted in March 2016.

[53] Claims were extracted in December 2016 and January 2017.

[54] Our analyses used MAX and Alpha-MAX data for Washington state for the period from July 2011 through June 2014. Our analyses were limited to this period because managed care reporting for 2009 and 2010 was not comparable to the reporting for 2011 to 2014.

data and then we analyzed the rate of claim submission by managed care plan and enrollee eligibility group (child, adult non-disabled, disabled, and aged).

Our analysis of managed care enrollment began by creating measures for each year for each patient indicating the number of months enrolled in a behavioral health organization (BHO) and the number of months enrolled in an HMO. Based on review of BHO and health maintenance organization (HMO) enrollment data, we found that BHO and HMO enrollment had ramped up over the proposed analysis period (2009–2014). Only a small share of the disabled population was enrolled in HMOs in 2011–2012; however, that share increased substantially in 2013. We also found that BHO enrollment ramped up between 2009 and 2010, and was constant between 2011 and 2013. Because we planned to use mental health visits to identify participants and comparison group members, we wanted consistency in mental health providers during the analysis period. We were concerned that including a period in which there was significant BHO enrollment ramp up would result in inconsistencies in mental health provider use and service utilization reporting. Therefore, we decided to analyze 2011–2014 Medicaid data, because managed care enrollment was more stable in this period. Further cementing our decision to use 2011 to 2014 data for analysis, we found through discussions with state and internal staff, and review of data that: 1) the state relied more on state-specific codes in 2009 and moved to more frequently use standard, national codes in later years, and 2) the state Medicaid Management Information System (MMIS) changed in May 2010, creating data issues such as changes in provider IDs and plan IDs, as well as creating the possibility for other, unknown changes that might affect the analysis.

To further review the encounter data and determine whether or not the encounter data for each plan was complete enough to use for analysis, we analyzed claim submission rates by plan ID and enrollee eligibility group. We calculated the following measures for each analysis year (2011–2014) for each BHO and HMO plan: number of inpatient (IP) stays per 1,000 enrolled months, number of ED visits per 1,000 enrolled months, and number of mental health visits per 1,000 enrolled months. We reviewed the number of IP stays, ED visits, or mental health visits by plan, as well as the average and standard deviation of the three measures. We excluded from analysis patients that, during any analysis year, were enrolled in one of three plans that did not report any encounters in either the IP or OT file in any analysis year (plan IDs 105010404, 105010405, and 105010406). All other plans met the data quality thresholds we set based on averages and standard deviations for the three measures so none were excluded from the analysis.[55]

3. Finder files

KMHS provided finder files listing the Medicare and Medicaid program identifiers for patients enrolled in these programs. These identifiers could be used to identify KMHS patients in the Medicare and Medicaid administrative data.

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[55] Our threshold was: for each plan for each year, plans' IP, ED, or mental health encounters per enrolled month must be within two standard deviations of the average of all plans' IP, ED, or mental health encounters per enrolled month.

C. Identification of intervention and comparison pool members

In this section we describe the steps taken to select the intervention and comparison pools for each of our analyses (Medicare analysis, Medicaid analysis, and health status measure analysis). For the Medicare and Medicaid analyses, we used matching methods to select the comparison group. Propensity score matching and related matching methods are designed to create a comparison group of nonparticipants who are similar in observable characteristics to KMHS Medicare participants (Rosenbaum and Rubin 1983; Dehejia and Wahba 2002).

1. KMHS Medicare

Because all KMHS patients are considered intervention participants, we identified all patients who received services at KMHS as intervention group members and patients of other mental health treatment facilities in the state of Washington as the potential pool of comparison patients. Then, from within the comparison pool, we identified individuals most closely matched to KMHS patients to include in the comparison population. Constructing the matched comparison group involved several steps, which we detail below.

Step 1a: Identify facilities similar to KMHS in Washington State. Using the Substance Abuse and Mental Health Services Administration's mental health treatment facility locator, we identified all mental health treatment facilities in Washington State in 2014 with the following characteristics:

- Provides outpatient care

- Serves patients with Medicaid and Medicare

- Privately owned

- Serves adults

- Allows psychiatric emergency walk-in clients

Based on this set of characteristics, we identified 24 facilities. We considered requiring facilities to match additional characteristics of KMHS, such as providing multiple levels of care, having special targeted programs,[56] or being in a geographic area of similar size; however, this would reduce the number of facilities from which to identify potential comparison group members to only five and would not allow for a sufficient number of potential comparison clients well-matched to KMHS clients. The current analysis period includes calendar years 2010 through June 2015. Of the 24 facilities initially identified, we excluded 7 facilities because they did not serve Medicare clients in all five and a half analysis years. We excluded one additional facility because multiple locations used the same National Provider Identifier (NPI), preventing us from identifying those services provided at the location that met the facility selection criteria. Thus, 16 comparison facilities were used in the analysis.

Step 1b: Identify additional facilities treating patients with dementia. When we compared the diagnoses reported on claims for KMHS patients to those for patients served by

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[56] KMHS provides multiple levels of care, including residential and hospital care. KMHS also has special programs for individuals with severe mental illness and for individuals with mental health and substance abuse disorders.

comparison facilities, we found substantial numbers of KMHS clients had a diagnosis of dementia; however, few of the patients at the comparison facilities had a dementia diagnosis. Thus, in order to assure a sufficient number of comparison pool members well-matched to the KMHS clients with dementia, we identified additional facilities in the state that served at least 100 patients with a diagnosis of dementia on a psychiatric service claim. We included patients with dementia from these additional facilities in the pool of potential comparison group members, and only matched these patients with treatment group members with dementia.

   Step 2: Identify treatment and potential comparison group members. Using Medicare data for calendar years 2010 through June 2015, we initially identified all individuals who received a mental health service at KMHS or one of the potential comparison facilities.[57] We used Current Procedural Terminology (CPT) and International Classification of Diseases, Ninth Revision (ICD-9) diagnosis codes to identify mental health services. Individuals with a claim meeting any one of the three mental health service category definitions in Table B.1 were selected for our initial analysis population. It should be noted that on January 1, 2013, the CPT codes used to bill psychiatric services changed. Providers began using new psychiatric visit codes 90791, 90792, and 90785 on that date. The psychiatric medication management code 90862 was not allowable beginning January 1, 2013. After this date, providers billed appropriate evaluation and management codes with a mental health primary diagnosis. Each individual who received a mental health service was assigned to an intervention or comparison group based on the facility in which they initially received treatment.[58] Medicare enrollment and claims data for January 2009 through June 2015 were extracted for this population and used to develop measures of enrollment history, demographics, health conditions, and HCC score. Health conditions and HCC score were measured in the 12-month period prior to the month of the initial mental health visit at KMHS or a comparison facility in January 2010 or later. Mental health diagnosis at treatment initiation (in a category listed in Table B.2) was measured in the initial month of mental health treatment and the two subsequent months. We allowed the two subsequent months because facilities commonly used a 799.9 (unknown or unspecified cause of morbidity) code during initial visits until they had specified a diagnosis.

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[57] We include individuals with limited exposure to KMHS in both the pre- and post-period to reflect the general population treated at KMHS. The intervention may also increase the number of visits at KMHS, and therefore we did not want to include the number of visits as a selection criteria.

[58] Eighteen individuals were excluded because they were observed to receive services at more than one facility in their initial treatment month and could not be attributed to only one facility.

Table B.1. Codes used to identify mental health services (KMHS Medicare)

Service category	CPT codes and additional requirements
1. Psychiatric visit	CPT-code = 90801 through 90899, 90791, 90792, and 90785 (psychiatric visit)
2. E&M visit with psych primary diagnosis	CPT-code = any outpatient E&M visit (CPT=99201-99205, 99211-99215) with a mental health primary diagnosis code listed in Table B.2
3. Psychiatric medication management visit	CPT-Code=M0064[a]

Source: Mathematica review of Current Procedural Terminology, Healthcare Common Procedure Coding System.

[a] M0064 was deleted from the HCPCS system December 31, 2014. Thus, this code was in use through the end of the period we used to identify patients for this analysis.

CPT= Current Procedural Terminology; E&M=Evaluation and management; HCPCS= Healthcare Common Procedure Coding System.

Table B.2. ICD-9 Mental health diagnosis codes (KMHS Medicare)

Diagnosis group	ICD-9 Diagnosis code value
Schizophrenic disorders	295.xx including 295.00
Bipolar disorders	296.00, 296.01, 296.02, 296.03, 296.04, 296.05,296.06, 296.10, 296.11, 296.12, 296.13, 296.14,296.15, 296.16, 296.40, 296.41, 296.42, 296.43,296.44, 296.45, 296.46, 296.50, 296.51, 296.52, 296.53, 296.54, 296.55, 296.56, 296.60, 296.61, 296.62, 296.63, 296.64, 296.65, 296.66, 296.7, 296.80, 296.81, 296.82, 296.89, 296.90, 296.99
Depressive disorders	296.20, 296.22, 296.23, 296.24, 296.25, 296.26, 296.30, 296.32, 296.33, 296.34, 296.35, 296.36, 311
Persistent mental disorders due to conditions classified elsewhere	294.8x, 294.9x
Dementia	290.xx, 294.1x
Other psychotic disorders	297.xx-298.xx
Anxiety, dissociative, and somatoform	300.xx
Adjustment reaction	309.xx
Drug and alcohol indicator	292, 292.0, 292.1, 292.2, 292.8, 292.9, 304, 304.0, 304.1, 304.2, 304.3, 304.4, 304.5, 304.6, 304.7, 304.8, 304.9, 305, 305.2, 305.3, 305.4, 305.5, 305.6, 305.7, 305.8, 305.9 291, 291.0, 291.1, 291.2, 291.3, 291.4, 291.5, 291.8, 291.9, 303, 303.0, 303.9, 305.0
Other diagnosis not listed above	Everything not above (293.83, V62.84, V62.85, E950, E951, E952, E953, E954, E955, E956, E957, E958, E959, 301.0 to 301.9, 307.40 to 307.49, 312.0 to 312.23, 312.4 to 312.89, 313.81, 312.30 to 312.39, 302.0 to 302.9, 299.00 to 299.91, 307.1, 307.5, 307.51, 314.00 to 314.01, 307.20 to 307.3, 313.0 to 313.3, 313.82 to 316, 648.4, V65.2, V71.09, 780.09, V15.41, V15.42, V15.81, V17.0, V60.0, V62.29, V62.4, V62.81, V62.89) and all other codes in the range of 290.0-299.91 and 300.00-316 Also include 7999 in this category.
Any 294 diagnosis	294.xx

Source: ICD-9 diagnosis codes, version 32
           (https://www.cms.gov/medicare/coding/ICD9providerdiagnosticcodes/codes.html).

ICD-9 = International Classification of Diseases, Ninth Revision.

We restricted the analysis population to those residing in the local area of the analysis facilities to assure the patients had the potential to consistently access the facilities during the

analysis period. We excluded individuals from the KMHS treatment group if they did not reside in Kitsap County or a contiguous county based on the most recent Medicare enrollment data available at the time they received their initial mental health service at KMHS. Potential comparison group members were similarly excluded if they did not reside in the county or a contiguous county for the mental health facility at which they initially received services.

Next, because of the limitations of the available Medicare data and to assure consistency in the expenditures observable for the analysis population, we required that during the full analysis period, the individual (1) not be enrolled in Medicare Advantage (because we do not have access to managed care encounters), (2) have Medicare as their primary payer, and (3) be enrolled in Medicare Parts A and B (to ensure that we capture both inpatient and outpatient services). Applying these restrictions in a step-wise fashion resulted in the exclusion of 15 percent, 2 percent, and 1 percent of the analysis population, respectively. We also required that the individual have a value for the hierarchical behavioral health diagnosis variable; we excluded another four individuals due to this requirement.

When this step was complete, the analysis population included 1,116 KMHS intervention participants and a pool of 12,017 individuals who received mental health services from comparison facilities.

Step 3: Match treatment participants at the individual level. The next step involved creating a matched comparison group. The matching process used metrics of individual-level characteristics identified based on pre-period Medicare data to select a subset of comparison pool members who were as similar as possible to the intervention group on observable characteristics. The matching algorithm first exact matched on the year an individual began treatment at KMHS or comparison mental health facility and a hierarchical variable of behavioral health diagnosis in the first three months of mental health treatment. The hierarchical variable included the following categories: dementia, schizophrenia, bipolar disorder, depression, or other condition. Then, within these cells, we used propensity score matching,[59] to match up to five comparison pool beneficiaries to each intervention group member. When a treatment beneficiary was difficult to match (that is, had few similar comparison beneficiaries in the same cell), the algorithm conducted a pairwise matching; when there were an abundance of comparisons for a treatment beneficiary, the algorithm matched multiple comparisons. The statistical goal is first to minimize bias and then, subject to that constraint, maximize the size of the comparison sample. The propensity score model included the following characteristics: age group (18–44, 45–54, 55–64, 65+), gender, disability status, the year treatment began at KMHS or comparison mental health facility, whether the beneficiary was enrolled in Medicare for a full 12 months prior to

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[59] A member's propensity score is the probability of belonging to the intervention group estimated based on a logistic regression model.

receiving mental health treatment at KMHS or a comparison facility, Medicare/Medicaid dual enrollment status, flags for psychiatric conditions,[60] and HCC score.[61]

When this step was complete, the analysis population included 1,116 KMHS intervention participants and 4,003 individuals in the comparison group. The reduction in the size of the comparison population relative to the previous step was due to individuals who were not matched to an individual attributed to KMHS.

Step 4: Assess the quality of the match. The following tests and procedures were used to verify that the treatment and comparison groups are similar or balanced. After we conducted matching, we examined the number of comparison beneficiaries matched to each treatment beneficiary (Table B.3). A large number of 1:1 matches, or a large number of comparison beneficiaries that were excluded, could indicate that the matching was problematic. In this case, we examined the balance diagnostics described below to determine which variable(s) may be causing the difficulty. The number of 1:1 matches is generally related to the small number of potential comparison group members in a given exact matching cell with the same hierarchical behavioral health diagnosis. Although requiring an exact match on diagnosis category increased the number of pairwise matches, we believed it was important that the treatment and associated comparison group member match on this characteristic.

Table B.3. Frequency table of ratio of treatment beneficiaries to comparison beneficiaries for each matched set (KMHS Medicare)

Ratio of treatment to comparison beneficiaries	1:1	1:2	1:3	1:4	1:5
Number of matched sets	292	81	56	54	633

Source: Mathematica analysis of Medicare administrative data for July 2010–June 2015.

Note: Each cell indicates the number of treatment beneficiaries matched to the number of comparison beneficiaries indicated for that column. In this example, most of the treatment beneficiaries (633) were matched to 5 comparison beneficiaries.

Next, we examined the overall balance of the matched sample. We used an omnibus test that checks for covariate balance across the individuals in the treatment and matched comparison group (Hansen and Bowers 2008). The omnibus test is based on the differences between the individuals in the treatment and matched group across the matching variables; these differences are standardized by their variances and covariances and aggregated into a single number, a weighted mean. Standardization in this way implies that a matching variable whose difference across matched sets has a small variance is given more weight and that a matching variable whose difference across sets is highly correlated with other differences is given less weight. The

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[60] We created flags to indicate that the patient had a diagnosis code for various conditions in the first three months of their claims during the intervention period. The diagnosis-related flags that we included in the matching included those for persistent mental disorder due to conditions classified elsewhere; dementia; anxiety, dissociative, or somatoform disorder; adjustment reaction disorder; alcohol- or drug-related diagnosis; "other" psychotic disorder; and "other" diagnosis.

[61] HCC score was used only for individuals enrolled in Medicare for 12 months prior to receiving a treatment at KMHS or a comparison facility because 12 months of claims history are required to calculate the score based on medical conditions.

advantages of the omnibus test are: (1) it generates a single probability statement through one *p*-value; (2) its distribution is roughly chi-square, which facilities the calculation of the *p*-value; and (3) it assesses balance on all linear combinations of the matching variables. However, a significant result from this chi-square test may be driven by a large sample rather than substantive differences between treatment and matched comparison groups. Alternatively, it could indicate that there may be some imbalance between the two groups on at least one of the matching variables. The results of this test were a chi-square statistic of 93.5 and a *p*-value of < 0.01, indicating that an imbalance exists.

To further investigate imbalance between treatment and matched comparison groups, we evaluated how matching affected the balance on all matching variables (Figure B.1) by comparing the absolute and standardized difference between the treatment and control groups for each variable before and after matching. The standardized difference measures the difference in means in *units* of the pooled standard deviation of treatment group and comparison group. The standardized difference measure is advantageous in that it allows us to compare all variables on the same scale. We compared the standardized differences using plots with dashed lines at +/- 0.15 standardized differences to visually inspect whether we obtained good balance for each variable, and using a balance table that shows both absolute and standardized differences between treatment and comparison groups before and after matching.

Figure B.1. Balance plot comparing the standardized difference for each matching variable before and after matching (KMHS Medicare)
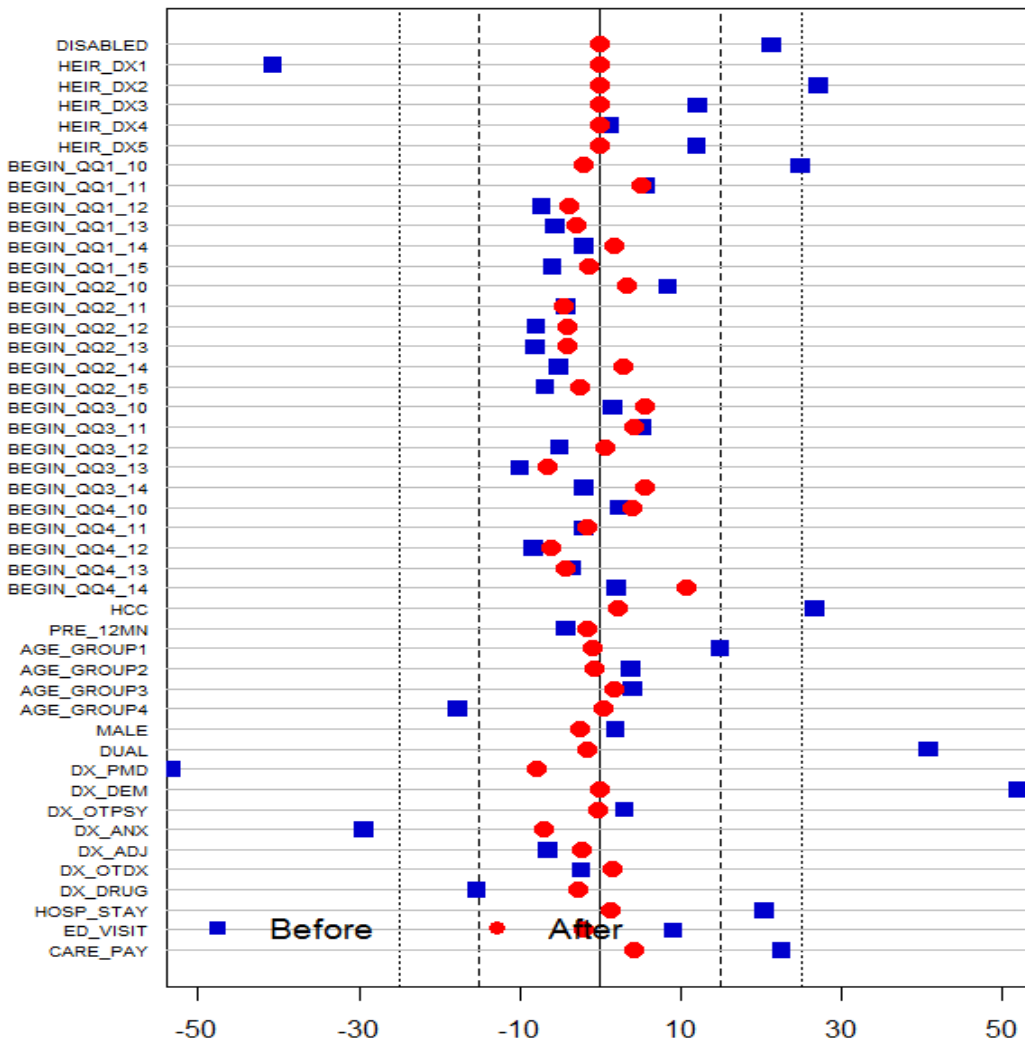
Source: Mathematica analysis of Medicare administrative data for July 2010–June 2015.

Note: Blue markers show the standardized difference before matching; red markers show the standardized difference after exact matching and propensity score modeling. See Table B.4 for descriptions of the variables included in this figure.

We provide more detail on the means and adjusted and standardized difference for the matching variables in Table B.4 below.

Table B.4. Balance table before and after matching (KMHS Medicare)

Variable Name	Variable description	Before matching					After matching				
		Comparison	Treatment	adj.diff	std.diff	P	Comparison	Treatment	adj.diff	std.diff	p
DISABLED	Disability status	0.5811	0.6855	0.1044	0.2126	0	0.6855	0.6855	0	0	1
HEIR_DX1	Hierarchical variable of behavioral health diagnosis: dementia	0.3434	0.1532	-0.1902	-0.408	0	0.1532	0.1532	0	0	1
HEIR_DX2	Hierarchical variable of behavioral health diagnosis: schizophrenia	0.1673	0.2697	0.1025	0.2698	0	0.2697	0.2697	0	0	1
HEIR_DX3	Hierarchical variable of behavioral health diagnosis: bipolar disorder	0.136	0.1774	0.0414	0.1197	0.0001	0.1774	0.1774	0	0	1
HEIR_DX4	Hierarchical variable of behavioral health diagnosis: depression	0.2092	0.2133	0.0041	0.01	0.75	0.2133	0.2133	0	0	1
HEIR_DX5	Hierarchical variable of behavioral health diagnosis: other condition	0.1441	0.1864	0.0423	0.1191	0.0001	0.1864	0.1864	0	0	1
BEGIN_QQ1_10	Began treatment at KMHS or comparison mental health facility in first quarter of 2010	0.229	0.3342	0.1052	0.2477	0	0.3448	0.3342	-0.0106	-0.0217	0.2921
BEGIN_QQ1_11	Began treatment at KMHS or comparison mental health facility in first quarter of 2011	0.0352	0.0457	0.0105	0.0563	0.0721	0.0358	0.0457	0.0099	0.0515	0.0948
BEGIN_QQ1_12	Began treatment at KMHS or comparison mental health facility in first quarter of 2012	0.0349	0.0215	-0.0134	-0.074	0.018	0.0275	0.0215	-0.006	-0.0386	0.2471
BEGIN_QQ1_13	Began treatment at KMHS or comparison mental health facility in first quarter of 2013	0.0387	0.0278	-0.0109	-0.0573	0.0672	0.0325	0.0278	-0.0048	-0.0292	0.4061
BEGIN_QQ1_14	Began treatment at KMHS or comparison mental health facility in first quarter of 2014	0.0353	0.0314	-0.0039	-0.0214	0.4951	0.0286	0.0314	0.0028	0.0171	0.6185
BEGIN_QQ1_15	Began treatment at KMHS or comparison mental health facility in first quarter of 2015	0.0341	0.0233	-0.0108	-0.0604	0.0536	0.0256	0.0233	-0.0023	-0.0151	0.678
BEGIN_QQ2_10	Began treatment at KMHS or comparison mental health facility in second quarter of 2010	0.0582	0.078	0.0198	0.0834	0.0077	0.0695	0.078	0.0084	0.0332	0.2314
BEGIN_QQ2_11	Began treatment at KMHS or comparison mental health facility in second quarter of 2011	0.0318	0.0242	-0.0076	-0.0437	0.1624	0.0314	0.0242	-0.0072	-0.0448	0.1898
BEGIN_QQ2_12	Began treatment at KMHS or comparison mental health facility in second quarter of 2012	0.0364	0.0215	-0.0149	-0.0808	0.0099	0.0277	0.0215	-0.0062	-0.0423	0.2171
BEGIN_QQ2_13	Began treatment at KMHS or comparison mental health facility in second quarter of 2013	0.0387	0.0233	-0.0154	-0.0812	0.0095	0.03	0.0233	-0.0067	-0.0404	0.2196
BEGIN_QQ2_14	Began treatment at KMHS or comparison mental health facility in second quarter of 2014	0.0376	0.0278	-0.0098	-0.0523	0.0949	0.0236	0.0278	0.0042	0.0274	0.403

Variable Name	Variable description	Before matching					After matching				
		Comparison	Treatment	adj.diff	std.diff	P	Comparison	Treatment	adj.diff	std.diff	p
BEGIN_QQ2_15	Began treatment at KMHS or comparison mental health facility in second quarter of 2015	0.0393	0.026	-0.0133	-0.0694	0.0266	0.03	0.026	-0.004	-0.0254	0.4304
BEGIN_QQ3_10	Began treatment at KMHS or comparison mental health facility in third quarter of 2010	0.0409	0.0439	0.003	0.0153	0.6238	0.0339	0.0439	0.0101	0.0543	0.0643
BEGIN_QQ3_11	Began treatment at KMHS or comparison mental health facility in third quarter of 2011	0.0328	0.0421	0.0093	0.0518	0.098	0.0346	0.0421	0.0075	0.0424	0.1867
BEGIN_QQ3_12	Began treatment at KMHS or comparison mental health facility in third quarter of 2012	0.0334	0.0242	-0.0092	-0.0517	0.0987	0.0234	0.0242	0.0008	0.0056	0.8805
BEGIN_QQ3_13	Began treatment at KMHS or comparison mental health facility in third quarter of 2013	0.0327	0.0152	-0.0175	-0.1005	0.0013	0.0248	0.0152	-0.0096	-0.0669	0.0607
BEGIN_QQ3_14	Began treatment at KMHS or comparison mental health facility in third quarter of 2014	0.0389	0.0349	-0.004	-0.0208	0.5072	0.0257	0.0349	0.0092	0.056	0.1053
BEGIN_QQ4_10	Began treatment at KMHS or comparison mental health facility in fourth quarter of 2010	0.0384	0.043	0.0046	0.0236	0.4502	0.0356	0.043	0.0074	0.04	0.1992
BEGIN_QQ4_11	Began treatment at KMHS or comparison mental health facility in fourth quarter of 2011	0.0334	0.0296	-0.0038	-0.0213	0.497	0.0324	0.0296	-0.0029	-0.0168	0.6064
BEGIN_QQ4_12	Began treatment at KMHS or comparison mental health facility in fourth quarter of 2012	0.0325	0.0179	-0.0146	-0.084	0.0073	0.0264	0.0179	-0.0085	-0.0605	0.0852
BEGIN_QQ4_13	Began treatment at KMHS or comparison mental health facility in fourth quarter of 2013	0.0354	0.0287	-0.0068	-0.0369	0.2379	0.036	0.0287	-0.0073	-0.0424	0.224
BEGIN_QQ4_14	Began treatment at KMHS or comparison mental health facility in fourth quarter of 2014	0.0325	0.0358	0.0034	0.019	0.5429	0.02	0.0358	0.0158	0.106	0.0037
HCC	HCC score	1.3122	1.5982	0.286	0.2664	0	1.5759	1.5982	0.0223	0.0226	0
PRE_12MN	Beneficiary was enrolled in Medicare for a full 12 months prior to receiving mental health treatment at KMHS or a comparison facility	0.8332	0.8172	-0.016	-0.0429	0.1707	0.824	0.8172	-0.0068	-0.0172	0.0547
AGE_GROUP1	Age group 18-44	0.2162	0.2778	0.0616	0.1484	0	0.2826	0.2778	-0.0048	-0.0102	0.2994
AGE_GROUP2	Age group 45-54	0.1663	0.1801	0.0138	0.0368	0.239	0.1831	0.1801	-0.003	-0.0074	0.5472
AGE_GROUP3	Age group 55-64	0.1292	0.1425	0.0132	0.0393	0.2089	0.1361	0.1425	0.0063	0.0177	0.2678
AGE_GROUP4	Age group 65+	0.4882	0.3996	-0.0886	-0.1775	0	0.3982	0.3996	0.0015	0.0032	0.7651
MALE	Gender	0.4372	0.4462	0.009	0.0182	0.5612	0.4587	0.4462	-0.0125	-0.025	0.076
DUAL	Medicare/Medicaid dual enrollment status	0.5476	0.7482	0.2007	0.4073	0	0.7549	0.7482	-0.0066	-0.0161	0.3613

Variable Name	Variable description	Before matching					After matching				
		Comparison	Treatment	adj.diff	std.diff	P	Comparison	Treatment	adj.diff	std.diff	p
DX_PMD	Diagnosis of persistent mental disorders due to conditions classified elsewhere	0.2155	0.0054	-0.2102	-0.5335	0	0.0132	0.0054	-0.0078	-0.0799	0.0032
DX_DEM	Diagnosis of dementia	0.0448	0.1613	0.1165	0.5178	0	0.1613	0.1613	0	0	1
DX_OTPSY	Diagnosis of other psychotic disorder	0.0517	0.0582	0.0066	0.0295	0.3456	0.059	0.0582	-0.0007	-0.0033	0.8091
DX_ANX	Diagnosis of anxiety, dissociative, or somatoform disorder	0.1108	0.0215	-0.0893	-0.2944	0	0.032	0.0215	-0.0105	-0.0697	0.0016
DX_ADJ	Diagnosis of adjustment reaction disorder	0.0875	0.069	-0.0185	-0.0662	0.0345	0.0751	0.069	-0.0061	-0.0238	0.0172
DX_OTDX	Other behavioral health diagnosis	0.0492	0.0439	-0.0053	-0.0245	0.4338	0.0414	0.0439	0.0025	0.0144	0.3193
DX_DRUG	Drug and/or alcohol-related diagnosis	0.0312	0.0054	-0.0258	-0.154	0	0.0076	0.0054	-0.0022	-0.0278	0.3734
HOSP_STAY	Hospitalizations utilization outcome measure	0.3948	0.5923	0.1975	0.2029	0	0.5808	0.5923	0.0115	0.0116	0.7635
ED_VISIT	ED visits utilization outcome measure	1.2451	1.517	0.272	0.0897	0.0042	1.7656	1.6998	-0.0658	-0.0205	0.6159
CARE_PAY	Total expenditures outcome measure	10,855	15,700	4,845	0.2241	0	14,695	15,601	906	0.0413	0.2298

Source: Mathematica analysis of Medicare administrative data for July 2010–June 2015.

HCC = Hierarchical Condition Category; adj.diff = The adjusted mean difference (adj. diff.) is the difference between weight-adjusted means for the treatment and comparison groups. 'Before matching' each treatment and comparison group member has equal weights in the mean calculation for their group. 'After matching' the members of the treatment group still have equal weight in their group mean, but the individuals in the comparison group are weighted based on one divided by the number of treatment group member to whom they are matched. Comparison group members who are not matched to a treatment group member are given a weight of zero; std.diff = The standardized difference (std. diff.) is the difference in weight-adjusted means between the treatment and comparison groups divided by the pooled standard deviation of treatment and matched comparison groups of the variable. This method places the mean difference between the treatment and comparison groups on the same scale (percentage) as the variance for each variable.

Step 5: Create analysis weights. Weights were developed for each member of the analysis population. Weights for KMHS attributed individuals were set to one. Weights for comparison group members were set to one divided by the number of comparison group members assigned to the member's associated treatment person. An individual's participation in the analysis could be terminated as a result of a change in status before the end of the analysis period. An individual's weight was set to zero in analysis months following any of these status changes. There were four status changes for which individuals were dropped from the analysis: (1) to assure consistency of care within the treatment and comparison groups, we removed individuals from the analysis if they received services at a mental health facility other than their assigned facility; (2) we also removed individuals from the analysis if they moved out of the set of counties designated for their assigned facility, because they would have no or less access to the assigned facility; (3) individuals who were no longer enrolled in Medicare were dropped from our analysis because they were no longer included in the data available for analysis; and lastly, (4) individuals were dropped from our analysis if they died.

2.   KMHS Medicaid

In this section, we describe the steps taken to select the intervention and matched comparison groups for the KMHS Medicaid analysis and provide diagnostics to assess balance between the matched groups. We describe these steps below.

Step 1: Identify treatment and potential comparison group members. The method used to create the treatment and potential comparison group pool for the Medicaid analysis differs from the Medicare analysis because we were unable to identify mental health treatment facilities in the Medicaid administrative data as we did in the Medicare data. Using Medicaid data for calendar years 2011 through 2014, we identified the treatment group members by using a finder file from the KMHS EHR data, limiting to those patients who had an in-person visit at KMHS in the EHR data on or after January 1, 2013, and finally, limiting to those patients with a mental health service in the Medicaid data during 2013 or 2014.[62] We then identified the potential comparison group members as those not in the treatment group, who did not have an in-person visit at KMHS in the EHR data after January 1, 2011, and who did have a mental health service in the Medicaid data during 2013 or 2014. For the treatment and comparison pool, we used CPT and ICD-9 diagnosis codes to identify mental health services in the Medicaid data (Table B.5). It should be noted that on January 1, 2013 the CPT codes used to bill psychiatric services changed. Providers began using new psychiatric visit codes 90791, 90792, and 90785 on that date. The psychiatric medication management code 90862 was not allowable beginning January 1, 2013. After this date, providers billed appropriate evaluation and management codes with a mental health primary diagnosis. Medicaid enrollment and claims data for January 2011 through June 2014 were extracted for the treatment population and comparison pool and used to develop measures of enrollment history, demographics, health conditions, and CDPS flags.[63] Mental

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[62] We include individuals with limited exposure to KMHS in both the pre- and post-period to reflect the general population treated at KMHS. The intervention may also increase the number of visits at KMHS, and therefore we did not want to include the number of visits as a selection criteria.

[63] The CDPS is a diagnosis-based risk adjustment model that was designed to allow Medicaid managed care organizations to adjust capitation payments for TANF and disabled beneficiaries for enrollee health status using administrative claims data. This is complemented by the Medicaid Rx (MRx) chronic disease classification, which

health diagnoses, identified by the codes in Table B.6, at treatment initiation were measured in the initial month of mental health treatment and the two subsequent months. Physical health conditions, identified by the codes in Table B.7, and CDPS flags were measured in the 12-month period prior to the month of the initial mental health visit in January 2013 or later.

Table B.5. Codes used to identify mental health services (KMHS Medicaid)

Service category	CPT codes and additional requirements
1. Psychiatric visit	CPT-code = 90801 through 90899, 90791, 90792, and 90785 (psychiatric visit)
2. E&M visit with psych primary diagnosis	CPT-code = any outpatient E&M visit (CPT=99201-99205, 99211-99215) with a mental health, alcohol, or drug abuse primary diagnosis code listed in Table B.6
3. Psychiatric medication management visit	CPT-Code=M0064[a]
4. Additional psychiatric visit codes used by KMHS in Medicaid data	0143M, 0149M, 96153, 96154, H0001, H0002, H0031, H0036, H0040, H2011, H2012, H2015, H2022, S9484, S9485, T1001, T1005, T1017, T1023

Source: Mathematica review of Current Procedural Terminology, Healthcare Common Procedure Coding System.

[a] M0064 was deleted from the HCPCS system December 31, 2014. Thus, this code was in use through the end of the period we used to identify patients for this analysis.

CPT= Current Procedural Terminology; E&M=Evaluation and management; HCPCS= Healthcare Common Procedure Coding System.

Table B.6. ICD-9 mental health diagnosis codes (KMHS Medicaid)

New variable name	Diagnosis group	ICD-9 Diagnosis code value
DX_SCHIZO	1. Schizophrenic disorders	295.xx including 295.00
DX_BIPOLAR	2. Bipolar disorders	296.00, 296.01, 296.02, 296.03, 296.04, 296.05,296.06, 296.10, 296.11, 296.12, 296.13, 296.14,296.15, 296.16, 296.40, 296.41, 296.42, 296.43,296.44, 296.45, 296.46, 296.50, 296.51, 296.52, 296.53, 296.54, 296.55, 296.56, 296.60, 296.61, 296.62, 296.63, 296.64, 296.65, 296.66, 296.7, 296.80, 296.81, 296.82, 296.89, 296.90, 296.99
DX_DEPRESS	3. Depressive disorders	296.20, 296.22, 296.23, 296.24, 296.25, 296.26, 296.30, 296.32, 296.33, 296.34, 296.35, 296.36, 311
DX_PMD	4. Persistent mental disorders due to conditions classified elsewhere	294.8x, 294.9x
DX_DEM	5. Dementia	290.xx, 294.1x
DX_OTPSY	6. Other psychotic disorders	297.xx-298.xx
DX_ANX	7. Anxiety, dissociative, and somatoform	300.xx
DX_ADJ	8. Adjustment reaction	309.xx

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uses NDC codes for prescription drugs. We used these complementary systems to create flags for chronic diseases and their expected level of expenditures.

New variable name	Diagnosis group	ICD-9 Diagnosis code value
DX_DRUG	9. Drug and alcohol indicator	292, 292.0, 292.1, 292.2, 292.8, 292.9, 304, 304.0, 304.1, 304.2, 304.3, 304.4, 304.5, 304.6, 304.7, 304.8, 304.9, 305, 305.2, 305.3, 305.4, 305.5, 305.6, 305.7, 305.8, 305.9 291, 291.0, 291.1, 291.2, 291.3, 291.4, 291.5, 291.8, 291.9, 303, 303.0, 303.9, 305.0
DX_DRUG_ALT	10. Alternative definition for drug and alcohol indicator	292.xx, 304.xx, 305, 305.2-305.9
DX_OTDX	11. Other diagnosis not listed above	Everything not above (293.83, V62.84, V62.85, E950, E951, E952, E953, E954, E955, E956, E957, E958, E959, 301.0 to 301.9, 307.40 to 307.49, 312.0 to 312.23, 312.4 to 312.89, 313.81, 312.30 to 312.39, 302.0 to 302.9, 299.00 to 299.91, 307.1, 307.5, 307.51, 314.00 to 314.01, 307.20 to 307.3, 313.0 to 313.3, 313.82 to 316, 648.4, V65.2, V71.09, 780.09, V15.41, V15.42, V15,81, V17.0, V60.0, V62.29, V62.4, V62.81, V62.89) and All other codes in the range of 290.0-299.91 and 300.00-316

Source: ICD-9 diagnosis codes, version 32 (https://www.cms.gov/medicare/coding/ICD9providerdiagnosticcodes/codes.html).

ICD-9 = International Classification of Diseases, Ninth Revision.

Table B.7. ICD-9 primary care and substance abuse diagnosis codes (KMHS Medicaid)

Diagnosis	Diagnosis code (ICD-9)
Hypertension	362.11, 401.0, 401.1, 401.9, 402.00, 402.01, 402.10, 402.11, 402.90, 402.91, 403.00, 403.01, 403.10, 403.11, 403.90, 403.91, 404.00, 404.01, 404.02, 404.03, 404.10, 404.11, 404.12, 404.13, 404.90, 404.91, 404.92, 404.93, 405.01, 405.09, 405.11, 405.19, 405.91, 405.99, 437.2 (any diagnosis on the claim)
Diabetes	249.00, 249.01, 249.10, 249.11, 249.20, 249.21, 249.30, 249.31, 249.40, 249.41, 249.50, 249.51, 249.60, 249.61, 249.70, 249.71, 249.80, 249.81, 249.90, 249.91,250.00, 250.01, 250.02, 250.03, 250.10, 250.11, 250.12, 250.13, 250.20, 250.21, 250.22, 250.23, 250.30, 250.31, 250.32, 250.33, 250.40, 250.41, 250.42,250.43, 250.50, 250.51, 250.52, 250.53, 250.60, 250.61, 250.62, 250.63, 250.70, 250.71, 250.72, 250.73, 250.80, 250.81, 250.82, 250.83, 250.90, 250.91, 250.92, 250.93, 357.2, 362.01, 362.02, 362.03, 362.04, 362.05, 362.06, 366.41 (any diagnosis on the claim)
Drug Abuse	292.xx, 304.xx, 305, 305.2-305.9
Alcohol Abuse	291.xx, 303.xx, 305.0

Source: ICD-9 diagnosis codes, version 32 (https://www.cms.gov/medicare/coding/ICD9providerdiagnosticcodes/codes.html).

ICD-9 = International Classification of Diseases, Ninth Revision.

To ensure consistency in Medicaid coverage and claims data availability across the analysis population, we required that during the full analysis period the individual (1) not be dually enrolled in Medicare, (2) have Medicaid as their primary payer, (3) not be a restricted-benefit enrollee, (4) not be an S-CHIP enrollee, (5) not have a missing enrollment record, and (6) have at least six months of Medicaid eligibility beginning in the month they first received mental health services during the intervention period through June 2014. Applying these restrictions resulted in the exclusion of 34 percent of the treatment group analysis population and 38 percent of the comparison pool analysis population, respectively.

When this step was complete, the analysis population included 3,750 KMHS intervention participants and a comparison pool of 188,563 individuals who received mental health services from other facilities.

Step 2: Match treatment participants at individual level. The next step involved creating a matched comparison group. The matching process used metrics of individual-level characteristics identified based on pre-period Medicaid data to select a subset of comparison pool members who were as similar as possible to the intervention group on observable characteristics. The matching algorithm first exact matched on aid category (disabled, other child, other adult), the year treatment began at KMHS or another mental health facility, and a hierarchical variable of mental health diagnosis in the first three months of treatment including the following categories: schizophrenia; bipolar disorder; adjustment reaction disorder; depression; anxiety, dissociative, or somatoform disorder; or other mental health diagnosis. We were able to exactly match on the hierarchical diagnosis variable for all treatment group members. Within the exact matching cells, we used propensity score matching,[64] to match up to five comparison pool beneficiaries to each intervention group member.

When a treatment beneficiary was difficult to match (that is, had few similar comparison beneficiaries in the same cell), the algorithm conducted a pairwise matching; when there were an abundance of comparisons for a treatment beneficiary, the algorithm matched multiple comparisons. The statistical goal is first to minimize bias and then, subject to that constraint, maximize the size of the comparison sample. The propensity score model included the following characteristics: age group (<18, 18–44, 45–54, 55–64), gender, aid category, year began treatment, whether the beneficiary was enrolled in Medicaid for a full 12 months prior to receiving mental health treatment during the intervention period, flags for psychiatric conditions,[65] each of the CDPS diagnosis flags, number of hospitalizations in the 12 months prior to intervention start, and prorated counts of ED visits for 1-6 months prior, 7-12 months prior, and 13-18 months prior. We were not able to find a good match for one person in the intervention group. This person was dropped from the intervention population.

When this step was complete the analysis population included 3,749 KMHS intervention participants and 15,929 individuals in the comparison group. The reduction in the size of the comparison population relative to the previous step was due to individuals who were not matched to an intervention group member.

Step 3: Assess the quality of the match. The following tests and procedures were used to verify that the treatment and comparison groups were similar or balanced. First, we graphically compared the propensity score distributions for all treatment and comparison beneficiaries post-

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[64] A member's propensity score is the probability of belonging to the intervention group estimated based on a logistic regression model.

[65] We created flags to indicate that the patient had a diagnosis code for various conditions in the first three months of their claims during the intervention period. The diagnosis-related flags that we included in the matching included those for schizophrenia, bipolar disorder, depressive disorder, persistent mental disorder due to conditions classified elsewhere; dementia; "other" psychotic disorder; anxiety, dissociative, or somatoform disorder; adjustment reaction disorder; alcohol- or drug-related diagnosis; and "other" diagnosis.

matching (Figure B.2). This figure shows the propensity scores for the two groups looking very similar.

Figure B.2. Propensity score distributions (KMHS Medicaid)
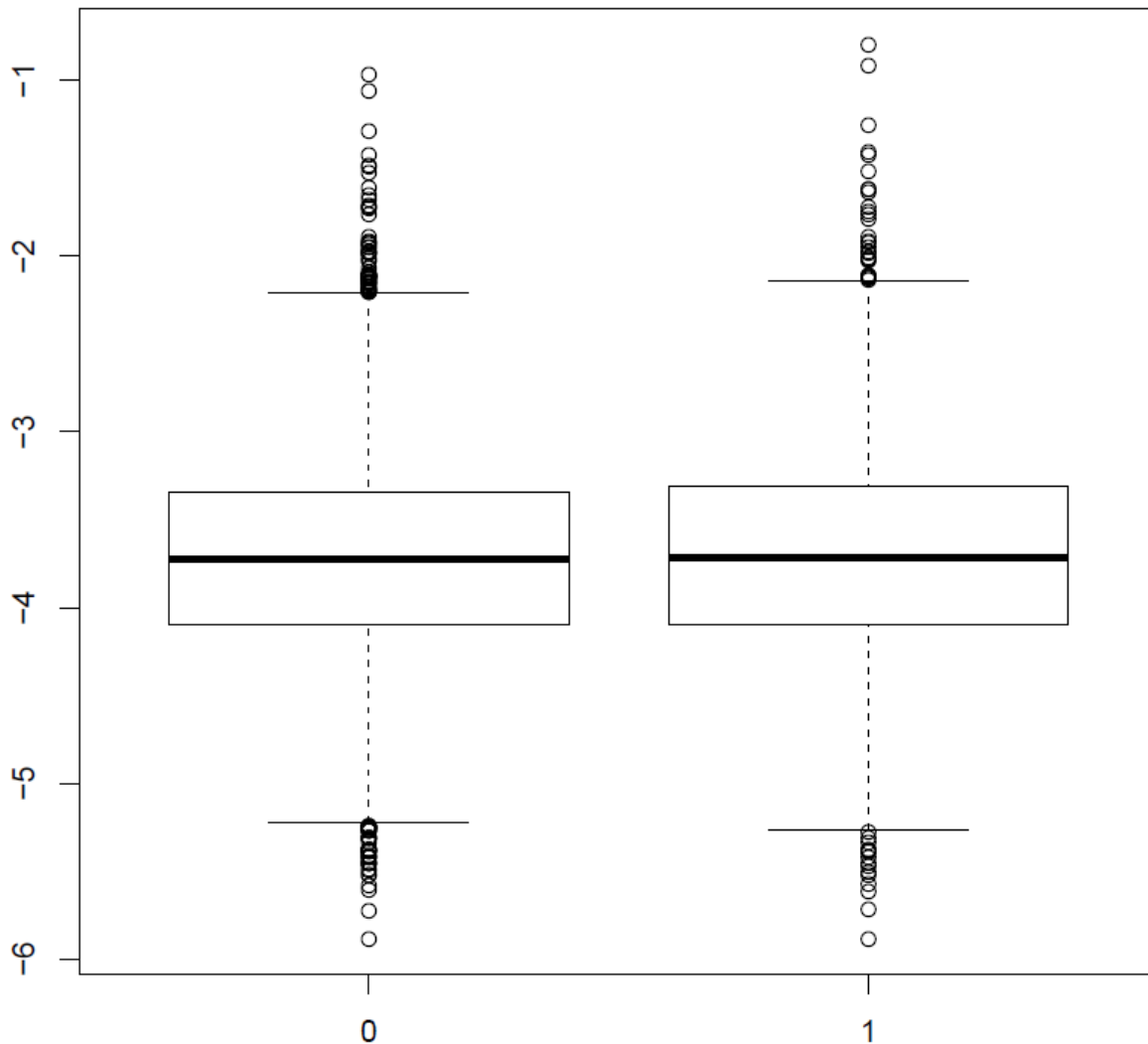
Source: Mathematica analysis of Medicaid administrative data for January 2011–June 2014.

Note: Figures present boxplots created using the estimated propensity scores for the comparison and intervention groups, the left and right panels, respectively. The line in the middle of each box represents the median score for the group. The lower and upper bounds of the box indicate the first and third quartile.

Next, we examined the number of comparison beneficiaries matched to each treatment beneficiary (Table B.8). A large number of 1:1 matches, or a large number of comparison beneficiaries that were excluded, could indicate that the matching was problematic. We found five matches for the vast majority of participants (76 percent), indicating substantial overlap between the characteristics of the individuals in the comparison pool and intervention group.

Table B.8. Frequency table of ratio of treatment beneficiaries to comparison beneficiaries for each matched set (KMHS)

Ratio of treatment to comparison beneficiaries	1:1	1:2	1:3	1:4	1:5
Number of matched sets	463	193	126	133	2,834

Source: Mathematica analysis of Medicaid administrative data for January 2011–June 2014.

Note: Each cell indicates the number of treatment beneficiaries matched to the number of comparison beneficiaries indicated for that column. In this example, most of the treatment beneficiaries (2,834) were matched to 5 comparison beneficiaries.

After evaluating the basic matching diagnostics above, we examined the overall balance of the matched sample. We used an omnibus test that checks for covariate balance across the individuals in the treatment and matched comparison group (Hansen and Bowers 2008). The omnibus test is based on the differences between the individuals in the treatment and matched group across the matching variables; these differences are standardized by their variances and covariances and aggregated into a single number, a weighted mean. Standardization in this way implies that a matching variable whose difference across matched sets has a small variance is given more weight and that a matching variable whose difference across sets is highly correlated with other differences is given less weight. The advantages of the omnibus test are: (1) it generates a single probability statement through one p-value; (2) its distribution is roughly chi-square, which facilities the calculation of the p-value; and (3) it assesses balance on all linear combinations of the matching variables. However, a significant result from this chi-square test may be driven by a large sample rather than substantive differences between treatment and matched comparison groups. Alternatively, it could indicate that there may be some imbalance between the two groups on at least one of the matching variables. The results of this test were a chi-square statistic of 153.7 and a p-value of < 0.01 indicating an imbalance exists.

To further investigate imbalance between treatment and matched comparison groups, we evaluated how matching affected the balance on all matching variables (Figure B.3) by comparing the absolute and standardized difference between the treatment and control groups for each variable before and after matching. The standardized difference measures the difference in means in *units* of the pooled standard deviation of treatment group and comparison group. The standardized difference measure is advantageous in that it allows us to compare all variables on the same scale. We compared the standardized differences using plots with dashed lines at +/- 0.15 standardized differences to visually inspect whether we obtained good balance for each variable, and using a balance table that shows both absolute and standardized differences between treatment and comparison groups before and after matching.

Figure B.3.a. Balance plot comparing the standardized difference for each matching variable before and after matching (KMHS Medicaid), part 1
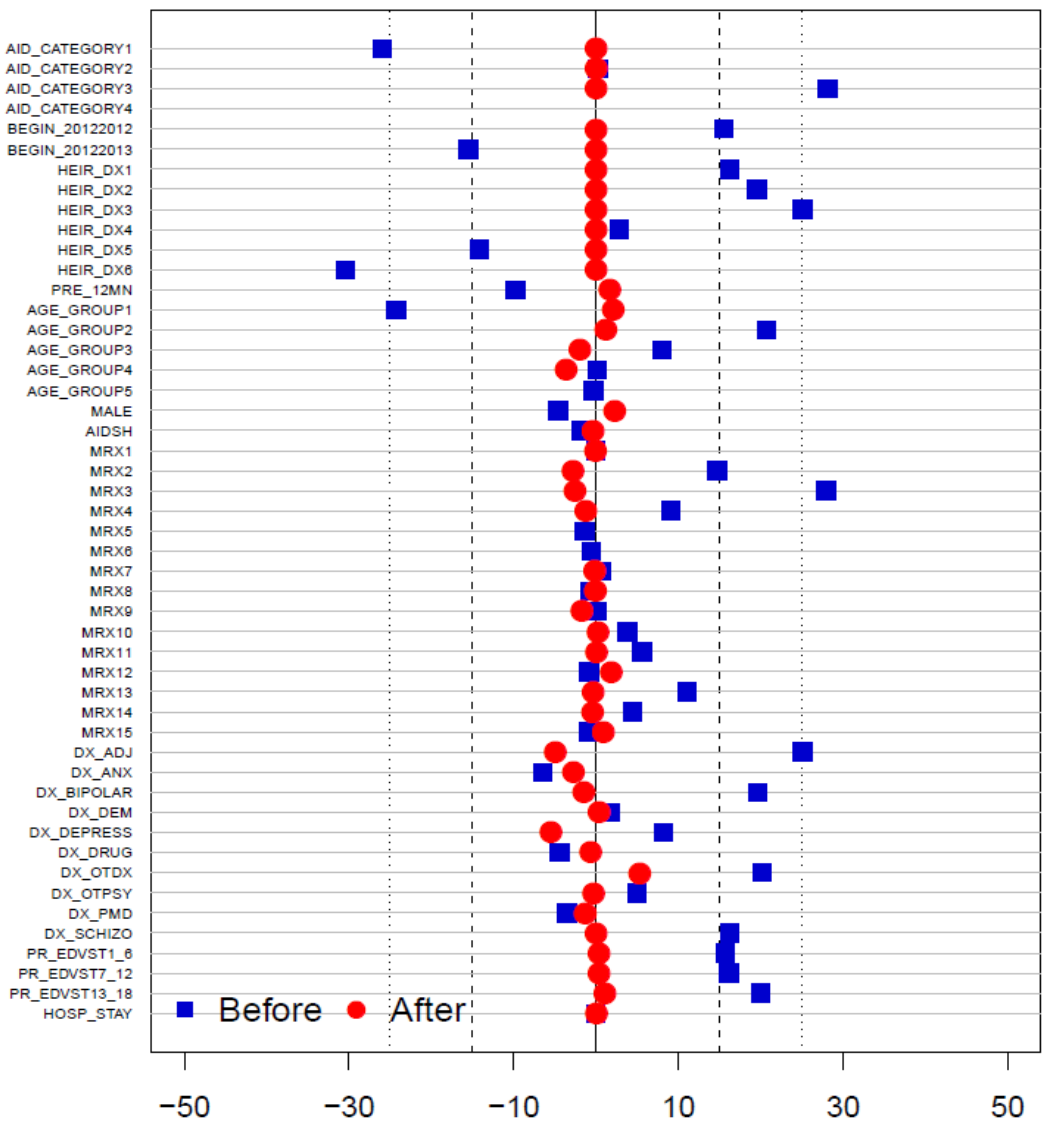
Source: Mathematica analysis of Medicaid administrative data for January 2011–June 2014.
Note: See Table B.9 for descriptions of the variables included in this figure.

Figure B.3.b. Balance plot comparing the standardized difference for each matching variable before and after matching (KMHS Medicaid), part 2
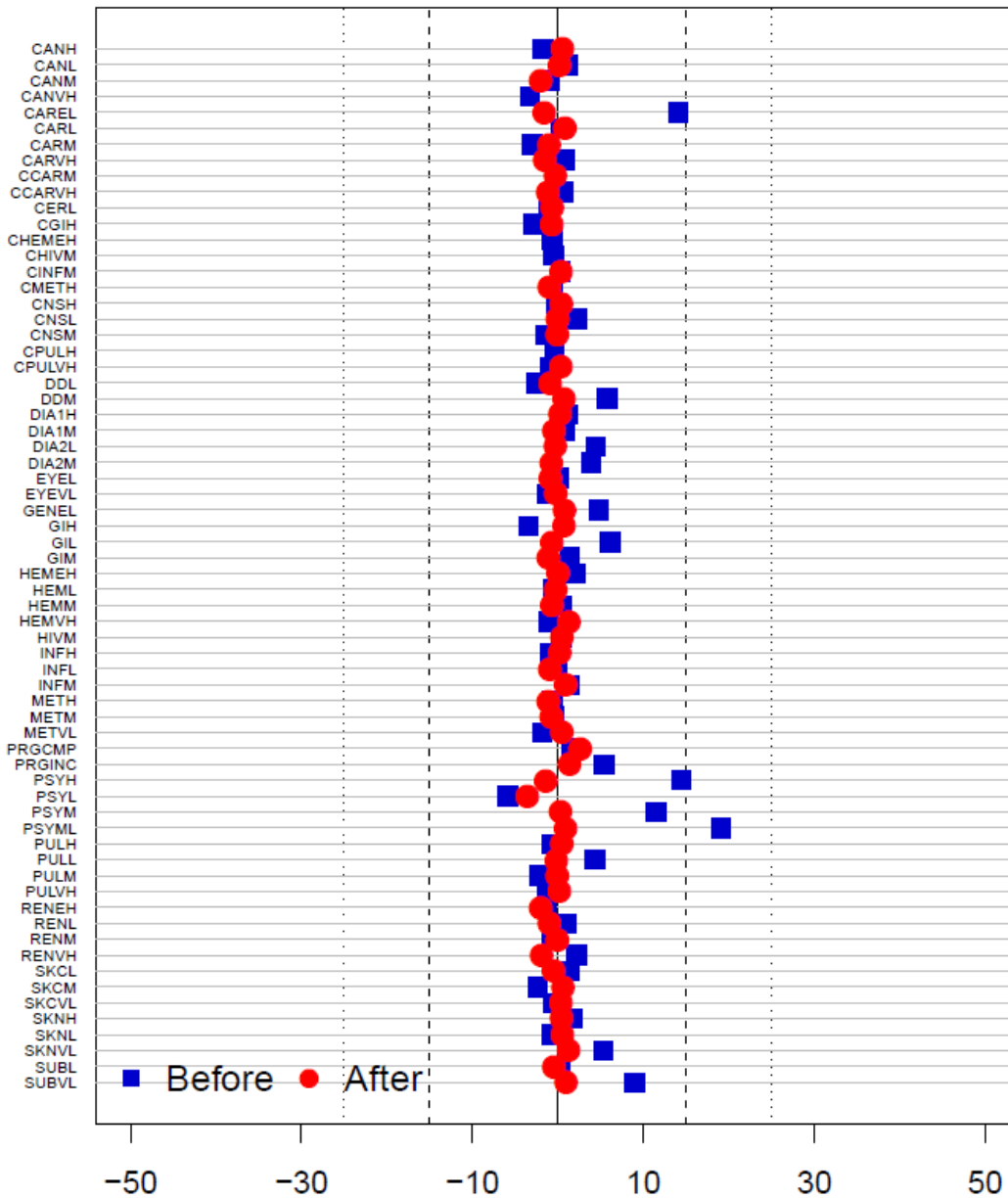
Source: Mathematica analysis of Medicaid administrative data for January 2011–June 2014.
Note: See Table B.9 for descriptions of the variables included in this figure.

   All variables were within 0.10 standard deviations, indicating a strong balance. We provide more detail on the means and adjusted and standardized difference for the matching variables in Table B.9 below.

Table B.9. Balance table before and after matching (KMHS Medicaid)

Variable Name	Variable description	Before matching					After matching				
		Comparison	Treatment	adj.diff	std.diff	p	Comparison	Treatment	adj.diff	std.diff	p
AID_CATEGORY1	Aid category: child	0.5029	0.3731	-0.1298	-0.2598	0	0.3732	0.3732	0	0	1
AID_CATEGORY2	Aid category: adult	0.1965	0.1973	0.0008	0.0021	0.8971	0.1974	0.1974	0	0	1
AID_CATEGORY3	Aid category: disabled	0.3006	0.4296	0.129	0.2808	0	0.4294	0.4294	0	0	1
AID_CATEGORY4	Aid category: aged	0	0	0	#N/A	1	0	0	0	#N/A	1
BEGIN_20122012	Year began treatment at KMHS or another mental health facility	0.6527	0.7264	0.0737	0.1551	0	0.7263	0.7263	0	0	1
BEGIN_20122013	Year began treatment at KMHS or another mental health facility	0.3473	0.2736	-0.0737	-0.1551	0	0.2737	0.2737	0	0	1
HEIR_DX1	Hierarchical variable of behavioral health diagnosis: schizophrenia	0.0363	0.0669	0.0306	0.1625	0	0.067	0.067	0	0	1
HEIR_DX2	Hierarchical variable of behavioral health diagnosis: bipolar disorder	0.0943	0.1517	0.0575	0.1957	0	0.1518	0.1518	0	0	1
HEIR_DX3	Hierarchical variable of behavioral health diagnosis: adjustment reaction disorder	0.1678	0.2619	0.094	0.2506	0	0.2619	0.2619	0	0	1
HEIR_DX4	Hierarchical variable of behavioral health diagnosis: depression	0.208	0.2195	0.0115	0.0283	0.0862	0.2195	0.2195	0	0	1
HEIR_DX5	Hierarchical variable of behavioral health diagnosis: anxiety, dissociative, or somatoform disorder	0.1327	0.0848	-0.0479	-0.1417	0	0.0846	0.0846	0	0	1
HEIR_DX6	Hierarchical variable of behavioral health diagnosis: any other	0.3609	0.2152	-0.1457	-0.3042	0	0.2153	0.2153	0	0	1
PRE_12MN	Beneficiary was enrolled in Medicaid for a full 12 months prior to receiving mental health treatment during the intervention period	0.7543	0.7123	-0.042	-0.0976	0	0.7045	0.7122	0.0077	0.0168	0.2117
AGE_GROUP1	Age group <=17	0.5183	0.3971	-0.1213	-0.2428	0	0.3873	0.3972	0.0099	0.0207	0.01
AGE_GROUP2	Age group 18-44	0.331	0.4285	0.0975	0.2071	0	0.4227	0.4286	0.0059	0.0119	0.3462
AGE_GROUP3	Age group 45-54	0.0951	0.1187	0.0235	0.08	0	0.1252	0.1184	-0.0068	-0.02	0.2032
AGE_GROUP4	Age group 55-64	0.0555	0.0557	0.0002	0.0009	0.9561	0.0648	0.0557	-0.0091	-0.0362	0.026
AGE_GROUP5	Age group 65+	0	0	0	-0.0033	0.8419	0	0	0	#N/A	1
MALE	Gender	0.4623	0.4392	-0.0231	-0.0463	0.005	0.4281	0.4393	0.0113	0.0228	0.0807

Variable Name	Variable description	Before matching					After matching				
		Comparison	Treatment	adj.diff	std.diff	p	Comparison	Treatment	adj.diff	std.diff	p
	Flags from CDPS+MRx algorithm										
AIDSH	AIDS, High	0.0028	0.0019	-0.0009	-0.0179	0.278	0.002	0.0019	-0.0002	-0.0037	0.8471
CANH	Cancer, High	0.0037	0.0027	-0.001	-0.0172	0.2958	0.0024	0.0027	0.0003	0.0055	0.7763
CANL	Cancer, Low	0.0043	0.0051	0.0007	0.0114	0.4887	0.0049	0.0051	0.0002	0.002	0.9071
CANM	Cancer, Medium	0.0018	0.0013	-0.0004	-0.0107	0.5179	0.0022	0.0013	-0.0008	-0.0205	0.3041
CANVH	Cancer, Very High	0.0011	0	-0.0011	-0.0331	0.0449	0	0	0	#N/A	1
CAREL	Cardiovascular, Extra Low	0.0626	0.0968	0.0342	0.1403	0	0.1017	0.0968	-0.0048	-0.016	0.3451
CARL	Cardiovascular, Low	0.0359	0.0365	0.0006	0.0035	0.8332	0.035	0.0365	0.0016	0.0082	0.6417
CARM	Cardiovascular, Medium	0.0124	0.0091	-0.0033	-0.0302	0.0668	0.0101	0.0091	-0.001	-0.0102	0.5811
CARVH	Cardiovascular, Very High	0.0016	0.0019	0.0003	0.0073	0.6563	0.0023	0.0016	-0.0007	-0.0155	0.427
CCARM	Children's Cardiovascular, medium	0.0003	0.0003	0	-0.0026	0.8739	0.0003	0.0003	-0.0001	-0.0028	0.8658
CCARVH	Children's Cardiovascular, Very High	0.0002	0.0003	0.0001	0.0059	0.7194	0.0005	0.0003	-0.0002	-0.0122	0.5763
CERL	Cerebrovascular, Low	0.007	0.0061	-0.0008	-0.0102	0.5374	0.0067	0.0061	-0.0006	-0.0067	0.6988
CGIH	Children's Gastro, High	0.0013	0.0003	-0.001	-0.0282	0.0877	0.0004	0.0003	-0.0001	-0.0071	0.7518
CHEMEH	Children's Hematological, extra high	0	0	0	-0.0066	0.69	0	0	0	#N/A	1
CHIVM	Children's HIV, medium	0	0	0	-0.0047	0.7779	0	0	0	#N/A	1
CINFM	Children's Infectious, medium	0.0002	0.0003	0	0.0033	0.8399	0.0002	0.0003	0.0001	0.0033	0.851
CMETH	Children's Metabolic, high	0.0007	0.0005	-0.0002	-0.0058	0.726	0.0008	0.0005	-0.0003	-0.0103	0.5565
CNSH	Central Nervous System, High	0.0019	0.0019	-0.0001	-0.0015	0.9298	0.0017	0.0019	0.0002	0.004	0.8316
CNSL	Central Nervous System, Low	0.0542	0.0592	0.005	0.0221	0.1799	0.0593	0.0592	-0.0001	-0.0004	0.981
CNSM	Central Nervous System, Medium	0.0089	0.0075	-0.0014	-0.0149	0.366	0.0075	0.0075	0	-0.0005	0.9773
CPULH	Children's Pulmonary, high	0	0	0	-0.004	0.807	0	0	0	#N/A	1
CPULVH	Children's Pulmonary, very high	0.0005	0.0003	-0.0002	-0.0097	0.557	0.0002	0.0003	0.0001	0.0033	0.8415
DDL	Developmental Disability, Low	0.0068	0.0048	-0.002	-0.0244	0.1382	0.0054	0.0048	-0.0006	-0.0087	0.6208
DDM	Developmental Disability, Medium	0.0004	0.0016	0.0012	0.0574	0.0005	0.0014	0.0016	0.0002	0.0071	0.778
DIA1H	Diabetes, Type 1 High	0.0005	0.0008	0.0003	0.0119	0.4689	0.0007	0.0008	0.0001	0.0023	0.9143
DIA1M	Diabetes, Type 1 Low	0.0063	0.0069	0.0006	0.0081	0.6219	0.007	0.0067	-0.0004	-0.0046	0.8116
DIA2L	Diabetes, Type 2 High	0.0322	0.04	0.0078	0.0443	0.0072	0.0406	0.04	-0.0006	-0.0032	0.8615
DIA2M	Diabetes, Type 2 Low	0.0086	0.0123	0.0036	0.0392	0.0175	0.0131	0.0123	-0.0009	-0.0076	0.6753
EYEL	Eye, Low	0.0016	0.0016	0	0.0002	0.9891	0.002	0.0016	-0.0004	-0.009	0.6519
EYEVL	Eye, Very Low	0.0116	0.0101	-0.0014	-0.0134	0.4158	0.0104	0.0101	-0.0003	-0.0026	0.8821

Variable Name	Variable description	Before matching					After matching				
		Comparison	Treatment	adj.diff	std.diff	p	Comparison	Treatment	adj.diff	std.diff	p
GENEL	Genital, Extra Low	0.0326	0.0411	0.0084	0.0474	0.004	0.0396	0.0411	0.0015	0.0076	0.6776
GIH	Gastrointestinal, High	0.0048	0.0024	-0.0024	-0.0345	0.0365	0.0018	0.0021	0.0003	0.0071	0.7186
GIL	Gastrointestinal, Low	0.0699	0.0856	0.0157	0.0615	0.0002	0.0877	0.0856	-0.002	-0.0074	0.6872
GIM	Gastrointestinal, Medium	0.0217	0.0237	0.0021	0.0141	0.393	0.0255	0.0237	-0.0018	-0.0114	0.5359
HEMEH	Hematological, Extra High	0.0002	0.0005	0.0003	0.0205	0.213	0.0005	0.0005	0	0	1
HEML	Hematological, Low	0.0076	0.0072	-0.0004	-0.0051	0.7554	0.0074	0.0072	-0.0002	-0.0026	0.886
HEMM	Hematological, Medium	0.0052	0.0056	0.0004	0.0049	0.7658	0.0061	0.0056	-0.0005	-0.007	0.7063
HEMVH	Hematological, Very High	0.0005	0.0003	-0.0003	-0.0115	0.4853	0.0001	0.0003	0.0002	0.013	0.4386
HIVM	HIV, Medium	0.0007	0.0008	0.0001	0.0044	0.7885	0.0007	0.0008	0.0001	0.0045	0.835
INFH	Infectious, High	0.0004	0.0003	-0.0002	-0.0083	0.6146	0.0002	0.0003	0	0.0025	0.8836
INFL	Infectious, Low	0.0258	0.0256	-0.0002	-0.001	0.9518	0.0272	0.0256	-0.0015	-0.0093	0.5992
INFM	Infectious, Medium	0.0072	0.0083	0.0011	0.013	0.4289	0.0072	0.008	0.0008	0.009	0.6214
METH	Metabolic, High	0.0067	0.0061	-0.0005	-0.0066	0.6883	0.0071	0.0061	-0.001	-0.0116	0.5265
METM	Metabolic, Medium	0.0106	0.0101	-0.0004	-0.0042	0.8006	0.0107	0.0099	-0.0008	-0.008	0.6608
METVL	Metabolic, Very Low	0.0332	0.0299	-0.0033	-0.0185	0.2626	0.0291	0.0299	0.0008	0.0048	0.7935
MRX1	Anti-coagulants	0.0083	0.0083	-0.0001	-0.0008	0.9599	0.0083	0.0083	0	-0.0004	0.9832
MRX2	Cardiac	0.1481	0.2003	0.0522	0.1466	0	0.2118	0.2003	-0.0114	-0.0281	0.0806
MRX3	Psychosis/bipolar/depression	0.3064	0.4355	0.129	0.2795	0	0.4481	0.4353	-0.0127	-0.0256	0.0363
MRX4	Diabetes	0.0396	0.0573	0.0178	0.0908	0	0.0604	0.0573	-0.003	-0.0128	0.4785
MRX5	ESRD/Renal	0.0002	0	-0.0002	-0.0141	0.391	0	0	0	#N/A	1
MRX6	Hemophilia/von Willebrands	0	0	0	-0.0057	0.7298	0	0	0	#N/A	1
MRX7	Hepatitis	0.0011	0.0013	0.0002	0.0057	0.729	0.0014	0.0013	-0.0001	-0.0021	0.9049
MRX8	HIV	0.0025	0.0021	-0.0004	-0.0072	0.6618	0.0022	0.0021	0	-0.0006	0.9759
MRX9	Infections, high	0.0013	0.0013	0	-0.0001	0.9959	0.0017	0.0011	-0.0006	-0.0171	0.3823
MRX10	Inflammatory/Autoimmune	0.0028	0.0048	0.002	0.038	0.0212	0.0047	0.0048	0.0001	0.0022	0.9155
MRX11	Malignancies	0.0049	0.0088	0.0039	0.056	0.0007	0.0088	0.0088	0	0.0006	0.9779
MRX12	Multiple Sclerosis/Paralysis	0.0008	0.0005	-0.0002	-0.0084	0.6121	0.0002	0.0005	0.0003	0.0183	0.2733
MRX13	Parkinson's/Tremor	0.0188	0.0339	0.0151	0.1103	0	0.0346	0.0339	-0.0007	-0.0037	0.824
MRX14	Seizure disorders	0.0346	0.0427	0.0081	0.044	0.0076	0.0435	0.0427	-0.0008	-0.0041	0.8177
MRX15	Tuberculosis	0.0014	0.0011	-0.0003	-0.0083	0.6146	0.0008	0.0011	0.0003	0.009	0.6012
PRGCMP	Pregnancy, Complete	0.0414	0.0445	0.0031	0.0156	0.3427	0.0393	0.0445	0.0052	0.0264	0.1112
PRGINC	Pregnancy, Incomplete	0.0163	0.0232	0.0069	0.0544	0.001	0.0213	0.0232	0.002	0.0135	0.4174
PSYH	Psychiatric, High	0.0392	0.0675	0.0282	0.1446	0	0.0712	0.0675	-0.0038	-0.0143	0.052
PSYL	Psychiatric, Low	0.0964	0.0792	-0.0172	-0.0583	0.0004	0.0893	0.0792	-0.0101	-0.0358	0.015
PSYM	Psychiatric, Medium	0.0713	0.1008	0.0295	0.1143	0	0.0996	0.1006	0.001	0.0032	0.8336

Variable Name	Variable description	Before matching					After matching				
		Comparison	Treatment	adj.diff	std.diff	p	Comparison	Treatment	adj.diff	std.diff	p
PSYML	Psychiatric, Medium Low	0.3452	0.436	0.0908	0.1908	0	0.4316	0.4361	0.0045	0.0092	0.4628
PULH	Pulmonary, High	0.0016	0.0013	-0.0003	-0.0076	0.6465	0.0012	0.0013	0.0002	0.0046	0.8339
PULL	Pulmonary, Low	0.1222	0.1363	0.0141	0.043	0.0091	0.1368	0.1363	-0.0005	-0.0016	0.9281
PULM	Pulmonary, Medium	0.0216	0.0184	-0.0032	-0.0218	0.1861	0.0185	0.0184	-0.0001	-0.0005	0.9777
PULVH	Pulmonary, Very High	0.0019	0.0013	-0.0006	-0.0128	0.4372	0.001	0.0011	0.0001	0.0016	0.9261
RENEH	Renal, Extra High	0.0006	0.0003	-0.0003	-0.0127	0.4414	0.0006	0.0003	-0.0004	-0.0203	0.3771
RENL	Renal, Low	0.039	0.0411	0.0021	0.0106	0.521	0.0429	0.0408	-0.0021	-0.0104	0.5597
RENM	Renal, Medium	0.0013	0.0011	-0.0003	-0.0075	0.648	0.0011	0.0011	0	-0.0008	0.9641
RENVH	Renal, Very High	0.006	0.0077	0.0017	0.022	0.1818	0.0095	0.0077	-0.0017	-0.019	0.3294
SKCL	Skeletal and Connective, Low	0.0542	0.0573	0.0031	0.0136	0.4081	0.0584	0.0571	-0.0013	-0.0056	0.748
SKCM	Skeletal and Connective, Medium	0.0324	0.0283	-0.0041	-0.0234	0.1556	0.0273	0.0283	0.001	0.0061	0.7397
SKCVL	Skeletal and Connective, Very Low	0.0588	0.0573	-0.0014	-0.0062	0.7089	0.0566	0.0573	0.0008	0.0033	0.8554
SKNH	Skin, High	0.0022	0.0029	0.0008	0.0165	0.3169	0.0027	0.0029	0.0002	0.0039	0.8279
SKNL	Skin, Low	0.0047	0.0043	-0.0004	-0.0065	0.6915	0.0037	0.004	0.0003	0.0056	0.7672
SKNVL	Skin, Very Low	0.0743	0.0883	0.014	0.0532	0.0013	0.0849	0.0883	0.0034	0.0123	0.5013
SUBL	Substance Abuse, Low	0.0874	0.088	0.0006	0.002	0.9044	0.0891	0.0878	-0.0014	-0.0047	0.78
SUBVL	Substance Abuse, Very Low	0.0406	0.0584	0.0178	0.0901	0	0.0562	0.0584	0.0022	0.0096	0.5844
DX_ADJ	Diagnosis of adjustment reaction disorder	0.1887	0.2872	0.0985	0.251	0	0.3098	0.2873	-0.0225	-0.0496	0
DX_ANX	Diagnosis of anxiety, dissociative, or somatoform disorder	0.2395	0.212	-0.0275	-0.0646	0.0001	0.2233	0.2118	-0.0115	-0.0276	0.0385
DX_BIPOLAR	Diagnosis of bipolar disorder	0.1013	0.1608	0.0595	0.1961	0	0.1666	0.1608	-0.0057	-0.015	0.0008
DX_DEM	Diagnosis of dementia	0.0013	0.0019	0.0006	0.0169	0.3041	0.0017	0.0019	0.0002	0.0037	0.8434
DX_DEPRESS	Diagnosis of depressive disorder	0.2738	0.3104	0.0366	0.082	0	0.3365	0.3105	-0.026	-0.0548	0
DX_DRUG	Drug and/or alcohol-related diagnosis	0.1543	0.1384	-0.0159	-0.0439	0.0077	0.1408	0.1384	-0.0024	-0.0069	0.6635
DX_OTDX	Other behavioral health diagnosis	0.4697	0.5701	0.1004	0.2013	0	0.544	0.5703	0.0263	0.0528	0
DX_OTPSY	Diagnosis of other psychotic disorder	0.0274	0.0355	0.008	0.0492	0.0029	0.0361	0.0355	-0.0006	-0.0032	0.8508
DX_PMD	Diagnosis of persistent mental disorders due to conditions classified elsewhere	0.0026	0.0008	-0.0018	-0.0354	0.0317	0.0011	0.0008	-0.0003	-0.013	0.6479

Variable Name	Variable description	Before matching					After matching				
		Comparison	Treatment	adj.diff	std.diff	p	Comparison	Treatment	adj.diff	std.diff	p
DX_SCHIZO	Diagnosis of schizophrenic disorder	0.0363	0.0669	0.0306	0.1625	0	0.067	0.067	0	0	1
PR_EDVST1_6	Continuous pro-rated version of the ED visits counts measure for visits 1-6 months prior	0.402	0.5917	0.1897	0.1572	0	0.5802	0.586	0.0058	0.0037	0.8528
PR_EDVST7_12	Continuous pro-rated version of the ED visits counts measure for visits 7-12 months prior	0.4193	0.6243	0.205	0.1612	0	0.6116	0.6167	0.0051	0.0033	0.8626
PR_EDVST13_18	Continuous pro-rated version of the hospitalization counts measure for visits 13-18 months prior	0.4034	0.6618	0.2583	0.1996	0	0.6393	0.6566	0.0174	0.0104	0.6028
HOSP_STAY	Number of hospitalizations in 12 month claims/encounter history	0.0961	0.096	-0.0001	-0.0002	0.9899	0.0939	0.0942	0.0003	0.0006	0.9743

Source: Mathematica analysis of Medicaid administrative data for January 2011–June 2014.

Note: We created CDPS flags following UCSD's (University of California San Diego) CDPS + MRx methodology. Please see the CDPS website for programs for further information regarding the individual flags.

CDPS = Chronic Illness and Disability Payment System; adj.diff = The adjusted mean difference (adj. diff.) is the difference between weight-adjusted means for the treatment and comparison groups. 'Before matching' each treatment and comparison group member has equal weights in the mean calculation for their group. 'After matching' the members of the treatment group still have equal weight in their group mean, but the individuals in the comparison group are weighted based on one divided by the number of treatment group member to whom they are matched. Comparison group members who are not matched to a treatment group member are given a weight of zero; std.diff = The standardized difference (std. diff.) is the difference in weight-adjusted means between the treatment and comparison groups divided by the pooled standard deviation of treatment and matched comparison groups of the variable. This method places the mean difference between the treatment and comparison groups on the same scale (percentage) as the variance for each variable.

Step 5: Create analysis weights. Weights were developed for each member of the analysis population. Weights for KMHS attributed individuals were set to one. Weights for comparison group members were set to one divided by the number of comparison group members assigned to the member's associated treatment person. An individual's participation in the analysis could be terminated as a result of a change in status before the end of the analysis period. An individual's weight was set to zero in analysis months following any of these status changes. There were two status changes for which individuals were dropped from the analysis: (1) individuals who were no longer enrolled in Medicaid were dropped from our analysis because they were no longer included in the data available for analysis; and (2) individuals were dropped from our analysis if they died.

D. Specifications of measures

We used multiple types of measures in these analyses. CMMI requested that we calculate four standardized outcome measures for all awardees to the extent feasible. These measures are: total Medicare and/or Medicaid expenditures, inpatient hospitalizations, hospital readmissions, and ED visits. If it was possible to calculate the core measures identified by CMS and these measures were appropriate to the intervention, we used them.[66] Our specifications for these measures in Medicare and Medicaid administrative data are described in the first section below (Section D.1). For KMHS, we used multivariate regression models to adjust for differences across the analysis population in demographics, geography, socioeconomics, Medicaid/Medicare enrollment, and health status. We describe the specifications for the control variables in these models (Section D.2).

1. Core measures in Medicare and Medicaid administrative data

In this section, we provide detail on the data and analytic methods used to develop the core outcome measures. We begin by describing how we identified the spans of Medicare or Medicaid enrollment that were included in the analyses for each intervention or comparison group member. Then, we describe how we processed claims data and assigned expenditure and utilization information to months to develop each of the core measures. Finally, we discuss how we annualized and weighted the regressions models to adjust for individuals who were not observable for a full 12 months.

a. Identifying periods with observable data

In this section we describe the approach we used to identify the patients and periods of Medicare or Medicaid enrollment included in the analysis.

Define intervention start date. We assigned each intervention and comparison group member identified in Section C above an intervention start month. For the Medicare analysis individuals were assigned to the treatment facility at which they were first observed to receive mental health treatment. The Race to Health! program began on January 1, 2013. For the Medicare population individuals already in care at a mental health facility prior to this month had

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[66] For the Medicare and Medicaid analyses we did not analyze readmissions due to the small number of patients with readmissions. For the Medicaid analysis we did not analyze total expenditures because expenditure information was not available for most Medicaid enrollees who were enrolled in a managed care plan.

January 2013 assigned as their intervention start month. Individuals who initiated care at KMHS or a comparison mental health facility during or after January 2013 had the first month they received mental health treatment at their assigned facility assigned as their intervention start month. Because individuals could not be assigned to a facility in the Medicaid analysis, we assigned intervention start month as the first month after December 2012 when the intervention or comparison group member was observed to receive a mental health treatment service in the Medicaid claims data.

Define baseline and intervention periods. Baseline and intervention periods were defined for each intervention participant or comparison group member relative to their intervention start month. The first intervention period was defined as the intervention start month and the appropriate number of months following that month.[67] Where applicable the second intervention period was defined starting in the months following the last month in the first intervention period. The first baseline period started in the month prior to the intervention start month and moved backward. For each individual included in the analysis the proportion of each baseline and intervention period for which the individual was eligible for the analysis was calculated. This proportion was used to pro-rate the expenditure and utilization measures for individuals enrolled for less than the full analysis period. It was also used to weight observations in the regression analysis.

b.   Summarizing monthly expenditures and utilization

Once the individuals and periods eligible for the analysis were identified as described above, expenditures and utilization associated with each core measure were aggregated for the periods during which the individual was deemed eligible for the analysis. In this section, we define the specifications for identifying total Medicare expenditures, hospitalizations, and ED visits, and total Medicaid hospitalizations and ED visits. We summarized each of these measures monthly for each individual in the analysis population. Then, we aggregated sets of months to the analysis period.

i.   Expenditures

For Medicare, the following claim types were included in this analysis: carrier, DME, home health, hospice, inpatient, outpatient, and skilled nursing facility. Only FFS data were included in this analysis. Part D services were excluded. Duplicate and denied claims were excluded. The total payment amount on each Medicare claim was summed across all file types to calculate total expenditures. For services that extend beyond a single day (for example, an inpatient or long-term care stay) we counted all Medicare payments recorded based on a single date. Inpatient stays expenditures were counted in the month of the discharge date. For other types of claims all expenditures were assigned based on the claim from date. Expenditures were excluded from this analysis if they were assigned to a month during which the associated Medicare beneficiary was deemed ineligible for the analysis.

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[67] This was five months for the descriptive analysis of outcomes and up to 29 months for the impact analysis.

ii. Hospitalizations

The specifications for the hospitalization measures were developed to align with the CMMI priority all-cause admissions per patient measure. For this measure only acute stays or psychiatric stays were included in the analysis. We describe the steps to develop these counts here.

Step 1: Identify hospitalization claims. For Medicare administrative data inpatient hospital claims were identified by claim type. Then, we identified and excluded rehabilitation and long-term care stays from the Medicare data based on provider identifier codes. At the end of this step, only acute and psychiatric stays were included in the file. For Medicaid MAX and Alpha-MAX, we analyzed all claims in the IP file.[68]

Step 2: Eliminate duplicate or denied claims. For Medicare, we identified claims with the same information in all fields and only kept one of these claims. We also excluded denied claims from our analysis. For MAX and Alpha-MAX the data files included final paid claims, so no additional adjustment was necessary.

Step 3: Combine claims that represent the same stay and combine transfer stays with initial stays. For all data types, we identified and combined initial and interim claims into one discharge. Interim claims had (1) the same admission date as the initial claim, (2) an admission date that was equal to the discharge date from the initial or another interim claim and the status on the other (previous) claim was "still a patient", or (3) a claim with an admission date that was equal to one day after the discharge date of the initial or another interim claim and the status on the other previous claim was "still a patient." Such claims were combined to count as a single stay.

Next, we identified and combined claims associated with a transfer into a single stay. We identified claims indicating that the patient was transferred to either another short-term hospital, a CAH, another type institution for inpatient care, a federal hospital, or a psychiatric hospital or unit. Then we combined these claims with claims for the same beneficiary at a different facility where the admission date fell within one day of the discharge date of the first claim.

Step 4: Sum the number of discharges in each month. Once claims representing a single stay were combined, we summed the number of unique discharges for each enrollee for each month. Inpatient stays were counted in the month of the discharge date.

iii. ED visits

Outpatient ED visit utilization is reflected in CMMI priority measure 62. This measure includes ED visits and observation stays that do not lead to an admission.

In the Medicare outpatient file, we identified outpatient ED claims as those with a revenue center value indicating an ED visit, excluding any claims that involved only lab or imaging

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[68] LT file claims were not included in this analysis. Psychiatric hospital services may be reported in the LT file. We will assess reporting and update to include psychiatric hospitalization services excluded from the IP file in the addendum to the current report.

services in the ED. We identified observation claims based on the combination of revenue center code, CPT-code and a unit count of greater than or equal to eight hours.

In addition to the codes identified above, for Medicaid data, we reviewed claims not identified as inpatient and considered them as ED visits if the procedure code indicated ED visit (CPT code = 99281-99285) or a combination of the procedure code and place of service code indicated ED visit. If the entire claim only included lab and imaging codes based on CPT codes = 70000-79999 or 80000-89999, we did not count the claim as an ED visit.

ED visits that led to inpatient stays (i.e., ones that share the same start date with an inpatient stay) were excluded. If two or more ED visits or observation stays had the same patient identifier and date of service, we counted them as one visit.

c. Calculating outcome measures

Once we identified the services and expenditures for each core measure for each month, the monthly measures were summed to the appropriate analysis periods. Only services in a month where a person was eligible for analysis were included in the sums.[69] For individuals eligible for less than the full analysis period, the sum for the eligible months was divided by the proportion of the analysis period for which they were eligible to create a full-time equivalent measure. Regressions were weighted by the proportion of period for which the individual was eligible.[70]

2. Other measures

In this section we describe the methods for creating other dependent and independent variables included in our analyses.

a. Office visits

For Medicare, we identified well-care, primary care, and preventive care visits in the carrier, outpatient hospital, SNF and HHA files based having line items with any codes listed in Table B.10. For each intervention and comparison group member we summed the number of visits in each month that were well care, preventive care or office visit. If there were multiple claims with the same date of service they were count as only one visit even if the providers were different.

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[69] For example, if a person had third party insurance coverage in a particular month, they were not counted as eligible for the analysis in that month. In parallel any services provided in that month were excluded from the analysis.

[70] For KMHS, weights for comparison group members were also based on the number of comparison group members associated with the same participant.

Table B.10. Office visit services

Variable name	Specification
Primary care visit	CPT Code = 99201-99205, 99211-99215, 99304-99310, 99315-99316, 99318, 99324-99328, 99334-99350
Well-visit	CPT Code = 99381-99387, 99391-99397, 99432, 99461; ICD-9 = V20.2,V20.3, V70.0, V70.3,V70.5, V70.6, V70.8, V70.9; HPCPS = G0438, G0439
Preventive care	CPT Code = 99401-99404, 99406-99409, 99411-99412, 99420, 99429

Source: Mathematica review of Current Procedural Terminology, Healthcare Common Procedure Coding System and Guidance for identifying primary care services provided by the Centers for Medicare and Medicaid services under the Affordable Care Act (http://www.cms.gov/Regulations-and-Guidance/Guidance/Transmittals/downloads/R2161CP.pdf).

CPT= Current Procedural Terminology; ICD-9 = International Classification of Diseases, Ninth Revision; HCPCS = Healthcare Common Procedure Coding System.

b.   Analysis control variables

The control variables included in the KMHS regression models are listed in Table B.11 (Medicare) and Table B.12 (Medicaid) along with the specifications for the variables. Variables were derived based on the program enrollment data provided by KMHS, and Medicare or Medicaid administrative data.

Table B.11. Impact analysis model control variable specifications—KMHS Medicare

Variable name	Specification
Treatment indicator	Categorical variable indicating treatment status. Categories include: comparison group member (reference); KMHS intervention participants.
Cohort indicator	Categorical variable indicating cohort group status. Categories include: non-cohort group member (reference); cohort group member.
Interaction between treatment and cohort	Interaction between treatment and cohort indicator variables.
Intervention period	Categorical variable indicating time period of observation. Categories include: six-month increments of the pre-intervention and post-intervention periods.
Interaction between treatment and intervention period	Interaction between treatment and intervention period indicator variables.
Interaction between cohort and intervention period	Interaction between cohort and intervention period indicator variables.
Interaction between treatment, cohort, and intervention period	Interaction between treatment, cohort, and intervention period indicator variables.
Black non-Hispanic race	Indicator variable for individual's race categorized as Black non-Hispanic.
Hispanic ethnicity	Indicator variable for individual's ethnicity categorized as Hispanic.
Unknown race	Indicator variable for individual's race categorized as unknown.
Age	Continuous variable indicating age when first used mental health service at KMHS or a comparison facility in the analysis period (Medicare), or first used mental health service in the analysis period (Medicaid).
Age squared	Continuous variable measuring age as defined above squared.
Sex	Categorical variable of member's sex. Categories include: female (reference); male.
Mental health diagnosis indicators	Indicator variables for mental health diagnoses in first three months in analysis period receiving services at KMHS or comparison facility. Indicators included: schizophrenia; bipolar disorder; depression; persistent mental disorders due to conditions classified elsewhere; dementia; other psychotic disorders; anxiety, dissociative, and somatoform disorders; adjustment reaction disorder; drug or alcohol-related disorder; other mental health diagnosis.

Variable name	Specification
Dually Enrolled in Medicare and Medicaid	Indicator variable for dually enrolled in Medicare and Medicaid based on Medicare enrollment database at time of first mental health visit in analysis period at KMHS or comparison facility.
Disabled	Indicator variable for original reason for Medicare entitlement.
Pre-Period Medicare enrolled	Indicator variable for availability of 12 months of FFS Medicare claims data prior to month of first mental health visit during analysis period at KMHS or comparison facility. Individual must have Medicare as primary insurer, be enrolled in Parts A&B and not be enrolled in Medicare Advantage during the pre-period.
Length of time in mental health treatment	Continuous variable of length of time in mental health treatment.
Length of time in mental health treatment squared	Continuous variable of length of time in mental health treatment squared.
HCC conditions	Flags for conditions from HCC algorithm calculated based on 12 months of Medicare FFS claims data from 12 months prior to first mental health visit in analysis period at KMHS or comparison facility. We excluded conditions with less than 2% of the population.

FFS = fee-for=service; HCC = Hierarchical Condition Category.

Table B.12. Impact analysis model control variable specifications—KMHS Medicaid

Variable name	Specification
Treatment indicator	Categorical variable indicating treatment status. Categories include: comparison group member (reference); KMHS intervention participants.
Intervention period	Categorical variable indicating time period of observation. Categories include: six-month increments of the pre-intervention and post-intervention periods.
Cohort indicator	An indicator of whether a treatment group client was selected into a cohort or whether a comparison group member is matched to a cohort member.
Interaction between treatment and intervention period	Interaction between treatment and intervention period indicator variables.
Interaction between treatment and cohort	Interaction between treatment and cohort indicators variables.
Interaction between intervention period and cohort	Interaction between disabled and intervention period indicator variables.
Interaction between treatment, intervention period and cohort	Interaction between treatment, disabled, and intervention period indicator variables.
Disabled	Indicator variable for current Medicaid entitlement based on disability
Sex	Categorical variable of member's sex. Categories include: female (reference); male.
Black non-Hispanic race	Indicator variable for individual's race categorized as Black non-Hispanic.
Hispanic ethnicity	Indicator variable for individual's ethnicity categorized as Hispanic.
Unknown race	Indicator variable for individual's race categorized as unknown.
Pre-Period Medicaid enrolled	Indicator variable for availability of 12 months of Medicaid claims or encounter data prior to month of first mental health visit during analysis period.
Categorical indicator of age	Continuous variable indicating age when first used mental health service in the analysis period (Medicaid).
New to mental health treatment	Indicator of new to mental health treatment in period
Mental health diagnosis indicators	Indicator variables for mental health diagnoses in first three months in analysis period receiving services at KMHS or another facility. Indicators included: schizophrenia; bipolar disorder; depression; other psychotic disorders; anxiety, dissociative, and somatoform disorders; adjustment reaction disorder; drug or alcohol-related disorder; other mental health diagnosis.
CPDS Score Indicators	
AIDSH	AIDS, High

Variable name	Specification
CANH	Cancer, High
CANL	Cancer, Low
CANM	Cancer, Medium
CANVH	Cancer, Very High
CAREL	Cardiovascular, Extra Low
CARL	Cardiovascular, Low
CARM	Cardiovascular, Medium
CARVH	Cardiovascular, Very High
CCARM	Children's Cardiovascular, medium
CCARVH	Children's Cardiovascular, Very High
CERL	Cerebrovascular, Low
CGIH	Children's Gastro, High
CHEMEH	Children's Hematological, extra high
CHIVM	Children's HIV, medium
CINFM	Children's Infectious, medium
CMETH	Children's Metabolic, high
CNSH	Central Nervous System, High
CNSL	Central Nervous System, Low
CNSM	Central Nervous System, Medium
CPULH	Children's Pulmonary, high
CPULVH	Children's Pulmonary, very high
DDL	Developmental Disability, Low
DDM	Developmental Disability, Medium
DIA1H	Diabetes, Type 1 High
DIA1M	Diabetes, Type 1 Low
DIA2L	Diabetes, Type 2 High
DIA2M	Diabetes, Type 2 Low
EYEL	Eye, Low
EYEVL	Eye, Very Low
GENEL	Genital, Extra Low
GIH	Gastrointestinal, High
GIL	Gastrointestinal, Low
GIM	Gastrointestinal, Medium
HEMEH	Hematological, Extra High
HEML	Hematological, Low
HEMM	Hematological, Medium
HEMVH	Hematological, Very High
HIVM	HIV, Medium
INFH	Infectious, High
INFL	Infectious, Low
INFM	Infectious, Medium
METH	Metabolic, High
METM	Metabolic, Medium
METVL	Metabolic, Very Low
MRX1	Anti-coagulants
MRX2	Cardiac
MRX3	Psychosis/bipolar/depression
MRX4	Diabetes
MRX5	ESRD/Renal
MRX6	Hemophilia/von Willebrands
MRX7	Hepatitis
MRX8	HIV
MRX9	Infections, high

Variable name	Specification
MRX10	Inflammatory/Autoimmune
MRX11	Malignancies
MRX12	Multiple Sclerosis/Paralysis
MRX13	Parkinson's/Tremor
MRX14	Seizure disorders
MRX15	Tuberculosis
PRGCMP	Pregnancy, Complete
PRGINC	Pregnancy, Incomplete
PSYH	Psychiatric, High
PSYL	Psychiatric, Low
PSYM	Psychiatric, Medium
PSYML	Psychiatric, Medium Low
PULH	Pulmonary, High
PULL	Pulmonary, Low
PULM	Pulmonary, Medium
PULVH	Pulmonary, Very High
RENEH	Renal, Extra High
RENL	Renal, Low
RENM	Renal, Medium
RENVH	Renal, Very High
SKCL	Skeletal and Connective, Low
SKCM	Skeletal and Connective, Medium
SKCVL	Skeletal and Connective, Very Low
SKNH	Skin, High
SKNL	Skin, Low
SKNVL	Skin, Very Low
SUBL	Substance Abuse, Low
SUBVL	Substance Abuse, Very Low

CDPS = Chronic Illness and Disability Payment System.

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APPENDIX C:

MMC TECHNICAL METHODS

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A. Introduction

We conducted our analysis of MMC's program separately for Medicare and Medicaid participants because the service use and expenditure information to support the analyses were in distinct data sources. In the following sections, we describe our data sources (Section B), how we identified the intervention groups for the Medicare and Medicaid analyses (Section C), the steps to construct the comparison groups for the Medicare and Medicaid impact analysis (Section D), and how we specified the measures for both analyses (Section E).

B. Description of data sources

In this section, we provide a general overview of the data sources used in the analyses for MMC:

- **Finder files.** MMC provided files with participant social security number (SSN), program enrollment date, demographic information (date of birth and gender), and Medicaid and Medicare identifiers (HICs) for participants enrolled in these programs. The SSNs and Medicaid and Medicare program identifiers were used to identify program participants in Medicaid and Medicare administrative data. MMC provided a separate finder file with participants who initially received care management services through CBC, another Medicaid health home that MMC collaborated with beginning in 2014. We used the identifiers for these individuals to exclude them from both the intervention and the comparison group.

- **CMS Medicare administrative data.** Our analysis of MMC program impacts for the Medicare population used CMS Medicare administrative data. We obtained data files through the CMS's VRDC. We extracted all final action claims with dates of service from January 1, 2009 through June 30, 2015[71] for individuals for whom the HIC or SSN included in the MMC finder files matched to a BENE_ID in the VRDC cross-reference files. We extracted standard analytic base and revenue-center/line-item claims datasets for the following claim types: carrier, DME, home health, hospice, inpatient, outpatient, and skilled nursing facility. To obtain information on beneficiary Medicare enrollment spans we used the MBSF. The MBSF includes information on date of birth, gender, most recent county of residence, enrollment in MA, and third party insurance coverage.

- **New York State (NYS) Medicaid claims and enrollment data.** We obtained claims and enrollment data from the NYSDOH Medicaid Data Warehouse for the period from January 1, 2009 through June 30, 2015. The claims data provided information on FFS and managed care payment amounts. When service level payment information was not available for managed care covered services, these payment amounts were estimated based on FFS payment guidelines. Claims fields relevant to this analysis also included service type, provider type, and procedure and diagnosis codes. The enrollment data provided monthly Medicaid enrollment and demographic information. Participants in MMC's health home were selected for this extract based on Medicaid identifiers provided by MMC.

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[71] Claims for the intervention group members were extracted from February 29 to March 1, 2016. Claims for the comparison group were extracted from May 8–11, 2016.

- **Program service use data.** MMC provided a file with a record for each service provided through the program. Each record identified a service recipient, date of service, and service type.

C. Identification of the intervention populations

In this section, we discuss how we identified the intervention populations used in our Medicare and Medicaid analyses. We could not include all program participants in either analysis due to data source limitations as well as specific exclusion criteria we applied.

1.   Medicare

As described above, MMC provided Mathematica with HIC numbers for their Medicare enrolled participants who enrolled in the MMC program between February 2013 and June 2015. We used these identifiers to extract Medicare enrollment and claims data for participants from CMS's VRDC. We started with 2,138 MMC Medicare participants and applied a number of exclusions in the following order:

- **CBC enrollees.** We excluded 764 participants who received care management services through Coordinated Behavioral Care (CBC), another Medicaid health home with which MMC collaborated beginning in 2014. We excluded CBC participants from the analysis because they primarily received services outside of the MMC Medicaid health home program and these services were not funded by HCIA.

- **Missing enrollment information.** We excluded 195 participants from our analysis because they were missing MBSF data in their MMC enrollment year.

- **Lack of Medicare FFS enrollment.** We excluded 563 participants from the sample because they were not continuously enrolled with FFS Medicare as their primary payer for six months around their program enrollment month (three months before their enrollment month, the month of enrollment, two months after enrollment). We excluded three participants because they were enrolled in FFS Medicare Parts A and B with Medicare as primary payer for less than 6 months in the 12 months before enrollment.

- **Geographic location.** We excluded 25 participants from the sample because they were not physically located in the MMC service area in Brooklyn, NY (as measured by zip code) during the month of enrollment.

- **Lack of SMI diagnosis in claims.** Beneficiaries were required to have a diagnosis of at least one of the targeted SMI condition categories: schizophrenia and related disorders, bipolar disorders, depressive disorders, other psychotic disorders, and childhood emotional disturbance. Beneficiaries were defined as having a condition if they had at least one inpatient or two or more outpatient claims (not including prescription drugs) with the relevant diagnoses in the two years prior to enrollment. We excluded 120 participants from the sample because they did not have a diagnosis of at least one of the targeted SMI condition categories in the claims data in the two years prior to enrollment. Then, we dropped participants with diagnoses of other psychotic disorders (n=7) and childhood emotional disturbance (n=0) due to small sample size. See Table C.1 below for the diagnosis codes used to identify participants with the three remaining qualifying SMI condition category.

Although our exclusions were processed in the order above, it should be noted that most participants who were excluded, were excluded for multiple reasons. Our final pre-matching Medicare intervention group included 464 participants.

Table C.1. Diagnoses codes used to identify qualifying condition categories in treatment and comparison groups

Schizophrenia and related disorders	295.XX including 295.00
Bipolar disorders	296.00, 296.01, 296.02, 296.03, 296.04, 296.05, 296.06, 296.10, 296.11, 296.12, 296.13, 296.14, 296.15, 296.16, 296.40, 296.41, 296.42, 296.43, 296.44, 296.45, 296.46, 296.50, 296.51, 296.52, 296.53, 296.54, 296.55, 296.56, 296.60, 296.61, 296.62, 296.63, 296.64, 296.65, 296.66, 296.7, 296.80, 296.81, 296.82, 296.89, 296.90, 296.99
Depressive disorders	296.20, 296.22, 296.23, 296.24, 296.25, 296.26, 296.30, 296.32, 296.33, 296.34, 296.35, 296.36
Other psychotic disorders	293.81, 293.82, 293.83
Childhood emotional disturbance	301.13

Source: ICD-9 diagnosis codes, version 32
          (https://www.cms.gov/medicare/coding/ICD9providerdiagnosticcodes/codes.html).

ICD-9 = International Classification of Diseases, Ninth Revision.

2.   Medicaid

MMC provided Mathematica with Medicaid program identifiers for their Medicaid enrolled participants who enrolled in the MMC program between November 2012 and June 2015. We obtained claims and enrollment data from the NYSDOH Medicaid Data Warehouse, using these identifiers to obtain data for MMC participants. We started with 8,946 MMC Medicaid participants who matched to NY data and applied three exclusions in the following order:

- **Medicare-Medicaid dual enrollees.** We excluded 1,349 participants who were dually enrolled in both Medicare and Medicaid.

- **CBC enrollees.** We excluded an additional 2,079 participants who received care management services through Coordinated Behavioral Care (CBC), another Medicaid health home with which MMC collaborated beginning in 2014. As for the Medicare analytic population, we excluded CBC participants from the analysis because they primarily received services outside of the MMC Medicaid health home program and these services were not funded by HCIA.

- **Lack of full-benefit enrollment.** We excluded 1,508 participants from the sample because they were not continuously enrolled with near full Medicaid benefits and Medicaid as their primary payer for six months prior to their enrollment month, their program enrollment month, and five months after their program enrollment month.

Our final Medicaid intervention group for the descriptive analyses of expenditures by type of service (Report Section C.4) included 4,010 participants. We made an additional exclusion for the Medicaid impact analyses (Report Section C.3):

- **Lack of SMI diagnosis in claims.** Beneficiaries were required to have a diagnosis of at least one of the targeted SMI condition categories: schizophrenia and related disorders, bipolar disorders, depressive disorders, other psychotic disorders, and childhood emotional disturbance. Beneficiaries were defined as having a condition if they had at least one claim with the relevant diagnoses in the two years prior to enrollment. We excluded 639 participants from the sample because they did not have a diagnosis of at least one of the targeted SMI condition categories in the claims data in the two years prior to enrollment. See Table C.1 above for the diagnosis codes used to identify participants with the qualifying SMI condition category.

Our final Medicaid intervention group for the impact analysis included 3,371 participants. Participants without an SMI diagnosis identified in the claims were excluded from the impact analysis because SMI diagnosis is necessary to assure that intervention group members are matched to comparison group member with the same diagnosis.

D. Identification of the comparison population

We used matching techniques to develop a comparison groups for MMC's FFS Medicare and Medicaid participants. Propensity score matching and related matching methods are designed to create a comparison group that is similar in observable characteristics to the treatment group (Rosenbaum and Rubin 1983; Dehejia and Wahba 2002). Limiting the comparison groups to a matched subsample of Medicare and Medicaid beneficiaries—closely matching on observed characteristics of the participants—may also reduce differences between participants and comparison group members in terms of unobserved characteristics if those characteristics are correlated with matching variables.

1. Medicare

We identified Medicare enrollees residing in three comparison cities (Philadelphia, Pennsylvania; Pittsburg, Pennsylvania; and Chicago, Illinois) with schizophrenia and related disorders, bipolar disorders, and/or depressive disorders[72] as the potential group of comparison patients. We focused on this subset of qualifying condition diagnoses because there were only seven individuals with the other two qualifying diagnoses—other psychotic disorders and childhood emotional disturbance—in the treatment group and these individuals were excluded from the analysis.

We chose a comparison group outside of NYS for several reasons. First, NYS's health home program was implemented across NYS and individuals enrolled in Medicare who are dually enrolled in Medicaid with eligibility for full Medicaid benefits are able to enroll. Thus, potential comparison group members for participants who were dually eligible for full Medicaid benefits may have been matched to individuals enrolled in other health homes, making them an inappropriate comparison group because they would be affected by a similar intervention. In addition, we were unable to obtain provider identifiers for all of MMC's many partners. Thus, we could not exclude patients from the comparison group who were not participating in the intervention but who received services from an MMC-participating provider, and thus may have

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[72] We excluded participants with diagnoses of other psychotic disorders or childhood emotional disturbance only from our analysis due to small sample size.

indirectly benefited from the intervention. By going outside of NYS to choose the comparison group, this potential contamination was avoided. To identify the most appropriate cities to use as comparison sites to MMC's service area in Brooklyn, NY, we conducted a comprehensive analysis of the relevant demographic, socioeconomic, and health care factors of approximately 20 of the largest urban centers in the country that are also located in states that did not implement a Medicaid health home program. We compared locations by examining the following characteristics: total Medicare spending per beneficiary, Medicare enrollee hospital discharge rates, the number of all physicians and primary care physicians per 100,000 residents, city poverty rate, and median household income. These characteristics are listed in Table C.2 below.

Table C.2. Characteristics of major metropolitan areas nation-wide without Medicaid Health Home Program

Candidates	City pop. rank	Region	Price, age, sex, and race adjusted total Medicare spending, 2012	Hospital discharges per 1,000 Medicare enrollees, 2012	All physicians per 100,000 residents, 2011	Primary care physicians per 100,000 residents, 2011	City poverty rate, 2010[a]	City median household income, 2010[a]	Total number of Medicare enrollees, 2012
Brooklyn, NY	*#1 (Part of NYC)*	*NE*	*$11,371*	*323.1*	*267*	*94*	*23.4%*	*$46,958*	*153,548*
Boston, MA	#10	NE	**$9,632**	286.5	325	117	21.9%	$54,485	70,962
San Antonio, TX	*#25*	*South*	*$10,330*	*262.7*	*195*	*63*	*20.1%*	*$46,317*	*141,885*
San Bernardino, CA	#13	West	$10,508	289.1	**173**	65	**33.0%**	$38,774	11,852
Pittsburgh, PA	*#22*	*NE*	*$10,725*	*313.5*	*226*	*76*	*22.8%*	*$40,009*	*61,122*
Philadelphia, PA	*#5*	*NE*	*$10,554*	*316.1*	*279*	*91*	*26.7%*	*$37,460*	*120,007*
Joilet, IL	#3 (Part of Chicago)	Midwest	$10,958	375.7	194	64	**12.5%**	**$62,008**	52,860
Chicago, IL	*#3*	*Midwest*	*$11,017*	*321.3*	*260*	*102*	*22.7%*	*$47,831*	*205,812*
Dallas, TX	#4	South	$11,039	**255.2**	208	66	24.1%	$43,359	149,774
Tampa, FL	*#19*	*South*	*$11,427*	*303.4*	*203*	*70*	*22.0%*	*$43,740*	*58,072*
Houston, TX	#6	South	$11,535	262.4	175	**50**	22.9%	$45,728	234,994
Fort Lauderdale, FL	*#8*	*South*	*$11,808*	*293.9*	*238*	*84*	*21.2%*	*$48,898*	*37,549*
Fort Worth, TX	#4 (Part of Dallas)	South	$11,905	304.9	**165**	**57**	19.3%	$52,492	72,874
Gary, IN	#3 (Part of Chicago)	Midwest	$12,260	**416.8**	192	62	**38.7%**	**$27,458**	24,945
Los Angeles, CA	#2	West	**$12,907**	313.2	236	79	22.4%	$49,682	109,206
Thresholds around the Brooklyn, NY mean			+/- 10%	+/- 20%	+/- 35%	+/- 35%	+/-20%	+/- 21%	n.a.

Source: "The Dartmouth Atlas of Health Care." 2016. The Dartmouth Institute for Health Policy and Clinical Practice. Available at http://www.dartmouthatlas.org/data/region/.

Note: Gray shading with bold and italicized text indicates the Brooklyn, NY mean to which other cities are compared. Red shading with bold text indicates values that fall outside the thresholds around the Brooklyn, NY mean. Blue shading with italicized text indicates cities for which all values fall within the thresholds.

[a] US Census Bureau Community Facts, 2010-2014 American Community Survey 5-Year Estimates. Available at http://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml.

n.a. = not applicable.

Chicago, Pittsburg, and Philadelphia were the only three cities that were similar to Brooklyn on all measures of interest, and were also comparable in regard to region and population composition. Like Brooklyn, the three comparison cities are major east coast or Midwest metropolitan areas. Unlike NYS, neither Pennsylvania nor Illinois started a health home program. In addition, we did not identify any major changes to the Medicaid program during the relevant time period in either state; thus, care was more stable in Philadelphia, Pittsburg, and Chicago, making them good comparisons.

From within the general pool of FFS Medicare enrollees with the targeted SMI diagnoses in the three comparison cities, we matched individuals to MMC's Medicare participants. Constructing the matched comparison group involved several steps, which we detail below.

Step 1: Identify potential comparison pool members. We initially extracted claims and enrollment information for all Medicare beneficiaries residing in the three comparison cities who had claims indicating one or more of the three qualifying conditions[73] during a 24-month period prior to any month between February 2013 and March 2015. For each potential comparison pool member, we needed to create a pseudo-enrollment month that reflected the month when the member likely would have enrolled in the intervention if they had been a participant. The pseudo-enrollment month allows us to define the pre- and post-intervention periods for the analysis. For each person in the potential comparison pool we identified all the months between February 2013 and March 2015 which had an eligible SMI diagnosis in the prior 24 months and an office visit claim in the current month. These criteria aim to ensure potential comparison beneficiaries have at least one target condition during the 24-month pre-period and that they have some engagement with the healthcare system, as measured by a primary care visit. Comparison pool members who did not have any months meeting this criteria were dropped. For remaining potential comparison pool members, we randomly selected one of their eligible months to be the pseudo-enrollment month, weighting the probability of selecting a given month based on the proportion of intervention participants who enrolled in the same month relative to the proportion of comparison pool members for which the month could be selected.

Step 2: Apply exclusion criteria. Once each potential comparison pool member had a pseudo-enrollment month assigned, we applied exclusion criteria parallel to the exclusion criteria for intervention group members discussed above. We excluded comparison pool members who were not continuously enrolled with FFS Medicare as their primary payer for six months around their pseudo-enrollment month (three months before their enrollment month, the month of enrollment, two months after enrollment). We also required at least six months of FFS Medicare data in the year prior to pseudo-enrollment. We excluded any potential comparison group members whose current or original eligibility is by end stage renal disease (ESRD).

Our potential comparison group included 48,067 beneficiaries who met all inclusion criteria and for whom we were able to set a pseudo-enrollment date.

Step 3: Match treatment participants at the individual level. The matching process used metrics of individual-level characteristics identified based on pre-period data to select a subset of comparison pool members who were as similar as possible to the intervention group on

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[73] At least one inpatient or two outpatient claims with the indicated diagnoses.

observable characteristics. The matching algorithm first exact matched on diagnoses of schizophrenia and related disorders, bipolar disorders, and/or depressive disorders, and disability status. We then fit a propensity score model. A beneficiary's propensity score is the probability of belonging to the treatment group estimated from this model. We included the following characteristics in the model: age, sex, race (White, Black, and other), dual status, HCC condition indicators (created as part of creating the HCC score),[74] the number of months the beneficiary was Medicare FFS eligible during the year prior to enrollment (or pseudo-enrollment), year and month of enrollment (or pseudo-enrollment), and number of qualifying condition categories (i.e., one, two, or three of the qualifying condition categories). We also included pre-period levels of two of the core outcomes measures (hospitalizations and ED visits), as well as the number of primary care visits, broken out into categories for the 12 months prior to enrollment. We chose not to include total expenditures due to potential differences in Medicare geographic adjustments to payment in New York City versus the comparison sites that might lead to different levels of spending for individuals with the same acuity. We also did not include readmissions due to the small number of participants who had readmissions.

We matched up to seven comparison group beneficiaries to each treatment group beneficiary. When a treatment beneficiary was difficult to match (that is, had few similar comparison beneficiaries), the algorithm conducted a pair match. When there was an abundance of comparisons for a treatment beneficiary, the algorithm matched multiple comparisons. The statistical goal was first to minimize bias and then, subject to that constraint, maximize the size of the comparison sample. The optimal matching algorithm that we used selected comparison beneficiaries without replacement and minimized the overall differences between treated and matched comparison beneficiaries so that they were similar, on average, on observed characteristics in the pre-period.

Step 4. Assess the quality of the match. This section describes diagnostic tests that we used to assess the quality of the matches.

We began by examining the ratio of potential comparison beneficiaries to treatment beneficiaries by exact matching strata prior to matching in order to understand how difficult it might be to match at least one comparison beneficiary to each participant. For example, if many strata had low ratios of potential comparison beneficiaries to participants prior to matching, we might have considered reducing the number of variables used for exact matching. We found a sufficient number of comparison group individuals for each treatment group person in each strata.

We graphically compared the propensity score distributions[75] for all treatment and comparison beneficiaries prior to matching, looking for overlap in the propensity scores for the treatment and comparison groups (Figure C.1). The distribution of propensity scores differed

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[74] HCC score = Hierarchical Condition Category Score. The HCC model was developed to risk adjust Medicare payments to Medicare Advantage plans by assessing expected expenditures of enrollees. The HCC score provides a proxy of overall health status, as sicker individuals are expected to cost more than healthier individuals.

[75] We calculated the log-odds of the propensity score rather than the more common probability scale, because log odds provided better overlap.

between the two groups, which is to be expected; however, there appeared to be sufficient overlap to find comparison group members for each treatment group member.

Figure C.1. Log-odds of propensity score distributions for treatment and comparison pool members (Medicare)
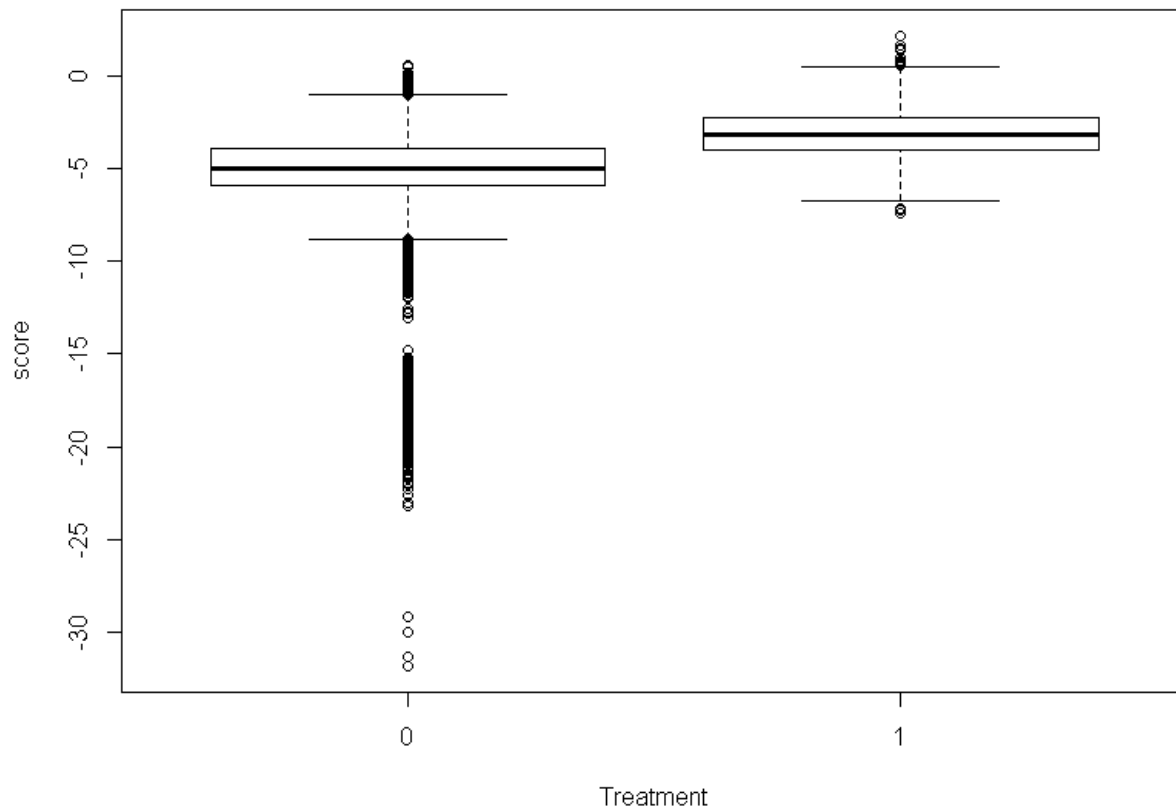
Source: Mathematica analysis of data from the Master Beneficiary Summary File, February 2012-January 2013.

Note: Figure presents boxplots created using the log-odds of the estimated propensity scores for the comparison and treatment groups, in the left and right panels respectively. The width of the boxplots corresponds to the amount of data that contributed to the plots.

After we conducted matching, we examined the number of comparison beneficiaries matched to each treatment beneficiary (Table C.3). A large number of 1:1 matches, or a large number of comparison beneficiaries that were excluded, could indicate that the matching was problematic. This was not an unexpected problem for MMC, as we knew that treatment group members were actively recruited and that selection criteria could not be mimicked for the comparison group. However, we found the number and distribution of matches to be acceptable. After the matching, there were 4,923 matched beneficiaries in the comparison group.

Table C.3. Frequency table of ratio of treatment beneficiaries to comparison beneficiaries for each matched set (Medicare)

Ratio of treatment to comparison beneficiaries	1:1	1:2	1:3	1:4	1:5	1:6	1:7
Number of matched sets	126	24	23	24	28	22	616

Source: Mathematica analysis of data from the Master Beneficiary Summary File, February 2012-January 2013.

Note: Each cell indicates the number of treatment beneficiaries matched to the number of comparison beneficiaries indicated for that column.

After evaluating the basic matching diagnostics above, we examined the overall balance of the matched sample. We used an omnibus test that checks for covariate balance across the treatment and matched comparison beneficiaries (Hansen and Bowers 2008). The omnibus test is based on the differences between treatment and matched comparison beneficiaries across the matching variables; these differences are standardized by their variances and covariances and aggregated into a single number, a weighted mean. Standardization in this way implies that a matching variable whose difference across matched sets has a small variance is given more weight and that a matching variable whose difference across sets is highly correlated with other differences is given less weight. The advantages of the omnibus test are: (1) it generates a single probability statement through one p-value; (2) its distribution is roughly chi-square, which facilities the calculation of the p-value; and (3) it assesses balance on all linear combinations of the matching variables. However, a significant result from this chi-squared test may be driven by a large sample size rather than substantive differences between treatment and matched comparison groups. Alternatively, it could indicate that there may be some imbalance between the two groups on at least one of the matching variables. The results of this test were a chi-square statistic of 132.83 and associated p-value of 0.02.

To further investigate imbalance between treatment and matched comparison groups, we evaluated how matching affected the balance on all matching variables by comparing the absolute and standardized differences between the treatment and comparison groups for each variable before and after matching (Figure C.2). The standardized difference measures the difference in means in units of the pooled standard deviation. The standardized difference measure is advantageous in that it allows us to compare all variables on the same scale. We compared the standardized differences using plots with dashed lines at +/- 0.10 and +/- 0.20 standardized differences to visually inspect whether we obtained good balance for each variable.

Figure C.2. Balance plot comparing the standardized difference for each matching variable before and after matching (Medicare)
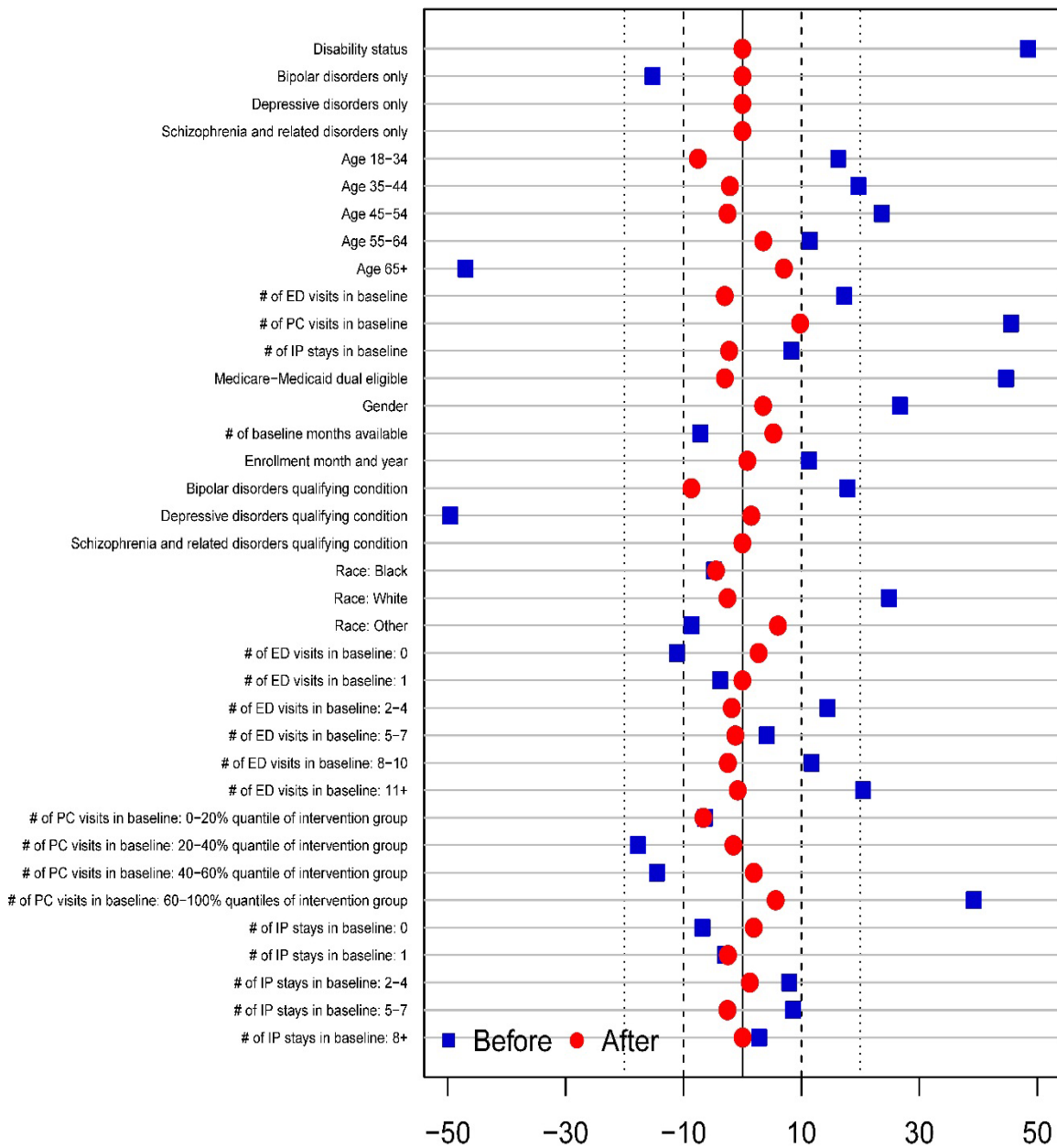
Figure C.2 *(continued)*
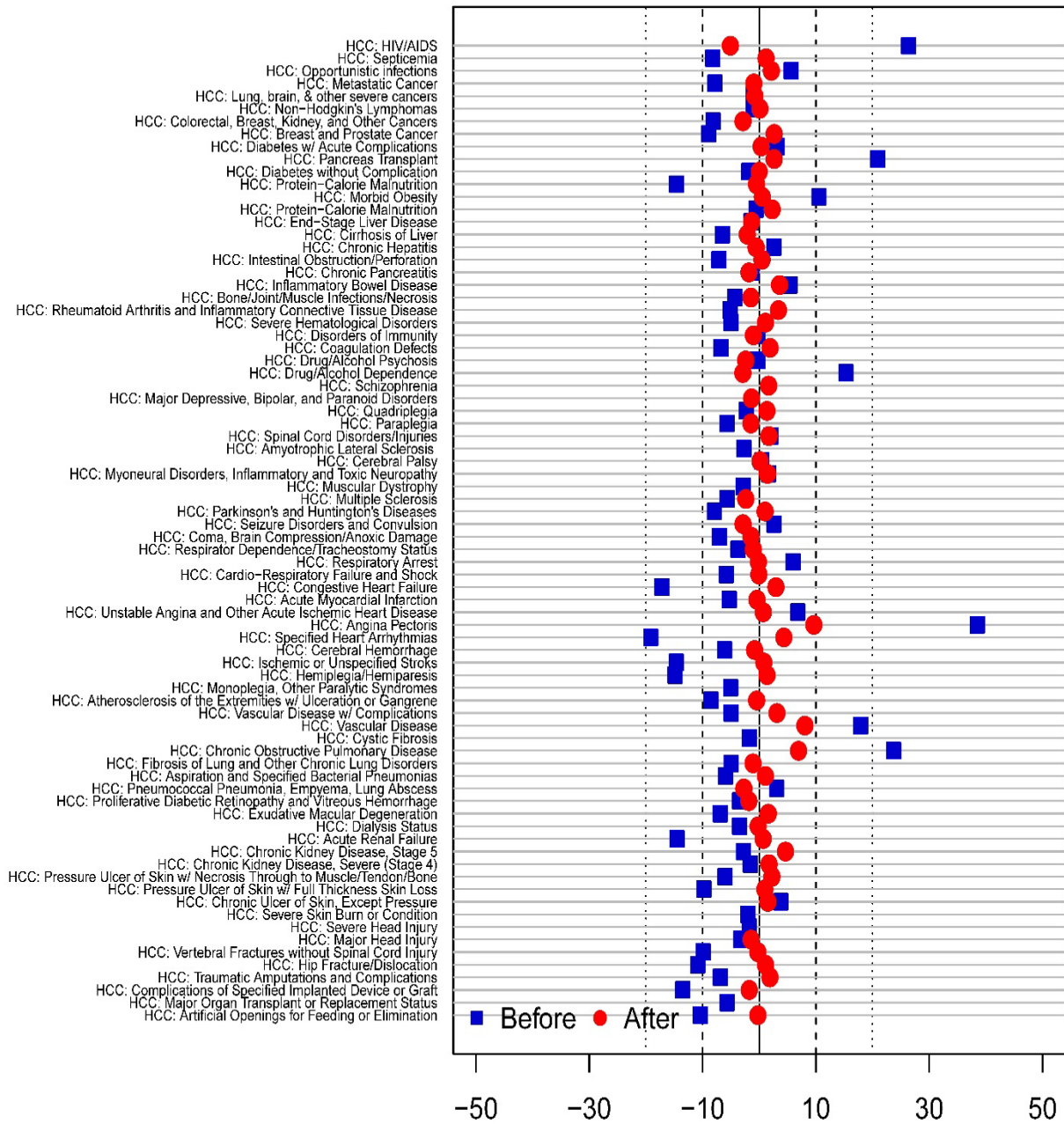
Source: Mathematica analysis of data from the Master Beneficiary Summary File, February 2012-January 2013.

Table C.4. Balance table before and after matching (MMC Medicare)

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	p	Comparison	Intervention	adj.diff	std.diff	p
	Exact match variables										
	Hierarchical diagnosis code prior to program enrollment										
HIER_DX BIPOLAR	Bipolar disorders	0.2729	0.2051	-0.0678	-0.1524	0.0000	0.2051	0.2051	0.0000	0.0000	1.0000
HIER_DX DEPRESSION	Depressive disorders	0.4194	0.0869	-0.3325	-0.6778	0.0000	0.0869	0.0869	0.0000	0.0000	1.0000
HIER_DX SCHIZOPHRENIA	Schizophrenia and related disorders	0.3077	0.708	0.4003	0.8674	0.0000	0.7080	0.7080	0.0000	0.0000	1.0000
DISABLED	Disability status	0.6563	0.8853	0.229	0.4844	0.0000	0.8853	0.8853	0.0000	0.0000	1.0000
	Propensity score variables										
	Age group										
AGE_CAT18-34	18-34	0.0616	0.1008	0.0392	0.1623	0.0000	0.1257	0.1008	-0.0249	-0.0754	0.0376
AGE_CAT35-44	35-44	0.0941	0.1518	0.0577	0.1966	0.0000	0.1596	0.1518	-0.0078	-0.0212	0.5783
AGE_CAT45-54	45-54	0.1792	0.2700	0.0908	0.2361	0.0000	0.2812	0.2700	-0.0112	-0.0253	0.5069
AGE_CAT55-64	55-64	0.2021	0.2480	0.0459	0.1142	0.0009	0.2329	0.2480	0.0151	0.0353	0.3570
AGE_CAT65+	65+	0.4630	0.2294	-0.2336	-0.4697	0.0000	0.2007	0.2294	0.0288	0.0705	0.0091
DUAL	Dually enrolled in Medicare and Medicaid	0.5426	0.7648	0.2222	0.4470	0.0000	0.7776	0.7648	-0.0129	-0.0297	0.3903
MALE	Male	0.4252	0.5574	0.1321	0.2672	0.0000	0.5398	0.5574	0.0175	0.0352	0.3549
PRE_ENROLL_LNGTH	Length of pre-period Medicare enrollment	11.8427	11.7891	-0.0536	-0.0716	0.0372	11.7397	11.7891	0.0495	0.0526	0.1692
	Mental health diagnosis										
QUAL_BIPOLAR_COND	Bipolar disorder	0.3827	0.4693	0.0866	0.1781	0.0000	0.5126	0.4693	-0.0433	-0.0865	0.0073
QUAL_DEPR_COND	Depression	0.5433	0.2966	-0.2466	-0.4958	0.0000	0.2898	0.2966	0.0068	0.0150	0.6526
QUAL_SCHIZ_COND	Schizophrenia	0.3077	0.7080	0.4003	0.8674	0.0000	0.7080	0.7080	0.0000	0.0000	1.0000
	Race/ethnicity										
RACE_CATBLACK	African American, not Hispanic	0.3498	0.3268	-0.0231	-0.0484	0.1591	0.3484	0.3268	-0.0217	-0.0448	0.2048
RACE_CATOTHER	Other	0.0745	0.1402	0.0657	0.2487	0.0000	0.1487	0.1402	-0.0085	-0.0253	0.5270
RACE_CATWHITE	White	0.5757	0.5330	-0.0427	-0.0863	0.0120	0.5029	0.5330	0.0301	0.0603	0.1095
	Number of ED visits in 12 months prior to program enrollment										
BASE_ER_VST_CAT0	0	0.5788	0.5238	-0.0550	-0.1114	0.0012	0.5101	0.5238	0.0137	0.0274	0.4744
BASE_ER_VST_CAT1	1	0.2077	0.1924	-0.0154	-0.0379	0.2695	0.1924	0.1924	0.0000	0.0000	0.9997
BASE_ER_VST_CAT2-4	2-4	0.1644	0.1796	0.0153	0.0411	0.2311	0.1841	0.1796	-0.0045	-0.0118	0.7622
BASE_ER_VST_CAT5-7	5-7	0.0280	0.0475	0.0195	0.1172	0.0006	0.0527	0.0475	-0.0052	-0.0247	0.5424
BASE_ER_VST_CAT8-10	8-10	0.0092	0.0290	0.0198	0.2043	0.0000	0.0302	0.0290	-0.0012	-0.0079	0.8607

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	p	Comparison	Intervention	adj.diff	std.diff	p
BASE_ER_VST_CAT11+	11+	0.0120	0.0278	0.0158	0.1441	0.0000	0.0306	0.0278	-0.0028	-0.0181	0.6814
	Relative number of primary care visits in 12 months prior to program enrollment										
BASE_PC_VST_CAT0-20%	0-20%	0.2041	0.1784	-0.0257	-0.0637	0.0635	0.2064	0.1784	-0.0279	-0.0662	0.0443
BASE_PC_VST_CAT20-40%	20-40%	0.2710	0.1924	-0.0786	-0.1773	0.0000	0.1987	0.1924	-0.0064	-0.0152	0.6509
BASE_PC_VST_CAT40-60%	40-60%	0.2794	0.2144	-0.0650	-0.1451	0.0000	0.2063	0.2144	0.0081	0.0194	0.5804
BASE_PC_VST_CAT60-100%	60-100%	0.2455	0.4148	0.1693	0.3923	0.0000	0.3886	0.4148	0.0262	0.0565	0.0680
	Number of hospitalizations in 12 months prior to program enrollment										
BASE_STAY_CNT_CAT 0	0	0.6274	0.5944	-0.0329	-0.0681	0.0475	0.5850	0.5944	0.0094	0.0193	0.6188
BASE_STAY_CNT_CAT 1	1	0.1901	0.1784	-0.0116	-0.0296	0.3883	0.1880	0.1784	-0.0095	-0.0245	0.5209
BASE_STAY_CNT_CAT 2-4	2-4	0.1468	0.1750	0.0282	0.0795	0.0206	0.1704	0.1750	0.0046	0.0127	0.7562
BASE_STAY_CNT_CAT 5-7	5-7	0.0248	0.0382	0.0134	0.0859	0.0124	0.0427	0.0382	-0.0045	-0.0253	0.5795
BASE_STAY_CNT_CAT 8+	8+	0.0110	0.0139	0.0029	0.0282	0.4120	0.0139	0.0139	0.0000	0.0004	0.9925
BASE_TOT_PMT	Total Medicare expenditures in 12 months prior to program enrollment	21,388.3667	25,075.5966	3,687.2300	0.1015	0.0031	20,398.4237	25,075.5966	4,677.1729	0.1648	0.0000
	Hierarchical Condition Category condition indicators										
HCC1	HIV/AIDS	0.0253	0.0672	0.0420	0.2638	0.0000	0.0788	0.0672	-0.0116	-0.0507	0.2303
HCC2	Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock	0.0503	0.0324	-0.0179	-0.0820	0.0170	0.0304	0.0324	0.0020	0.0122	0.7622
HCC6	Opportunistic Infections	0.0069	0.0116	0.0047	0.0565	0.0999	0.0095	0.0116	0.0021	0.0215	0.5593
HCC8	Metastatic Cancer and Acute Leukemia	0.0119	0.0035	-0.0084	-0.0783	0.0226	0.0040	0.0035	-0.0006	-0.0094	0.8030
HCC9	Lung and Other Severe Cancers	0.0128	0.0116	-0.0012	-0.0106	0.7582	0.0124	0.0116	-0.0008	-0.0074	0.8520

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	p	Comparison	Intervention	adj.diff	std.diff	p
HCC10	Lymphoma and Other Cancers	0.0127	0.0116	-0.0011	-0.0102	0.7661	0.0114	0.0116	0.0001	0.0014	0.9737
HCC11	Colorectal, Bladder, and Other Cancers	0.0176	0.0070	-0.0107	-0.0815	0.0176	0.0093	0.0070	-0.0023	-0.0285	0.5057
HCC12	Breast, Prostate, and Other Cancers and Tumors	0.0480	0.0290	-0.0191	-0.0895	0.0092	0.0247	0.0290	0.0043	0.0266	0.4756
HCC17	Diabetes with Acute Complication	0.0096	0.0127	0.0031	0.0320	0.3509	0.0124	0.0127	0.0004	0.0036	0.9329
HCC18	Diabetes with Chronic Complications	0.1365	0.2086	0.0721	0.2093	0.0000	0.1987	0.2086	0.0098	0.0265	0.5218
HCC19	Diabetes without Complication	0.1727	0.1657	-0.0070	-0.0184	0.5921	0.1657	0.1657	0.0000	0.0001	0.9983
HCC21	Protein-Calorie Malnutrition	0.0417	0.0127	-0.0290	-0.1458	0.0000	0.0133	0.0127	-0.0005	-0.0046	0.8946
HCC22	Morbid Obesity	0.0713	0.0985	0.0272	0.1054	0.0022	0.0969	0.0985	0.0015	0.0055	0.8905
HCC23	Other Significant Endocrine and Metabolic Disorder	0.0475	0.0463	-0.0012	-0.0056	0.8709	0.0419	0.0463	0.0045	0.0230	0.5798
HCC27	End-Stage Liver Disease	0.0095	0.0081	-0.0014	-0.0144	0.6749	0.0095	0.0081	-0.0014	-0.0133	0.7036
HCC28	Cirrhosis of Liver	0.0116	0.0046	-0.0069	-0.0652	0.0578	0.0062	0.0046	-0.0016	-0.0209	0.5765
HCC29	Chronic Hepatitis	0.0207	0.0243	0.0037	0.0256	0.4554	0.0252	0.0243	-0.0008	-0.0055	0.8876
HCC33	Intestinal Obstruction/Perforation	0.0308	0.0185	-0.0122	-0.0711	0.0385	0.0179	0.0185	0.0007	0.0051	0.8957
HCC34	Chronic Pancreatitis	0.0056	0.0046	-0.0010	-0.0129	0.7071	0.0059	0.0046	-0.0013	-0.0180	0.6396
HCC35	Inflammatory Bowel Disease	0.0125	0.0185	0.0060	0.0541	0.1152	0.0144	0.0185	0.0042	0.0360	0.4137
HCC39	Bone/Joint/Muscle Infections/Necrosis	0.0225	0.0162	-0.0063	-0.0426	0.2147	0.0181	0.0162	-0.0018	-0.0145	0.7187
HCC40	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	0.0584	0.0463	-0.0120	-0.0514	0.1346	0.0396	0.0463	0.0068	0.0341	0.3768
HCC46	Severe Hematological Disorders	0.0078	0.0035	-0.0043	-0.0496	0.1489	0.0028	0.0035	0.0007	0.0113	0.7353
HCC47	Disorders of Immunity	0.0188	0.0185	-0.0003	-0.0020	0.9543	0.0198	0.0185	-0.0013	-0.0101	0.8015
HCC48	Coagulation Defects and Other Specified Hematological Disorders	0.0587	0.0429	-0.0158	-0.0675	0.0493	0.0392	0.0429	0.0037	0.0192	0.6244
HCC54	Drug/Alcohol Psychosis	0.0376	0.0371	-0.0005	-0.0026	0.9399	0.0417	0.0371	-0.0046	-0.0237	0.5405
HCC55	Drug/Alcohol Dependence	0.0616	0.0985	0.0369	0.1529	0.0000	0.1071	0.0985	-0.0086	-0.0288	0.4490

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	p	Comparison	Intervention	adj.diff	std.diff	p
HCC57	Schizophrenia	0.2656	0.6651	0.3995	0.9034	0.0000	0.6569	0.6651	0.0082	0.0168	0.3445
HCC58	Major Depressive, Bipolar and Paranoid Disorders	0.5493	0.2677	-0.2816	-0.5670	0.0000	0.2739	0.2677	-0.0062	-0.0135	0.5097
HCC70	Quadriplegia	0.0051	0.0035	-0.0016	-0.0228	0.5063	0.0027	0.0035	0.0008	0.0138	0.6907
HCC71	Paraplegia	0.0053	0.0012	-0.0041	-0.0571	0.0963	0.0018	0.0012	-0.0006	-0.0144	0.6684
HCC72	Spinal Cord Disorders/Injuries	0.0117	0.0139	0.0022	0.0206	0.5496	0.0121	0.0139	0.0018	0.0172	0.6833
HCC73	Amyotrophic Lateral Sclerosis and Other Motor	0.0007	0.0000	-0.0007	-0.0272	0.4278	0.0000	0.0000	0.0000	N/A	1.0000
HCC74	Cerebral Palsy	0.0055	0.0058	0.0003	0.0047	0.8922	0.0057	0.0058	0.0001	0.0017	0.9644
HCC75	Myasthenia Gravis/Myoneural Disorders, Inflammatory and Toxic Neuropathy	0.0143	0.0162	0.0020	0.0166	0.6286	0.0145	0.0162	0.0017	0.0147	0.7205
HCC76	Muscular Dystrophy	0.0008	0.0000	-0.0008	-0.0284	0.4086	0.0000	0.0000	0.0000	N/A	1.0000
HCC77	Multiple Sclerosis	0.0119	0.0058	-0.0061	-0.0566	0.0996	0.0079	0.0058	-0.0021	-0.0236	0.5026
HCC78	Parkinson's and Huntington's Diseases	0.0340	0.0197	-0.0143	-0.0790	0.0215	0.0183	0.0197	0.0014	0.0106	0.7849
HCC79	Seizure Disorders and Convulsions	0.1021	0.1101	0.0080	0.0263	0.4435	0.1189	0.1101	-0.0088	-0.0285	0.4800
HCC80	Coma, Brain Compression/Anoxic Damage	0.0070	0.0012	-0.0058	-0.0704	0.0405	0.0017	0.0012	-0.0006	-0.0141	0.6857
HCC82	Respirator Dependence/Tracheostomy Status	0.0094	0.0058	-0.0036	-0.0372	0.2791	0.0065	0.0058	-0.0007	-0.0101	0.8159
HCC83	Respiratory Arrest	0.0007	0.0023	0.0016	0.0594	0.0838	0.0024	0.0023	-0.0001	-0.0013	0.9787
HCC84	Cardio0Respiratory Failure and Shock	0.0483	0.0359	-0.0124	-0.0580	0.0914	0.0360	0.0359	-0.0001	-0.0006	0.9896
HCC85	Congestive Heart Failure	0.1670	0.1031	-0.0638	-0.1716	0.0000	0.0944	0.1031	0.0087	0.0297	0.4233
HCC86	Acute Myocardial Infarction	0.0159	0.0093	-0.0066	-0.0530	0.1226	0.0096	0.0093	-0.0003	-0.0038	0.9306
HCC87	Unstable Angina and Other Acute Ischemic Heart Disease	0.0281	0.0394	0.0113	0.0681	0.0474	0.0381	0.0394	0.0013	0.0073	0.8644
HCC88	Angina Pectoris	0.0186	0.0718	0.0532	0.3848	0.0000	0.0543	0.0718	0.0176	0.0967	0.0716
HCC96	Specified Heart Arrhythmias	0.1243	0.0614	-0.0629	-0.1915	0.0000	0.0516	0.0614	0.0098	0.0436	0.2654
HCC99	Cerebral Hemorrhage	0.0110	0.0046	-0.0063	-0.0612	0.0746	0.0052	0.0046	-0.0005	-0.0081	0.8385
HCC100	Ischemic or Unspecified Stroke	0.0696	0.0324	-0.0371	-0.1466	0.0000	0.0310	0.0324	0.0014	0.0082	0.8256

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	p	Comparison	Intervention	adj.diff	std.diff	p
HCC103	Hemiplegia/Hemiparesis	0.0335	0.0070	-0.0265	-0.1486	0.0000	0.0058	0.0070	0.0012	0.0140	0.7001
HCC104	Monoplegia, Other Oaralytic Syndromes	0.0025	0.0000	-0.0025	-0.0505	0.1417	0.0000	0.0000	0.0000	N/A	1.0000
HCC106	Atherosclerosis of the Extremities with Ulceration or Gangrene	0.0131	0.0035	-0.0096	-0.0852	0.0131	0.0038	0.0035	-0.0003	-0.0044	0.8966
HCC107	Vascular Disease with Complications	0.0332	0.0243	-0.0089	-0.0496	0.1485	0.0198	0.0243	0.0045	0.0315	0.4265
HCC108	Vascular Disease	0.2440	0.3210	0.0770	0.1789	0.0000	0.2859	0.3210	0.0351	0.0807	0.0316
HCC110	Cystic Fibrosis	0.0003	0.0000	-0.0003	-0.0172	0.6161	0.0000	0.0000	0.0000	N/A	1.0000
HCC111	Chronic Obstructive Pulmonary Disease	0.2132	0.3105	0.0973	0.2370	0.0000	0.2805	0.3105	0.0300	0.0696	0.0668
HCC112	Fibrosis of Lung and Other Chronic Lung Disorders	0.0094	0.0046	-0.0047	-0.0493	0.1511	0.0055	0.0046	-0.0009	-0.0107	0.7468
HCC114	Aspiration and Specified Bacterial Pneumonias	0.0284	0.0185	-0.0098	-0.0594	0.0836	0.0172	0.0185	0.0014	0.0111	0.7794
HCC115	Pneumococcal Pneumonia, Empyema, Lung Abscess	0.0039	0.0058	0.0019	0.0309	0.3689	0.0077	0.0058	-0.0019	-0.0271	0.5790
HCC122	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	0.0118	0.0081	-0.0037	-0.0344	0.3167	0.0098	0.0081	-0.0017	-0.0181	0.6336
HCC124	Exudative Macular Degeneration	0.0087	0.0023	-0.0063	-0.0689	0.0450	0.0016	0.0023	0.0007	0.0161	0.6393
HCC134	Dialysis Status	0.0118	0.0081	-0.0037	-0.0345	0.3144	0.0083	0.0081	-0.0002	-0.0018	0.9621
HCC135	Acute Renal Failure	0.0857	0.0452	-0.0405	-0.1452	0.0000	0.0437	0.0452	0.0015	0.0072	0.8472
HCC136	Chronic Kidney Disease, Stage 5	0.0055	0.0035	-0.0020	-0.0276	0.4217	0.0014	0.0035	0.0020	0.0465	0.2718
HCC137	Chronic Kidney Disease, Stage 4	0.0045	0.0035	-0.0011	-0.0158	0.6456	0.0025	0.0035	0.0010	0.0173	0.6587
HCC157	Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	0.0056	0.0012	-0.0045	-0.0602	0.0794	0.0006	0.0012	0.0006	0.0227	0.5165
HCC158	Pressure Ulcer of Skin with Full Thickness Skin Loss	0.0115	0.0012	-0.0103	-0.0978	0.0044	0.0008	0.0012	0.0003	0.0103	0.7576
HCC161	Chronic Ulcer of Skin, Except Pressure	0.0465	0.0545	0.0080	0.0380	0.2688	0.0512	0.0545	0.0032	0.0153	0.7187
HCC162	Severe Skin Burn or Condition	0.0004	0.0000	-0.0004	-0.0201	0.5591	0.0000	0.0000	0.0000	N/A	1.0000
HCC166	Severe Head Injury	0.0003	0.0000	-0.0003	-0.0178	0.6037	0.0000	0.0000	0.0000	N/A	1.0000

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	p	Comparison	Intervention	adj.diff	std.diff	p
HCC167	Major Head Injury	0.0170	0.0127	-0.0043	-0.0330	0.3373	0.0144	0.0127	-0.0016	-0.0141	0.7192
HCC169	Vertebral Fractures without Spinal Cord Injury	0.0138	0.0023	-0.0115	-0.0991	0.0039	0.0024	0.0023	-0.0001	-0.0024	0.9460
HCC170	Hip Fracture/Dislocation	0.0214	0.0058	-0.0156	-0.1084	0.0016	0.0050	0.0058	0.0008	0.0113	0.7580
HCC173	Traumatic Amputations and Complications	0.0086	0.0023	-0.0063	-0.0684	0.0463	0.0015	0.0023	0.0008	0.0190	0.5688
HCC176	Complications of Specified Implanted Device or Graft	0.0316	0.0081	-0.0234	-0.1350	0.0001	0.0099	0.0081	-0.0018	-0.0175	0.6128
HCC186	Major Organ Transplant or Replacement Status	0.0032	0.0000	-0.0032	-0.0568	0.0980	0.0000	0.0000	0.0000	N/A	1.0000
HCC188	Artificial Openings for Feeding or Elimination	0.0239	0.0081	-0.0158	-0.1039	0.0025	0.0083	0.0081	-0.0002	-0.0022	0.9564
HCC189	Amputation Status, Lower Limb/Amputation Complications	0.0085	0.0012	-0.0074	-0.0806	0.0189	0.0010	0.0012	0.0002	0.0048	0.8864

Source: Mathematica analysis of data from the Master Beneficiary Summary File, February 2012-January 2013.

HCC = Heirarchical Condition Category; ED = Emergency Department. adj.diff = The adjusted mean difference (adj. diff.) is the difference between weight-adjusted means for the treatment and comparison groups. 'Before matching' each treatment and comparison group member has equal weights in the mean calculation for their group. 'After matching' the members of the treatment group still have equal weight in their group mean, but the individuals in the comparison group are weighted based on one divided by the number of treatment group member to whom they are matched. Comparison group members who are not matched to a treatment group member are given a weight of zero; std.diff = The standardized difference (std. diff.) is the difference in weight-adjusted means between the treatment and comparison groups divided by the pooled standard deviation of treatment and matched comparison groups of the variable. This method places the mean difference between the treatment and comparison groups on the same scale (percentage) as the variance for each variable.

In addition to the exact match variables (with zero absolute and standardized differences), we ideally wanted all variables to fall within +/- 0.10 standardized differences. All of the matching variables met these conditions. Although we did not include total expenditures as a matching variable, we examined the standardized differences between the treatment and comparison group for this measure. This difference fell within +/- 0.25 which we felt was acceptable given the known difference in Medicare spending between NYS and the comparison sites. The absolute mean difference between the intervention and comparison groups on the expenditure measure was $3,915.

2. Medicaid

We constructed the matched comparison group in several steps:

Step 1: Identify potential comparison pool members. We identified Medicaid enrollees who resided in New York City, had a behavioral health diagnosis, and had enrolled in a Medicaid health home between January 2012 and January 2015. We selected Medicaid enrollees who participated in health homes other than MMC's in New York City as the comparison pool to isolate the impact of the HCIA-funded information technology platform used by MMC's health home. New York State provided data on health home enrollment and each enrollee's health home enrollment date. In parallel with the definition of the intervention start month for MMC health home enrollees, we defined each enrollee's intervention start month as their Medicaid health home enrollment month.

Step 2: Extract claims and apply diagnostic exclusions. We initially extracted claims and enrollment information for all potential comparison pool members. Then we identified those comparison pool members who had at least one claims with the relevant diagnoses (See Table C.1 above) in the 24 months prior to the intervention start month. Individuals who did not have one of the relevant diagnoses identified were excluded from the comparison pool.

Step 3: Apply other exclusion criteria. Next, we applied exclusion criteria parallel to the exclusion criteria for intervention group members discussed above (See Section C.2). We excluded comparison pool members who were not continuously enrolled with Medicaid as their primary payer and eligible for Medicaid coverage of services including hospitalization and emergency room services for six months prior to their intervention start month, the intervention start month, and the five months following the intervention start month. Our potential comparison group included 20,819 Medicaid enrollees who met all inclusion criteria.

Step 4: Match treatment participants at the individual level. The matching process used metrics of individual-level characteristics identified based on pre-period data to select a subset of comparison pool members who were as similar as possible to the intervention group on observable characteristics. The matching algorithm first exact matched mental health diagnosis and AIDS status. We then fit a propensity score model. A beneficiary's propensity score is the probability of belonging to the treatment group estimated from this model. We included the following characteristics in the model: age, sex, race (Hispanic, Black, and other), disability status, CDPS condition indicators (created as part of creating the CDPS score),[76] whether the

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[76] We calculated CDPS scores based on a risk adjustment model developed by the University of California, San Diego (USCD), which some Medicaid programs use to adjust payments for beneficiaries who are disabled or on

individual was enrolled in Medicaid and eligible for the analysis for a full 12 months prior health home enrollment. We also included pre-period levels of two of the core outcomes measures (hospitalizations and ED visits) and total expenditures broken out into categories for the 12 months prior to enrollment.

We matched up to five comparison group members to each treatment group member. When a treatment group member was difficult to match (that is, had few similar comparison group members), the algorithm conducted a pair match. When there was an abundance of comparisons for a treatment group member, the algorithm matched multiple comparisons. The statistical goal was first to minimize bias and then, subject to that constraint, maximize the size of the comparison sample. The optimal matching algorithm that we used selected comparison group members without replacement and minimized the overall differences between treated and matched comparison group members so that they were similar, on average, on observed characteristics in the pre-period.

Step 5. Assess the quality of the match. This section describes diagnostic tests that we used to assess the quality of the matches. We began by examining the ratio of potential comparison to treatment group members by exact matching strata prior to matching in order to understand how difficult it might be to match at least one comparison group member to each treatment group member. For example, if many strata had low ratios of potential comparison group members to participants prior to matching, we might have considered reducing the number of variables used for exact matching. We found a sufficient number of comparison group individuals for each treatment group person in each strata.

We graphically compared the propensity score distributions[77] for all treatment and comparison group members prior to matching, looking for overlap in the propensity scores for the treatment and comparison groups (Figure C.3). The distribution of propensity scores differed between the two groups, which is to be expected; however, there appeared to be sufficient overlap to find comparison group members for each treatment group member.

Temporary Assistance for Needy Families. Scores reflect the ratio of predicted health expenditures for a given beneficiary relative to average Medicaid per-person expenditures. Each beneficiary's CDPS scores are estimated based on diagnoses in the past 12 months of Medicaid claims data, as well as demographic characteristics. We created CDPS scores following UCSD's CDPS + MRx methodology. They were based on the conditions reported in Medicaid claims data in the 12-month period prior to health home enrollment.

[77] We calculated the log-odds of the propensity score rather than the more common probability scale, because log odds provided better overlap.

Figure C.3. Log-odds of propensity score distributions for treatment and comparison pool members (Medicaid)
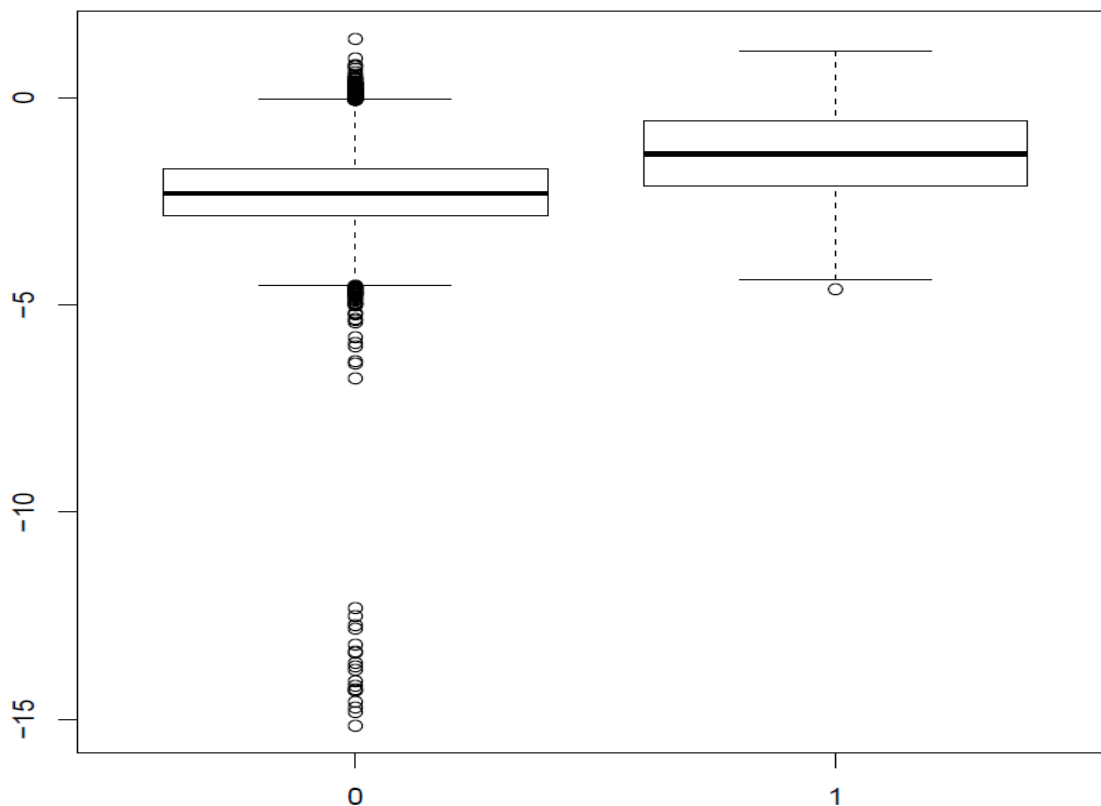
Source: Mathematica analysis of Medicaid administrative data from New York State, November 2011-October 2012.

Note: Figure presents boxplots created using the log-odds of the estimated propensity scores for the comparison and treatment groups, in the left and right panels respectively. The width of the boxplots corresponds to the amount of data that contributed to the plots.

After we conducted matching, we examined the number of comparison beneficiaries matched to each treatment beneficiary (Table C.5). A large number of 1:1 matches, or a large number of comparison beneficiaries that were excluded, could indicate that the matching was problematic. However, we found the number and distribution of matches to be acceptable. After the matching, there were 10,944 matched beneficiaries in the comparison group.

Table C.5. Frequency table of ratio of treatment beneficiaries to comparison beneficiaries for each matched set (Medicaid)

Ratio of treatment to comparison beneficiaries	1:1	1:2	1:3	1:4	1:5
Number of matched sets	1,246	157	156	144	1,668

Source: Mathematica analysis of Medicaid administrative data from New York State, November 2011-October 2012.

Note: Each cell indicates the number of treatment beneficiaries matched to the number of comparison beneficiaries indicated for that column.

After evaluating the basic matching diagnostics above, we examined the overall balance of the matched sample. We used an omnibus test that checks for covariate balance across the treatment and matched comparison beneficiaries (Hansen and Bowers 2008). The omnibus test is based on the differences between treatment and matched comparison beneficiaries across the matching variables; these differences are standardized by their variances and covariances and aggregated into a single number, a weighted mean. Standardization in this way implies that a matching variable whose difference across matched sets has a small variance is given more weight and that a matching variable whose difference across sets is highly correlated with other differences is given less weight. The advantages of the omnibus test are: (1) it generates a single probability statement through one p-value; (2) its distribution is roughly chi-square, which facilities the calculation of the p-value; and (3) it assesses balance on all linear combinations of the matching variables. However, a significant result from this chi-squared test may be driven by a large sample size rather than substantive differences between treatment and matched comparison groups. Alternatively, it could indicate that there may be some imbalance between the two groups on at least one of the matching variables. The results of this test were a chi-square statistic of 412 and associated p-value of less than 0.01.

To further investigate imbalance between treatment and matched comparison groups, we evaluated how matching affected the balance on all matching variables by comparing the absolute and standardized differences between the treatment and comparison groups for each variable before and after matching (Figure C.4). The standardized difference measures the difference in means in units of the pooled standard deviation. The standardized difference measure is advantageous in that it allows us to compare all variables on the same scale. We compared the standardized differences using plots with dashed lines at +/- 0.10 and +/- 0.20 standardized differences to visually inspect whether we obtained good balance for each variable.

Figure C.4. Balance plot comparing the standardized difference for each matching variable before and after matching (Medicaid)
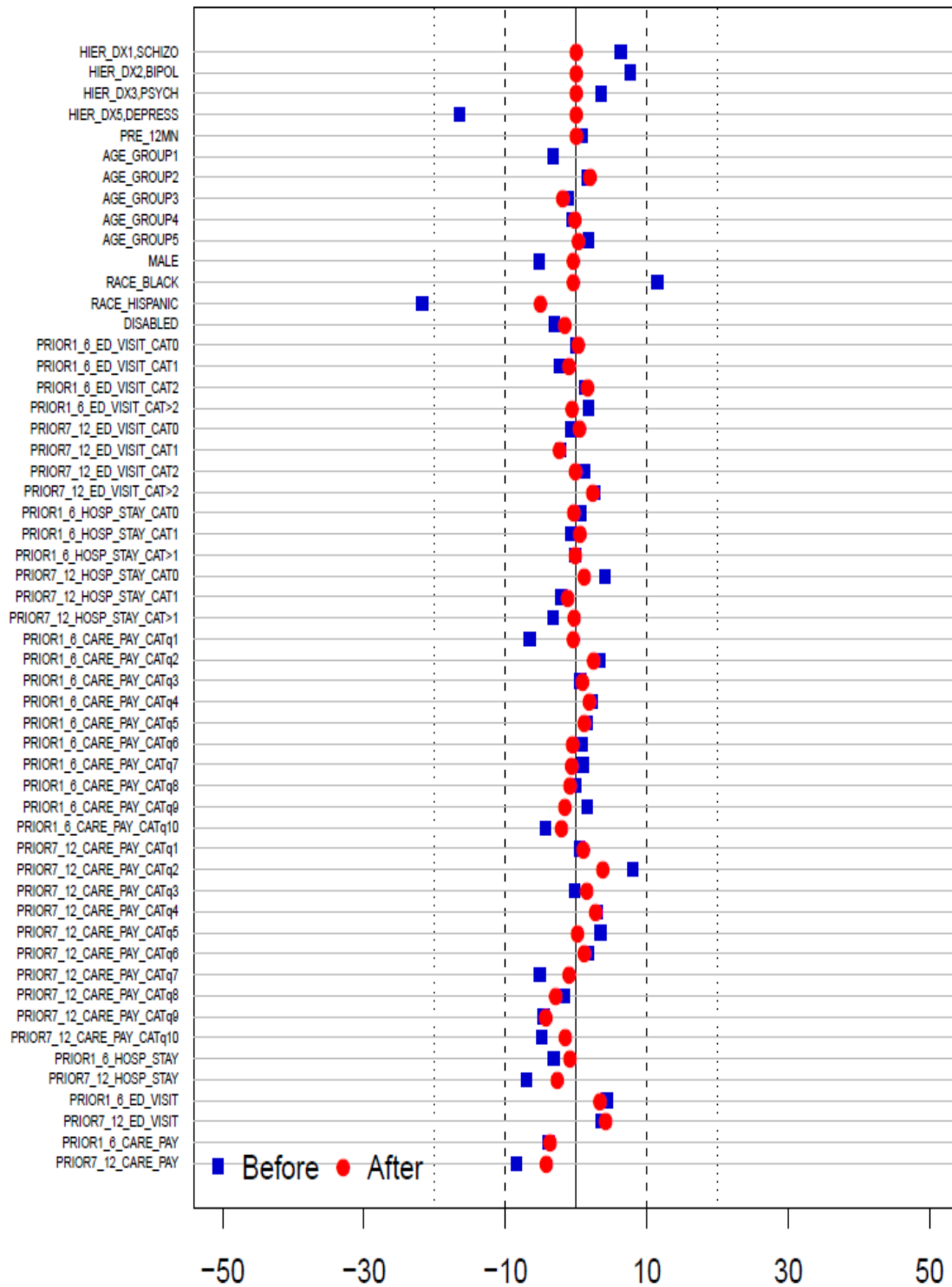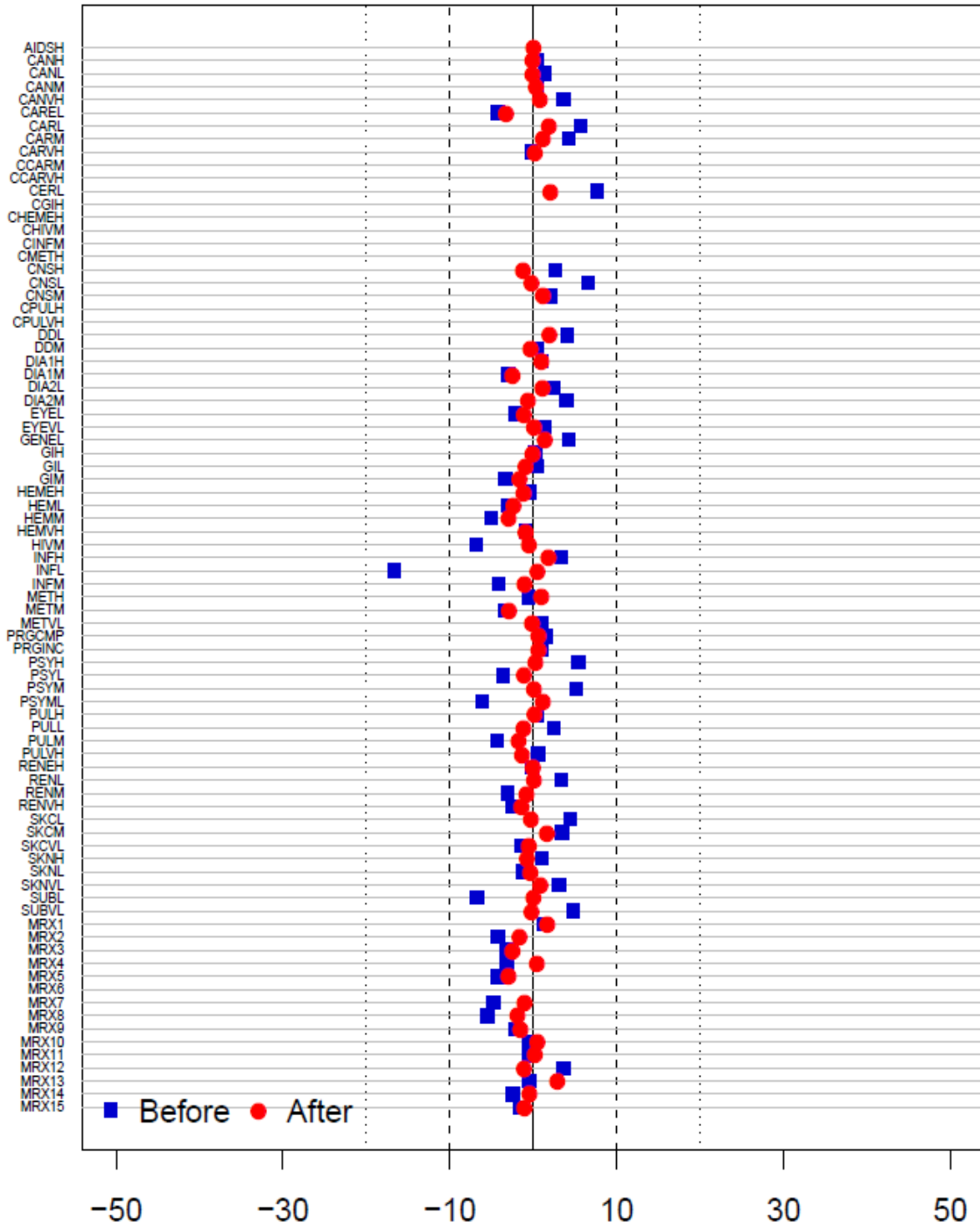
Figure C.4 *(continued)*

Source: Mathematica analysis of Medicaid administrative data from New York State, November 2011-October 2012.

Note: We created CDPS flags following UCSD's (University of California San Diego) CDPS + MRx methodology. Please see the CDPS website for programs for further information regarding the individual flags.

Table C.6. Balance table before and after matching (MMC Medicaid)

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	p	Comparison	Intervention	adj.diff	std.diff	p
Exact match variables											
	Hierarchical diagnosis code prior to program enrollment										
HIER_DX1,SCHIZO	Schizophrenia and related disorders	0.4310	0.4622	0.0312	0.0630	0.0007	0.4622	0.4622	0.0000	0.0000	1.0000
HIER_DX2,BIPOL	Bipolar disorders	0.3017	0.3367	0.0350	0.0760	0.0000	0.3367	0.3367	0.0000	0.0000	1.0000
HIER_DX3,PSYCH	Psychotic disorders	0.0155	0.0199	0.0044	0.0348	0.0606	0.0199	0.0199	0.0000	0.0000	1.0000
HIER_DX5,DEPRESS	Depressive disorders	0.2519	0.1813	-0.0706	-0.1652	0.0000	0.1813	0.1813	0.0000	0.0000	1.0000
AIDSH	AIDS, High	0.2617	0.5885	0.3268	0.7307	0.0000	0.5885	0.5885	0.0000	0.0000	1.0000
Propensity score variables											
PRE_12MN		0.9142	0.9163	0.0021	0.0075	0.6862	0.9163	0.9163	0.0000	0.0000	1.0000
SUBL		0.3823	0.3495	-0.0328	-0.0677	0.0003	0.3495	0.3495	0.0000	0.0000	1.0000
	Age group										
AGE_GROUP1		0.0009	0.0000	-0.0009	-0.0325	0.0796	0.0000	0.0000	0.0000	N/A	1.0000
AGE_GROUP2		0.4119	0.4195	0.0076	0.0154	0.4066	0.4099	0.4195	0.0096	0.0195	0.3514
AGE_GROUP3		0.3561	0.3503	-0.0057	-0.0119	0.5205	0.3595	0.3503	-0.0092	-0.0190	0.3573
AGE_GROUP4		0.2265	0.2243	-0.0022	-0.0053	0.7771	0.2249	0.2243	-0.0007	-0.0016	0.9404
AGE_GROUP5		0.0047	0.0059	0.0012	0.0177	0.3401	0.0057	0.0059	0.0002	0.0032	0.8915
MALE	Male	0.4888	0.4628	-0.0260	-0.0520	0.0051	0.4647	0.4628	-0.0019	-0.0039	0.8493
	Race/ethnicity										
RACE_BLACK	African American, not Hispanic	0.3537	0.4088	0.0550	0.1146	0.0000	0.4108	0.4088	-0.0020	-0.0041	0.8442
RACE_HISPANIC	Hispanic	0.4194	0.3130	-0.1064	-0.2175	0.0000	0.3372	0.3130	-0.0243	-0.0503	0.0049
DISABLED	Disabled	0.6256	0.6108	-0.0148	-0.0305	0.1002	0.6187	0.6108	-0.0079	-0.0162	0.4219
	Number of ED visits in months 1-6 prior to program enrollment										
PRIOR1_6_ED_VISIT_CAT0	0	0.5462	0.5461	-0.0001	-0.0002	0.9931	0.5446	0.5461	0.0015	0.0030	0.8834
PRIOR1_6_ED_VISIT_CAT1	1	0.2153	0.2059	-0.0095	-0.0231	0.2139	0.2101	0.2059	-0.0042	-0.0102	0.6253
PRIOR1_6_ED_VISIT_CAT2	2	0.0980	0.1015	0.0034	0.0115	0.5359	0.0967	0.1015	0.0047	0.0160	0.4593
PRIOR1_6_ED_VISIT_CAT>2	More than 2	0.1404	0.1465	0.0061	0.0176	0.3440	0.1486	0.1465	-0.0021	-0.0059	0.7804

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	p	Comparison	Intervention	adj.diff	std.diff	p
	Number of ED visits in months 7-12 prior to program enrollment										
PRIOR7_12_ED_VISIT_CAT0	0	0.6049	0.6016	-0.0033	-0.0067	0.7194	0.5992	0.6016	0.0024	0.0048	0.8094
PRIOR7_12_ED_VISIT_CAT1	1	0.1915	0.1830	-0.0085	-0.0216	0.2451	0.1924	0.1830	-0.0094	-0.0240	0.2469
PRIOR7_12_ED_VISIT_CAT2	2	0.0874	0.0905	0.0031	0.0109	0.5557	0.0908	0.0905	-0.0003	-0.0010	0.9639
PRIOR7_12_ED_VISIT_CAT>2	More than 2	0.1163	0.1249	0.0086	0.0268	0.1485	0.1176	0.1249	0.0073	0.0231	0.2902
	Number of hospitalizations in months 1-6 prior to program enrollment										
PRIOR1_6_HOSP_STAY_CAT0	0	0.6912	0.6945	0.0032	0.0070	0.7077	0.6961	0.6945	-0.0017	-0.0037	0.8583
PRIOR1_6_HOSP_STAY_CAT1	1	0.1596	0.1569	-0.0026	-0.0072	0.6982	0.1549	0.1569	0.0020	0.0055	0.7955
PRIOR1_6_HOSP_STAY_CAT>1	More than 1	0.1492	0.1486	-0.0006	-0.0016	0.9300	0.1489	0.1486	-0.0003	-0.0009	0.9661
	Number of hospitalizations in months 7-12 prior to program enrollment										
PRIOR7_12_HOSP_STAY_CAT0	0	0.7452	0.7630	0.0178	0.0410	0.0274	0.7580	0.7630	0.0050	0.0117	0.5593
PRIOR7_12_HOSP_STAY_CAT1	1	0.1375	0.1302	-0.0073	-0.0212	0.2539	0.1343	0.1302	-0.0041	-0.0120	0.5658
PRIOR7_12_HOSP_STAY_CAT>1	More than 1	0.1173	0.1068	-0.0105	-0.0329	0.0767	0.1077	0.1068	-0.0009	-0.0029	0.8831
	Total expenditures 1-6 months prior to enrollment (deciles)										
PRIOR1_6_CARE_PAY_CATq1	First	0.1028	0.0831	-0.0197	-0.0657	0.0004	0.0842	0.0831	-0.0012	-0.0041	0.8407
PRIOR1_6_CARE_PAY_CATq2	Second	0.0986	0.1086	0.0100	0.0332	0.0734	0.1014	0.1086	0.0072	0.0244	0.2630
PRIOR1_6_CARE_PAY_CATq3	Third	0.0998	0.1015	0.0017	0.0057	0.7604	0.0988	0.1015	0.0027	0.0093	0.6685
PRIOR1_6_CARE_PAY_CATq4	Fourth	0.0990	0.1059	0.0069	0.0229	0.2175	0.1005	0.1059	0.0054	0.0185	0.3957
PRIOR1_6_CARE_PAY_CATq5	Fifth	0.0993	0.1041	0.0048	0.0160	0.3888	0.1008	0.1041	0.0034	0.0114	0.6009

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	p	Comparison	Intervention	adj.diff	std.diff	p
PRIOR1_6_CARE_PAY_CATq6	Sixth	0.0997	0.1020	0.0024	0.0080	0.6681	0.1036	0.1020	-0.0016	-0.0052	0.8116
PRIOR1_6_CARE_PAY_CATq7	Seventh	0.0996	0.1023	0.0027	0.0091	0.6237	0.1043	0.1023	-0.0019	-0.0062	0.7626
PRIOR1_6_CARE_PAY_CATq8	Eighth	0.1000	0.0997	-0.0004	-0.0012	0.9471	0.1024	0.0997	-0.0027	-0.0087	0.6629
PRIOR1_6_CARE_PAY_CATq9	Ninth	0.0993	0.1041	0.0048	0.0160	0.3888	0.1092	0.1041	-0.0051	-0.0162	0.4239
PRIOR1_6_CARE_PAY_CATq10	Tenth	0.1019	0.0887	-0.0132	-0.0439	0.0181	0.0949	0.0887	-0.0062	-0.0205	0.2828
	Total expenditures 7-12 months prior to enrollment (deciles)										
PRIOR7_12_CARE_PAY_CATq1	First	0.0999	0.1012	0.0013	0.0044	0.8147	0.0980	0.1012	0.0032	0.0103	0.2545
PRIOR7_12_CARE_PAY_CATq2	Second	0.0966	0.1207	0.0241	0.0804	0.0000	0.1097	0.1207	0.0110	0.0374	0.1017
PRIOR7_12_CARE_PAY_CATq3	Third	0.1001	0.0994	-0.0007	-0.0024	0.8980	0.0951	0.0994	0.0042	0.0148	0.4963
PRIOR7_12_CARE_PAY_CATq4	Fourth	0.0987	0.1077	0.0089	0.0298	0.1086	0.0997	0.1077	0.0080	0.0275	0.2173
PRIOR7_12_CARE_PAY_CATq5	Fifth	0.0986	0.1089	0.0103	0.0344	0.0640	0.1084	0.1089	0.0005	0.0016	0.9414
PRIOR7_12_CARE_PAY_CATq6	Sixth	0.0993	0.1044	0.0051	0.0171	0.3556	0.1011	0.1044	0.0033	0.0114	0.6071
PRIOR7_12_CARE_PAY_CATq7	Seventh	0.1022	0.0866	-0.0155	-0.0518	0.0053	0.0897	0.0866	-0.0030	-0.0102	0.5920
PRIOR7_12_CARE_PAY_CATq8	Eighth	0.1007	0.0955	-0.0052	-0.0173	0.3510	0.1046	0.0955	-0.0091	-0.0292	0.1364
PRIOR7_12_CARE_PAY_CATq9	Ninth	0.1019	0.0881	-0.0138	-0.0460	0.0132	0.1015	0.0881	-0.0134	-0.0428	0.0196
PRIOR7_12_CARE_PAY_CATq10	Tenth	0.1021	0.0875	-0.0145	-0.0485	0.0090	0.0923	0.0875	-0.0047	-0.0155	0.3946
	CDPS condition flags										
CANH	Cancer, High	0.0111	0.0116	0.0005	0.0047	0.8012	0.0117	0.0116	-0.0001	-0.0012	0.9552
CANL	Cancer, Low	0.0143	0.0160	0.0017	0.0140	0.4504	0.0162	0.0160	-0.0002	-0.0013	0.9537
CANM	Cancer, Medium	0.0073	0.0077	0.0004	0.0044	0.8135	0.0074	0.0077	0.0003	0.0030	0.8833
CANVH	Cancer, Very High	0.0036	0.0059	0.0023	0.0364	0.0498	0.0054	0.0059	0.0005	0.0081	0.7327
CAREL	Cardiovascular, Extra Low	0.2358	0.2177	-0.0180	-0.0426	0.0217	0.2316	0.2177	-0.0138	-0.0329	0.1069
CARL	Cardiovascular, Low	0.2113	0.2346	0.0233	0.0569	0.0022	0.2269	0.2346	0.0077	0.0188	0.3758
CARM	Cardiovascular, Medium	0.0713	0.0825	0.0112	0.0429	0.0208	0.0795	0.0825	0.0030	0.0114	0.6120

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	p	Comparison	Intervention	adj.diff	std.diff	p
CARVH	Cardiovascular, Very High	0.0043	0.0042	-0.0002	-0.0025	0.8930	0.0040	0.0042	0.0001	0.0017	0.9326
CCARM	Children's Cardiovascular, medium	0.0000	0.0000	0.0000	#N/A	1.0000	0.0000	0.0000	0.0000	#N/A	1.0000
CCARVH	Children's Cardiovascular, Very High	0.0000	0.0000	0.0000	#N/A	1.0000	0.0000	0.0000	0.0000	N/A	1.0000
CERL	Cerebrovascular, Low	0.0304	0.0439	0.0135	0.0764	0.0000	0.0401	0.0439	0.0038	0.0206	0.3733
CGIH	Children's Gastrointestinal, High	0.0000	0.0000	0.0000	#N/A	1.0000	0.0000	0.0000	0.0000	#N/A	1.0000
CHEMEH	Children's Hematological, Extra High	0.0000	0.0000	0.0000	#N/A	1.0000	0.0000	0.0000	0.0000	#N/A	1.0000
CHIVM	Children's HIV, Medium	0.0000	0.0000	0.0000	#N/A	1.0000	0.0000	0.0000	0.0000	#N/A	1.0000
CINFM	Children's Infectious, Medium	0.0000	0.0000	0.0000	#N/A	1.0000	0.0000	0.0000	0.0000	#N/A	1.0000
CMETH	Children's Metabolic, High	0.0000	0.0000	0.0000	#N/A	1.0000	0.0000	0.0000	0.0000	#N/A	1.0000
CNSH	Nervous System, High	0.0013	0.0024	0.0010	0.0267	0.1497	0.0029	0.0024	-0.0005	-0.0126	0.6469
CNSL	Nervous System, Low	0.1829	0.2085	0.0256	0.0658	0.0004	0.2095	0.2085	-0.0010	-0.0024	0.9096
CNSM	Nervous System, Medium	0.0363	0.0400	0.0038	0.0201	0.2781	0.0380	0.0400	0.0021	0.0112	0.6224
CPULH	Children's Pulmonary, High	0.0000	0.0000	0.0000	#N/A	1.0000	0.0000	0.0000	0.0000	N/A	1.0000
CPULVH	Children's Pulmonary, Very High	0.0000	0.0000	0.0000	#N/A	1.0000	0.0000	0.0000	0.0000	N/A	1.0000
DDL	Developmental Disability, Low	0.0130	0.0178	0.0048	0.0409	0.0276	0.0156	0.0178	0.0022	0.0194	0.4092
DDM	Developmental Disability, Medium	0.0005	0.0006	0.0001	0.0051	0.7831	0.0007	0.0006	-0.0001	-0.0036	0.8749
DIA1H	Diabetes, Type 1 High	0.0022	0.0027	0.0005	0.0097	0.5997	0.0022	0.0027	0.0004	0.0097	0.6774
DIA1M	Diabetes, Type 1 Low	0.0488	0.0424	-0.0064	-0.0300	0.1065	0.0476	0.0424	-0.0052	-0.0247	0.2239
DIA2L	Diabetes, Type 2 High	0.1616	0.1709	0.0092	0.0250	0.1774	0.1669	0.1709	0.0039	0.0106	0.6228
DIA2M	Diabetes, Type 2 Low	0.0502	0.0590	0.0088	0.0399	0.0315	0.0604	0.0590	-0.0014	-0.0063	0.7786
EYEL	Eye, Low	0.0118	0.0095	-0.0024	-0.0221	0.2348	0.0107	0.0095	-0.0012	-0.0110	0.5723
EYEVL	Eye, Very Low	0.0569	0.0602	0.0033	0.0142	0.4458	0.0600	0.0602	0.0002	0.0009	0.9672
GENEL	Genital, Extra Low	0.0897	0.1020	0.0123	0.0427	0.0214	0.0981	0.1020	0.0039	0.0135	0.5423
GIH	Gastrointestinal, High	0.0072	0.0074	0.0002	0.0021	0.9120	0.0075	0.0074	-0.0001	-0.0013	0.9546
GIL	Gastrointestinal, Low	0.2095	0.2112	0.0017	0.0042	0.8193	0.2150	0.2112	-0.0038	-0.0093	0.6552
GIM	Gastrointestinal, Medium	0.0809	0.0718	-0.0091	-0.0335	0.0710	0.0763	0.0718	-0.0045	-0.0163	0.4044
HEMEH	Hematological, Extra High	0.0004	0.0003	-0.0001	-0.0045	0.8078	0.0005	0.0003	-0.0002	-0.0116	0.5716
HEML	Hematological, Low	0.0330	0.0276	-0.0054	-0.0306	0.0991	0.0318	0.0276	-0.0042	-0.0239	0.2368
HEMM	Hematological, Medium	0.0304	0.0220	-0.0085	-0.0502	0.0069	0.0269	0.0220	-0.0050	-0.0295	0.1086
HEMVH	Hematological, Very High	0.0019	0.0015	-0.0004	-0.0091	0.6243	0.0019	0.0015	-0.0004	-0.0097	0.6555
HIVM	HIV, Medium	0.0092	0.0030	-0.0062	-0.0683	0.0002	0.0033	0.0030	-0.0004	-0.0054	0.7422

Variable name	Variable description	Before matching					After matching				
		Comparison	Intervention	adj.diff	std.diff	p	Comparison	Intervention	adj.diff	std.diff	p
INFH	Infectious, High	0.0010	0.0021	0.0011	0.0335	0.0713	0.0015	0.0021	0.0005	0.0177	0.5296
INFL	Infectious, Low	0.0731	0.0314	-0.0416	-0.1665	0.0000	0.0305	0.0314	0.0009	0.0049	0.7664
INFM	Infectious, Medium	0.0103	0.0062	-0.0041	-0.0416	0.0252	0.0071	0.0062	-0.0009	-0.0104	0.5848
METH	Metabolic, High	0.0156	0.0148	-0.0008	-0.0061	0.7420	0.0137	0.0148	0.0012	0.0094	0.6399
METM	Metabolic, Medium	0.0591	0.0513	-0.0078	-0.0334	0.0719	0.0584	0.0513	-0.0070	-0.0291	0.1292
METVL	Metabolic, Very Low	0.0412	0.0433	0.0021	0.0104	0.5771	0.0436	0.0433	-0.0003	-0.0014	0.9480
PRGCMP	Pregnancy, Complete	0.0204	0.0225	0.0021	0.0148	0.4240	0.0217	0.0225	0.0008	0.0059	0.7965
PRGINC	Pregnancy, Incomplete	0.0091	0.0101	0.0010	0.0107	0.5644	0.0095	0.0101	0.0006	0.0060	0.7903
PSYH	Psychiatric, High	0.3440	0.3696	0.0256	0.0538	0.0038	0.3684	0.3696	0.0012	0.0026	0.8026
PSYL	Psychiatric, Low	0.0248	0.0193	-0.0055	-0.0360	0.0525	0.0210	0.0193	-0.0017	-0.0115	0.5435
PSYM	Psychiatric, Medium	0.1678	0.1872	0.0194	0.0517	0.0054	0.1869	0.1872	0.0003	0.0008	0.9644
PSYML	Psychiatric, Medium Low	0.3259	0.2975	-0.0284	-0.0608	0.0011	0.2922	0.2975	0.0054	0.0115	0.4653
PULH	Pulmonary, High	0.0064	0.0068	0.0004	0.0049	0.7902	0.0067	0.0068	0.0001	0.0013	0.9504
PULL	Pulmonary, Low	0.3084	0.3195	0.0111	0.0240	0.1956	0.3250	0.3195	-0.0055	-0.0118	0.5657
PULM	Pulmonary, Medium	0.0750	0.0638	-0.0112	-0.0429	0.0209	0.0684	0.0638	-0.0046	-0.0177	0.3611
PULVH	Pulmonary, Very High	0.0061	0.0065	0.0004	0.0056	0.7642	0.0076	0.0065	-0.0011	-0.0136	0.5551
RENEH	Renal, Extra High	0.0039	0.0039	-0.0001	-0.0012	0.9476	0.0039	0.0039	0.0000	-0.0006	0.9755
RENL	Renal, Low	0.0588	0.0667	0.0079	0.0335	0.0712	0.0666	0.0667	0.0001	0.0006	0.9780
RENM	Renal, Medium	0.0047	0.0027	-0.0020	-0.0306	0.0991	0.0032	0.0027	-0.0005	-0.0080	0.6729
RENVH	Renal, Very High	0.0368	0.0320	-0.0047	-0.0254	0.1706	0.0346	0.0320	-0.0026	-0.0140	0.4858
SKCL	Skeletal and Connective, Low	0.1139	0.1282	0.0143	0.0447	0.0161	0.1291	0.1282	-0.0010	-0.0030	0.8903
SKCM	Skeletal and Connective, Medium	0.0863	0.0961	0.0098	0.0346	0.0623	0.0915	0.0961	0.0046	0.0164	0.4527
SKCVL	Skeletal and Connective, Very Low	0.1118	0.1074	-0.0045	-0.0142	0.4453	0.1091	0.1074	-0.0017	-0.0055	0.7962
SKNH	Skin, High	0.0060	0.0068	0.0008	0.0106	0.5671	0.0074	0.0068	-0.0006	-0.0074	0.7328
SKNL	Skin, Low	0.0207	0.0190	-0.0017	-0.0119	0.5212	0.0195	0.0190	-0.0005	-0.0035	0.8671
SKNVL	Skin, Very Low	0.1188	0.1287	0.0099	0.0306	0.0993	0.1260	0.1287	0.0027	0.0082	0.7006
SUBVL	Substance Abuse, Very Low	0.0552	0.0662	0.0110	0.0473	0.0108	0.0666	0.0662	-0.0005	-0.0021	0.9227
	Medicaid Rx categories										
MRX1	Anti-coagulants	0.0131	0.0145	0.0014	0.0122	0.5124	0.0127	0.0145	0.0019	0.0165	0.4455
MRX2	Cardiac	0.0360	0.0282	-0.0078	-0.0424	0.0222	0.0313	0.0282	-0.0031	-0.0168	0.3719
MRX3	Psychosis/Bipolar/Depression	0.0212	0.0166	-0.0045	-0.0320	0.0847	0.0202	0.0166	-0.0036	-0.0249	0.1876
MRX4	Diabetes	0.0071	0.0044	-0.0026	-0.0319	0.0857	0.0041	0.0044	0.0003	0.0042	0.8212
MRX5	ESRD/Renal	0.0022	0.0003	-0.0019	-0.0428	0.0213	0.0015	0.0003	-0.0012	-0.0298	0.0348

		Before matching					After matching				
Variable name	Variable description	Comparison	Intervention	adj.diff	std.diff	p	Comparison	Intervention	adj.diff	std.diff	p
MRX6	Hemophilia/von Willebrands	0.0000	0.0000	0.0000	#N/A	1.0000	0.0000	0.0000	0.0000	N/A	1.0000
MRX7	Hepatitis	0.0046	0.0015	-0.0031	-0.0479	0.0098	0.0020	0.0015	-0.0005	-0.0105	0.5508
MRX8	HIV	0.0037	0.0006	-0.0031	-0.0549	0.0031	0.0012	0.0006	-0.0006	-0.0190	0.3630
MRX9	Infections, high	0.0014	0.0006	-0.0008	-0.0223	0.2295	0.0010	0.0006	-0.0004	-0.0155	0.4599
MRX10	Inflammatory/Autoimmune	0.0017	0.0015	-0.0002	-0.0059	0.7499	0.0013	0.0015	0.0002	0.0048	0.7739
MRX11	Malignancies	0.0097	0.0092	-0.0005	-0.0050	0.7861	0.0090	0.0092	0.0002	0.0019	0.9283
MRX12	Multiple Sclerosis/Paralysis	0.0017	0.0033	0.0016	0.0364	0.0499	0.0038	0.0033	-0.0005	-0.0115	0.6719
MRX13	Parkinson's/tremor	0.0985	0.0970	-0.0015	-0.0051	0.7854	0.0889	0.0970	0.0081	0.0290	0.1723
MRX14	Seizure disorders	0.0498	0.0445	-0.0053	-0.0245	0.1875	0.0454	0.0445	-0.0009	-0.0045	0.8276
MRX15	Tuberculosis	0.0040	0.0030	-0.0011	-0.0171	0.3575	0.0036	0.0030	-0.0007	-0.0106	0.5856

Source: Mathematica analysis of Medicaid administrative data for January 2011–June 2014.

Note: We created CDPS flags following UCSD's (University of California San Diego) CDPS + MRx methodology. Please see the CDPS website for programs for further information regarding the individual flags.

CDPS = Chronic Illness and Disability Payment System; ED = Emergency Department. adj.diff = The adjusted mean difference (adj. diff.) is the difference between weight-adjusted means for the treatment and comparison groups. 'Before matching' each treatment and comparison group member has equal weights in the mean calculation for their group. 'After matching' the members of the treatment group still have equal weight in their group mean, but the individuals in the comparison group are weighted based on one divided by the number of treatment group member to whom they are matched. Comparison group members who are not matched to a treatment group member are given a weight of zero; std.diff = The standardized difference (std. diff.) is the difference in weight-adjusted means between the treatment and comparison groups divided by the pooled standard deviation of treatment and matched comparison groups of the variable. This method places the mean difference between the treatment and comparison groups on the same scale (percentage) as the variance for each variable.

In addition to the exact match variables (with zero absolute and standardized differences), we ideally wanted all variables to fall within +/- 0.10 standardized differences. All of the matching variables met these conditions.

E. Specifications of measures

We analyzed program impact on four of CMMI's core outcome measures: total Medicare or Medicaid[78] expenditures, inpatient hospitalizations, hospital readmissions,[79] and ED visits. These outcomes are appropriate for evaluating the MMC program because improvements in care coordination and management were anticipated to reduce acute care service use and thereby reduce overall expenditures.[80] Our specifications for these measures in Medicare and Medicaid administrative data are described in Section E.1 below. Our analyses also used several other types of measures, as described in Section E.2 below.

1.   Core measures in Medicare and Medicaid administrative data

In this section, we provide detail on the data and analytic methods used to develop the core outcome measures in Medicare and Medicaid administrative data. We begin by describing how we identified the patient population and the associated spans of Medicare or Medicaid enrollment that were included in the analyses. Then, we describe how we processed claims data and assigned expenditure and utilization information to months to develop each of the core measures. Finally, we discuss how we annualized and weighted the regressions models to adjust for individuals who were not observable for a full 12 months.

a.   Identifying periods with observable data

In this section we describe the approach we used to identify the patients and periods of Medicare or Medicaid enrollment included in the analyses. Some periods are excluded from the analyses because sufficient data was not available to calculate the core measures.

i.   CMS Medicare administrative data

Identifying the patients and periods of enrollment to include in the analysis for CMS Medicare administrative data required several steps.

Step 1: Link awardee identifiers to CMS administrative files. MMC provided us with a finder file including HIC numbers and SSNs for all participants. We first matched the HIC numbers to the VRDC BENE_ID crosswalk. Individuals who did not match to the crosswalk by HIC number were then matched by SSN. Matches by HIC and SSN were verified by comparing

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[78] Medicaid expenditures include both FFS and managed care payments. When service level payment information was not available for managed care covered services, these payment amounts were estimated based on FFS payment guidelines.

[79] We were unable to estimate the readmission measure for the Medicaid population.

[80] Because of data limitations, Medicaid costs and service utilization for dual Medicare-Medicaid enrollees are not included in the analyses, even though dual enrollees are included in the Medicare analytic population. Although Medicare is the primary payer, the exclusion of Medicaid costs for dual enrollees means that specialized services for people with serious mental illness covered under Medicaid options and waivers provided to dual enrollees are not reflected in the analyses.

the date of birth, gender, SSN, and HIC to the data from the matched record. Records that matched on all of these variables or that had only a discrepancy in one component of these variables were retained in the analysis. For example, if HIC, SSN, gender, year of birth, and month of birth matched but day of birth was discrepant, the record was retained in the analysis. Where discrepant information was identified, the information from the Medicare record was used for the remainder of the analysis because this information was deemed more reliable than the information included in the patient record.

Step 2: Exclude months where FFS Medicare is not the primary payer. In order to be included in the analysis, the potential analysis months had to meet the following requirements: (1) the person had to be enrolled in Medicare Part A and B during the month; and (2) the person could not: a) be enrolled in MA, b) have a primary insurer that was not Medicare, c) be a railroad retiree, or d) have a date of death prior to the enrollment month. Based on the criteria for identifying intervention patients and the criteria for excluding months from the analysis based on Medicare enrollment information, we created a variable for each month from January 2010 to June 2015 indicating whether or not the month was eligible for analysis. This indicator was used to identify enrolled months to include in the analysis as well as to assure that services were only included when the associated service month was eligible for the analysis. See Section C.1 above for additional exclusion criteria that were applied during the development of the intervention participant group.

Step 3: Define baseline and intervention periods. Baseline and intervention periods were defined for each intervention participant or comparison group member, relative to their enrollment month (or pseudo-enrollment month).[81] The first intervention period was defined as the enrollment month and five months following that month. Where applicable the second intervention period was defined starting in the months following the last month in the first intervention period. The first baseline period started in the month prior to the enrollment month and moved backward five months. For each individual included in the analysis the proportion of each baseline and intervention period for which the individual was eligible for the analysis was calculated. This proportion was used to pro-rate the expenditure and utilization measures for individuals enrolled for less than the full analysis period. It was also used to weight observations in the regression analysis.

ii.   MMC Medicaid administrative data

Identifying the patients and periods of enrollment to include in the analysis for MMC Medicaid required several steps.

Step 1: Link awardee provided Medicaid identifiers to administrative data. We identified intervention group members based on Medicaid identifiers provided by MMC. We first matched the Medicaid identifiers in the program administrative data to those in the NYS Medicaid enrollment data extract. Identifiers associated with 44 (less than 0.5 percent) individuals did not match to the extract. For records that did match, we compared the gender, day of birth, month of birth, and year of birth listed in the Medicaid enrollment extract to the same information in the program administrative data. Matches were excluded from the analysis if there

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[81] Pseudo-enrollment was defined for comparison group members as described in Section D.1.

was a discrepancy in more than one of these measures. For example, if gender, year of birth, and month of birth matched but day of birth was discrepant, the record was retained in the analysis. Where discrepant information was identified, the information from the Medicaid extract record was used for the remainder of the analysis because this information was deemed more reliable than the information included in the patient record. Because of discrepant information, 1,500 matches (14.4 percent) were excluded, resulting in 8,946 individuals moving to the next analytic step.

Step 2: Exclude Medicare-Medicaid dual enrollees and enrollees in CBC. To ensure a consistent set of benefits were represented in the Medicaid administrative claims for the analysis population, we required full benefit Medicaid enrollment and no third party coverage. Based on this restriction, 1,349 individuals who were dually eligible for Medicare and Medicaid were excluded. We also excluded 2,079 participants who were in the CBC program and 1,508 individuals who lacked sufficient enrollment in Medicaid, as mentioned earlier. These exclusions reduced the sample to 4,010 MMC participants included in the analysis of expenditures by type of service (Report Section C.4) and exclusion of individuals with no qualifying mental health diagnosis in the 24 months prior to health home enrollment reduced the sample for the impact analysis to 3,371 (Report Section C.3).

Step 3: Define baseline and intervention periods. Six-month baseline and intervention periods were defined for each intervention participant relative to their health home enrollment month.

b. Summarizing monthly expenditures and utilization

Once the individuals and periods eligible for the Medicare and Medicaid analyses were identified as described above, expenditures and utilization associated with each core measure were aggregated for the periods during which the individual was deemed eligible for the analysis. In this section, we define the specifications for identifying total Medicare or Medicaid[82] expenditures, hospitalizations, hospital readmissions,[83] and ED visits. We summarized each of these measures monthly for each individual in the analysis population. Then, we aggregated sets of months into the analysis periods tailored for the specific analyses.

i. Expenditures

For Medicare, the following claim types were included in this analysis: carrier, DME, home health, hospice, inpatient, outpatient, and skilled nursing facility. Only FFS data were included in this analysis. Part D services were excluded. Duplicate and denied claims were excluded. The total payment amount on each Medicare claim was summed across all file types to calculate total expenditures. For services that extend beyond a single day (for example, an inpatient or long-term care stay) we counted all Medicare payments recorded based on a single date. Inpatient stays expenditures were counted in the month of the discharge date. For other types of claims, all expenditures were assigned based on the claim from date. Expenditures were excluded from this

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[82] Medicaid expenditures include both fee-for-service and managed care payments. When service level payment information is not available for managed care covered services, these payment amounts are estimated based on fee-for-service payment guidelines.

[83] We were unable to estimate the readmission measure outcome for the Medicaid population.

analysis if they were assigned to a month during which the associated Medicare beneficiary was deemed ineligible for the analysis.

For the Medicaid analysis, all claim types in the NY Medicaid administrative data were included in the analysis. Duplicate and denied claims were excluded. For claims with services spanning more than one day, expenditures were counted based on the service begin date. Expenditures included both FFS and managed care payments, but excluded capitation payments. When service level payment information was not available for managed care covered services, these payment amounts were estimated based on FFS payment guidelines.

ii. Hospitalizations

The specifications for the hospitalization measures were developed to align with the CMMI priority all-cause admissions per patient measure. For this measure, only acute stays or psychiatric stays were included in the analysis. We describe the steps to develop these counts here.

Step 1: Identify hospitalization claims. For Medicare administrative data, we identified inpatient hospital claims by claim type. Then, we identified and excluded rehabilitation and long-term care based on provider identifier codes. At the end of this step, only acute and psychiatric stays were included in the file.

For NY State Medicaid data, inpatient hospital claims were identified by using the Medicaid Managed Care Operating Report code (MMCOR_CD) values of 01 ("Inpatient Psych, Acute Detox Subabuse") or 04 ("Medical/surgical"), Surveillance and Utilization Review System Category of Service code (SURS_SUBSYSTEM_COS_CD) value of 11 ("Inpatient"), and the eMedNY claim type code (CLAIM_TYPE_CD) value of "I" ("Inpatient").

Step 2: Eliminate duplicate or denied claims. For Medicare and Medicaid, we identified claims with the same information in all fields and only kept one of these claims. We also excluded denied claims from our analysis.

Step 3: Combine claims that represent the same stay and combine transfer stays with initial stays. For Medicare and Medicaid data, we identified and combined initial and interim claims into one discharge. Interim claims had (1) the same admission date as the initial claim, (2) an admission date that was equal to the discharge date from the initial or another interim claim and the status on the other (previous) claim was "still a patient", or (3) a claim with an admission date that was equal to one day after the discharge date of the initial or another interim claim and the status on the other previous claim was "still a patient." Such claims were combined to count as a single stay.

Next, we identified and combined claims associated with a transfer into a single stay. We identified claims indicating that the patient was transferred to either another short-term hospital, a CAH, another type institution for inpatient care, a federal hospital, or a psychiatric hospital or unit. Then combined these claims with claims for the same beneficiary at a different facility where the admission date fell within one day of the discharge date of the first claim.

Step 4: Sum the number of discharges in each month. Once claims representing a single stay were combined, we summed the number of unique discharges for each enrollee for each month. Inpatient stays were counted in the month of the discharge date.

iii. Readmissions

Hospital readmissions were only counted for the Medicare analysis. The approach to calculating hospital readmissions in the Medicare claims data required several steps. We describe these steps below.

Step 1: Select stays qualifying as index stays. We began with the stays identified above for the hospitalization measure. Then we excluded stays that ended in death, had a principal diagnosis of pregnancy or condition originating in the perinatal period, or for which the patient was not continuously enrolled in Medicaid for the 30 days following the discharge date.

Step 2: Identify stays qualifying as readmissions. The remaining discharges were designated as index discharges. We identified readmissions for the same patients in the 30-day window following the discharge date. Then we excluded planned readmissions following HEDIS specifications.

Step 3: Sum index stays and readmissions by month. For each patient and calendar month, we summed the index stays with a discharge date in the month and any associated readmissions. To be included in our analysis the patient had to be continuously eligible for our analysis during the 30-day period following discharge from the index stay.

iv. ED visits

Outpatient ED visit utilization is reflected in CMMI priority measure 62. This measure includes ED visits that do not lead to an inpatient stay, as well as observation stays that do not lead to an admission.

In the Medicare outpatient file, we identified outpatient ED claims as those with a revenue center value indicating and ED visit, excluding any claims that involved only lab or imaging services in the ED. We identified observation claims based on the combination of revenue center code, CPT-code and a unit count of greater than or equal to eight hours.

In addition, for Medicaid data, we reviewed claims not identified as inpatient and considered them as ED visits if the procedure code, cost center revenue code, or managed care operating report code indicated ED visit.

ED visits that led to inpatient stays (i.e., ones that overlapped with or were adjacent to an inpatient stay) were excluded. If two or more ED visits or observation stays had the same patient identifier and beginning date of service, we counted them as one visit.

c. Calculating outcome measures

Once we identified the services and expenditures for each core measure for each month, the monthly measures were summed to the appropriate analysis periods. Only services in a month

where a person was eligible for analysis were included in the sums.[84] For individuals eligible for less than the full analysis period, the sum for the eligible months was divided by the proportion of the analysis period for which they were eligible to create a full-time equivalent measure. Regressions were weighted by the proportion of period for which the individual was eligible.[85]

2. Other measures

In this section we describe the methods for creating the control variables included in our analyses. Our analyses used multivariate regression models to adjust for differences across the analysis populations in demographics, geography, socioeconomic characteristics, Medicaid/Medicare enrollment, and health status.

a. Medicare measures

The control variables included in the MMC Medicare impact regression models are listed in Table C.7 along with the specifications for the variables. Note that when HCC categorical variables had means of less than two percent, we did not include them as control variables.

Table C.7. Impact analysis model control variable specifications—MMC Medicare analysis

Variable name	Specification
Intervention period	Categorical variable indicating time period of observation. Categories include: baseline period (pre-enrollment; reference category); nine months post enrollment
Treatment indicator	Categorical variable indicating treatment status. Categories include: comparison group member (reference category); MMC intervention participants
Interaction between intervention period and treatment	Interaction between intervention period and treatment indicator variables
Time period	Categorical variable indicating the calendar quarter of the initial month of observation period. Categories range from: 1Q2012 (reference category) to 1Q2014
Race	Categorical variable indicating the individual's race. Categories include: White (reference category); Black; and Hispanic
Age	Continuous variable indicating age on the first day of the observation period
Age squared	Continuous variable measuring age as defined above squared
Sex	Categorical variable of member's sex. Categories include: female (reference category); male
Dually enrolled in Medicare and Medicaid	Indicator variable for dually enrolled in Medicare and Medicaid based on Medicare enrollment database indicator for dual status indicating dual status in one or more months during the observation period
Disabled	Indicator variable for original reason for Medicare entitlement based on disability
Pre-period Medicare enrolled	Indicator variable for availability of 12 months of FFS Medicare claims data prior to first day of observation period
HCC score	Indicator variables for HCC conditions in Medicare FFS claims data for 12 months prior to enrollment date

[84] For example, if a person had third party insurance coverage in a particular month, they were not counted as eligible for the analysis in that month. In parallel, any services provided in that month were excluded from the analysis.

[85] Weights for comparison group members in the Medicare and Medicaid impact analyses were also based on the number of comparison group members associated with the same participant.

Variable name	Specification
Bipolar disorder	Indicator variable for schizophrenia diagnosis on one inpatient or two or more outpatient claims (not including prescription drugs) with the relevant diagnoses in the two years prior to enrollment
Schizophrenia	Indicator variable for depression disorder diagnosis on one inpatient or two or more outpatient claims (not including prescription drugs) with the relevant diagnoses in the two years prior to enrollment
Depression	Indicator variable for bipolar disorder diagnosis on one inpatient or two or more outpatient claims (not including prescription drugs) with the relevant diagnoses in the two years prior to enrollment
Health service area	Indicator of health service area of member's residence. Categories include: Brooklyn (reference category), Philadelphia, Chicago, Pittsburg

b. Medicaid measures

The control variables included in the MMC Medicaid impact analysis are listed in Table C.8 along with the specifications for the variables. Note that when CDPS categorical variables had means of less than two percent, we did not include them as control variables.

Table C.8. Impact analysis model control variable specifications—MMC Medicaid analysis

Variable name	Specification
Period	Categorical variable indicating whether each period is an intervention or baseline period (reference category)
Treatment indicator	Categorical variable indicating treatment status. Categories include: comparison group member (reference category); MMC intervention participants
Interaction between period and AIDSH	Interaction between intervention period and AIDS status indicator variables
Interaction between period and treatment	Interaction between intervention period and treatment indicator variables
Interaction between period, treatment, and AIDSH	Interaction between intervention period, treatment, and AIDS status indicator variables
Age	Categorical indicators of age categories (<17, 18-44, 45-54, 55-64) based on age as of the first month of each analysis period
Sex	Categorical variable of member's sex. Categories include: female (reference category); male
Disabled	Categorical variable indicating whether member was eligible for Medicaid based on disability
Race	Categorical variable of member's race. Categories include: Black, Hispanic, Asian, other, African-American, and White (reference category)
Categorical indicator of Medicaid enrollment	Categorical variable indicating whether the enrollee had continuous enrollment in Medicaid for the 12 months prior to enrollment in the program
Calendar month flags	Vector of categorical variables that index the calendar month during which each analysis period falls
CDPS flags	Flags indicating member's conditions based on the CDPS
AIDS, high	Categorical variable indicating whether member had AIDS, pneumocystis pneumonia, cryptococcosis, or Kaposi's sarcoma
Metabolic, high	Categorical variable indicating whether member had panhypopituitarism, pituitary dwarfism, non-HIV immunity deficiencies
Metabolic, medium	Categorical variable indicating whether member had kwashiorkor, marasmus, and other malnutrition, parathyroid, and adrenal gland disorders
Metabolic, very low	Categorical variable indicating whether member had other pituitary disorders, gout

Variable name	Specification
Hematological, medium	Categorical variable indicating whether member had other hereditary hemolytic anemia, aplastic anemia, splenomegaly, agranulocytosis
Hematological, low	Categorical variable indicating whether member had other white blood cell disorders, purpura, other coagulation defects
Substance abuse, low	Categorical variable indicating whether member had opioid, barbiturate, cocaine, amphetamine abuse or dependence, drug psychoses
Substance abuse, very low	Categorical variable indicating whether member had alcohol abuse, dependence, or psychosis
Infectious, high	Categorical variable indicating whether member had staphylococcal or pseudomonas septicemia, cytomegaloviral disease
Infectious, low	Categorical variable indicating whether member had poliomyelitis, oral candida, herpes zoster, parasitic intestinal infections
Cancer, medium	Categorical variable indicating whether member had mouth, breast or brain cancer, malignant melanoma, radiation or chemotherapy
Cancer, high	Categorical variable indicating whether member had lung cancer, ovarian cancer, secondary malignant neoplasms, leukemia, multiple myeloma
Diabetes Type 1, medium	Categorical variable indicating whether member had type 1 diabetes without complications or with neurological or ophthalmic complications
Diabetes Type 2, medium	Categorical variable indicating whether member had type 2 or unspecified diabetes with complications, proliferative diabetic retinopathy
Diabetes Type 2, low	Categorical variable indicating whether member had type 2 or unspecified diabetes without complications
Eye, low	Categorical variable indicating whether member had retinal detachment, choroidal disorders, vitreous hemorrhage
Eye, very low	Categorical variable indicating whether member had cataract, glaucoma, congenital eye anomaly, corneal ulcer
Cerebrovascular, low	Categorical variable indicating whether member had intracerebral hemorrhage, precerebral occlusion, hemiplegia, cerebrovascular accident
Cardiovascular, medium	Categorical variable indicating whether member had congestive heart failure, cardiomyopathy, tricuspid and pulmonary valve disease
Cardiovascular, low	Categorical variable indicating whether member had endocardial disease, myocardial infarction, angina, coronary atherosclerosis, or dysrhythmias
Cardiovascular, extra low	Categorical variable indicating whether member had hypertension
Gastrointestinal, medium	Categorical variable indicating whether member had regional enteritis and ulcerative colitis, chronic liver disease and cirrhosis, enterostomy
Nervous system, medium	Categorical variable indicating whether member had paraplegia, muscular dystrophy, multiple sclerosis
Nervous system, low	Categorical variable indicating whether member had epilepsy, Parkinson's disease, cerebral palsy, migraine, or cerebral degeneration
Genital, extra low	Categorical variable indicating whether member had uterine and pelvic inflammatory disease, endometriosis, or hyperplasia of prostate
Gastrointestinal, low	Categorical variable indicating whether member had ulcer, hernia, GI hemorrhage, intestinal infectious disease, or intestinal obstruction
Psychiatric, high	Categorical variable indicating whether member had schizophrenia
Psychiatric, medium	Categorical variable indicating whether member had bipolar affective disorder
Psychiatric, low	Categorical variable indicating whether member had other depression, panic disorder, or phobic disorder
Developmental disability, low	Categorical variable indicating whether member had mild or moderate mental retardation, Down's syndrome
Pregnancy, complete	Categorical variable indicating whether member had normal delivery, multiple delivery, delivery with complications

Variable name	Specification
Pulmonary, medium	Categorical variable indicating whether member had other bacterial pneumonias, chronic obstructive asthma, adult respiratory distress syndrome
Pulmonary, low	Categorical variable indicating whether member had viral pneumonias, chronic bronchitis, asthma, COPD, or emphysema
Renal, very high	Categorical variable indicating whether member had chronic renal failure, kidney transplant status or complications
Renal, low	Categorical variable indicating whether member had kidney infection, kidney stones, hematuria, urethral stricture, bladder disorders
Skeletal, medium	Categorical variable indicating whether member had chronic osteomyelitis, aseptic necrosis of bone
Skeletal, low	Categorical variable indicating whether member had rheumatoid arthritis, osteomyelitis, systemic lupus, or traumatic amputation of foot or leg
Skeletal, very low	Categorical variable indicating whether member had osteoporosis, musculoskeletal anomalies, thoracic and lumbar disc degeneration
Skin, low	Categorical variable indicating member had other chronic ulcer of skin
Skin, very low	Categorical variable indicating member had Cellulitis, burn, lupus erythematosus
Alzheimer's	Categorical variable indicating use of cholinesterase inhibitors, NMDA receptor antagonists
Anti-coagulants	Categorical variable indicating use of coumarin, heparin
Folate deficiency	Categorical variable indicating use of folic acid
CMV Retinitis	Categorical variable indicating use of eye antivirals
ICD-9 diagnosis category	Categorical variable indicating whether member had one of the following conditions based on ICD-9 diagnoses codes in the 24 months prior to enrollment in the program
Psychotic disorders	Categorical variable indicating claim diagnosis of: 293.81, 293.82, 293.83
Schizophrenia and related disorders	Categorical variable indicating claim diagnosis of: 295.XX including 295 with no digits after or 295.00
Bipolar disorders	Categorical variable indicating claim diagnosis of: 296.00, 296.01, 296.02, 296.03, 296.04, 296.05, 296.06, 296.10, 296.11, 296.12, 296.13, 296.14, 296.15, 296.16, 296.40, 296.41, 296.42, 296.43, 296.44, 296.45, 296.46, 296.50, 296.51, 296.52, 296.53, 296.54, 296.55, 296.56, 296.60, 296.61, 296.62, 296.63, 296.64, 296.65, 296.66, 296.7, 296.80, 296.81, 296.82, 296.89, 296.90, 296.99
Depressive disorders	Categorical variable indicating claim diagnosis of: 296.20, 296.22, 296.23, 296.24, 296.25, 296.26, 296.30, 296.32, 296.33, 296.34, 296.35, 296.36,

Source:　ICD-9 diagnosis codes, version 32
　　　　　(https://www.cms.gov/medicare/coding/ICD9providerdiagnosticcodes/codes.html).

Note:　We created CDPS flags following UCSD's (University of California San Diego) CDPS + MRx methodology. Please see the CDPS website for programs for further information regarding the individual flags.

ICD-9 = International Classification of Diseases, Ninth Revision.

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APPENDIX D:

VALUEOPTIONS TECHNICAL METHODS

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A. Introduction

This chapter describes the methods for our analysis of ValueOptions program impacts. We first describe the data sources (Section B) and sample for the impact analysis (Section C). Then, we specify how we constructed outcome and control variables (Section D).

B. Description of data sources

MBHP provided the data for this analysis. The data included program participants and a comparison group including people who met all eligibility criteria for the program, but who received treatment as usual. Program eligibility criteria required that participants be 18 to 64 years old and have at least two detoxification treatments in the past 12 months. Analysis data included program enrollment and Medicaid administrative data.

Program enrollment data. MBHP provided data files containing demographic characteristics (date of birth and gender), and service begin and end dates for program participants.

Medicaid administrative data. MBHP provided three types of Medicaid administrative data: 1) Medicaid fee-for-service claims for medical and pharmacy services from March 2012 through March 2016, 2) encounter data for behavioral health services covered by MBHP from March 2012 through March 2016, and 3) Medicaid eligibility records that listed the beginning and end dates for MBHP enrollment spans for the period July 1996 through April 2016. The behavioral health encounter claims listed a paid amount which represents the negotiated payment rate paid to the service provider.

C. Identification of intervention and comparison groups

We received program enrollment data for 1,618 intervention and comparison group members of which there were 1,271 intervention and 337 comparison group members.

We restricted our analysis of program impacts on expenditures and service use, namely (1) total expenditures, (2) ED visits, (3) short-term residential stays, and (4) intensive day treatments, to individuals who were continuously enrolled in MBHP for the first 12 months of the program. Application of this restriction resulted in 449 intervention group members and 109 comparison group members being included in the analysis.[86]

To examine program impacts on the initiation of and engagement with treatment and medication use after discharge from detoxification stay, we required that the claims data available for our analysis include a detoxification stay at the time of enrollment in the program, a detoxification stay in the one year prior to enrollment, and 45 days of continuous MBHP eligibility following discharge from each detoxification stay. These criteria resulted in 808 intervention group members and 210 comparison group members eligible for the analysis.

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[86] These members had similar demographic composition and rates of substance use as the full sample.

D. Specifications of measures

Our specifications for the core measures are described in Section D.1 below. Specifications for initiation and engagement with treatment outcomes are described in Section D.2. Our analyses used several other types of measures as control variables, described in Section D.3.

1.   Core measures

CMMI requested that we examine program impacts on four standardized outcome measures for all awardees to the extent feasible. These measures are: total Medicare and/or Medicaid expenditures, inpatient hospitalizations, hospital readmissions, and ED visits. We analyzed two of the CMMI core measures for ValueOptions: total Medicaid expenditures and ED visits. We did not analyze hospitalizations and hospital readmissions, because ValueOptions program participants had few hospital stays at baseline. Since treatment population members frequently used residential stays and intensive day treatment at baseline, we analyzed program impacts on these services instead of hospitalizations and readmissions.

We first described how we identified observation periods, then describe how each of these four outcome measures were constructed for each period.

a.   Identifying observation periods

Baseline and intervention periods were defined for each intervention or comparison group member relative to their program enrollment month. The first intervention period was six months long and defined as the date of enrollment and the 179 days[87] following that date. Where applicable, the second intervention period was the six months following the first intervention period. The first baseline period was the six months prior to the date of program enrollment and additional baseline periods were identified by moving backward six months from the first baseline period. For each individual included in the analysis, the proportion of each baseline and intervention period for which the individual was enrolled in MBHP was calculated. This proportion was used to pro-rate the expenditure and utilization measures for individuals enrolled for less than the full intervention or baseline period. It was also used to weight observations in the regression analysis.

b.   Calculating total expenditures

We calculated total expenditures by summing the total amount paid field on approved claims for medical (including institutional and outpatient services), pharmacy and behavioral health services. Duplicate and denied claims were excluded. For claims with services spanning more than one day, expenditures were counted on a single day. The day on which costs were counted varied depending on the type of claim. Costs for inpatient stays, residential stays, and intensive day treatments were counted on the discharge date and costs for ED visits were counted on the first date of service. Costs for all other claims were counted on the last date of service. Expenditures were excluded from this

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[87] For brevity, we only discuss the six-month baseline and intervention periods created for the analysis of trends in regression-adjusted means. We also defined a second set of baseline and intervention periods and weights corresponding to 18 months from program enrollment, used in the impact and total savings table in the report (Table X.2).

analysis if they occurred in months during which the associated patient was deemed ineligible for the analysis.

c. ED visits

We used the following revenue center codes to identify ED services:

0450 = Emergency room-general classification
0451 = Emergency room-emtala emergency medical screening services (eff 10/96)
0452 = Emergency room-ER beyond emtala screening (eff 10/96)
0456 = Emergency room-urgent care (eff 10/96)
0459 = Emergency room-other
0981 = Professional fees-emergency room

All medical claims not classified as inpatient were reviewed for these codes. If these codes were present and one of the following criteria were met, the claim was considered an ED visit:

- The procedure code was in the range of 10040–69979 and the place of service was hospital emergency department; or

- The procedure code was 99281–99285.

ED visits that led to inpatient stays (i.e., ones that overlapped with an inpatient stay) were excluded. If two or more ED visits had the same patient identifier and overlapping dates of service, we counted them as one visit.

d. Residential stays and days of intensive day treatment

To estimate the number of residential stays and days of intensive day treatment we started with all claims with type=inpatient. Then we identified three distinct service types based on revenue code: inpatient, residential, and intensive day treatment. Residential stay claims were identified based on the revenue code 907 and intensive day treatment claims were identified based on the revenue code 1002.

After eliminating duplicate and denied claims, we combined claims that represent the same residential stay or the same intensive day treatment episode. All claims of a given type (residential stay or intensive day treatment) which had an admission date on, before, or the day after the previous discharge date were considered to be part of the same stay (or treatment). For example, if a residential claim ended on March 31 and the next residential claim began on April 1, those claims are considered to be part of the same stay. However, if the second claim began on April 2 instead of April 1, it would be considered as part of a separate stay. To identify the number of days of an intensive day treatment episode, the difference between the discharge date on the last claim and the admission date on the first claim of the episode plus 1 was used. Residential stays and intensive day treatment episodes were counted in the intervention year or baseline period based on the discharge date.

2.   Initiation and engagement with treatment and initiation of medication use after discharge from detoxification stay

For constructing outcomes measures of initiation and engagement with treatment and medication use, we followed Healthcare Effectiveness Data and Information Set (HEDIS) specifications for initiation and engagement of alcohol and other drug dependence treatment measures. Specifically, we constructed three measures: (1) likelihood of initiation of substance use disorder treatment (an inpatient admission, outpatient visit, intensive outpatient encounter, or partial hospitalization) within 14 days of discharge from a detoxification facility, (2) likelihood of engagement with substance use disorder treatment within 30 days of initiation of treatment, and (3) likelihood of initiation of medication use within 14 days of discharge from a detoxification facility.

a.   Identifying detoxification stays

We identified the post-intervention stay as the detoxification stay during which the member was enrolled in the program (see Table D.1 for codes we used to identify the stay). Next we identified the baseline detoxification stay as the most recent detoxification stay in the year prior to the post-intervention stay as long as the stay ended at least 44 days prior to the start of the post-intervention stay (see Table D.2 for codes we used to identify the stay). Per MBHP's guidance we used a broader set of services to identify the baseline detoxification stay.

Table D.1. Codes to identify the post-intervention detoxification stay

HCPCS	ICD-9-CM Procedure	UB Revenue	MBHP codes
H0008-H0014	94.62, 94.65, 94.68	0116, 0126, 0136, 0146, 0156	Claim type=I3 and Service code=1002

Source: HEDIS Initiation and Engagement of Alcohol and other Drug Dependence Treatment Measure codes and additional codes provided by MBHP.

HEDIS= Healthcare Effectiveness Data and Information Set; MBHP= The Massachusetts Behavioral Health Partnership

Table D.2. Codes to identify the baseline detoxification stay

HCPCS	ICD-9-CM Procedure	UB Revenue	MBHP codes
H0008-H0014	94.62, 94.65, 94.68	0116, 0126, 0136, 0146, 0156	Claim type=I3 and service code=1002 Claim type = PI, DX, and D3

Source: HEDIS Initiation and Engagement of Alcohol and other Drug Dependence Treatment Measure codes and additional codes provided by MBHP.

HEDIS= Healthcare Effectiveness Data and Information Set; MBHP= The Massachusetts Behavioral Health Partnership

Next we identified whether the stay was for alcohol use dependence (AUD) only, other drug use dependence (OUD) only, or both by examining *all* diagnosis fields on the claim against the AUD and OUD diagnosis codes in Table D.3.

Table D.3. Codes to Identify AUD and OUD

ICD-9-CM Diagnosis
AUD and OUD 291-292, 303.00-303.02, 303.90-303.92, 304.00-304.02, 304.10-304.12, 304.20-304.22, 304.30-304.32, 304.40-304.42, 304.50-304.52, 304.60-304.62, 304.70-304.72, 304.80-304.82, 304.90-304.92, 305.00-305.02, 305.20-305.22, 305.30-305.32, 305.40-305.42, 305.50-305.52, 305.60-305.62, 305.70-305.72, 305.80-305.82, 305.90-305.92, 535.3, 571.1
AUD only 291, 303.00-303.02, 303.90-303.92, 305.00-305.02, 535.3, 571.1
OUD only 292, 304.00-304.02, 304.10-304.12, 304.20-304.22, 304.30-304.32, 304.40-304.42, 304.50-304.52, 304.60-304.62, 304.70-304.72, 304.80-304.82, 304.90-304.92, 305.20-305.22, 305.30-305.32, 305.40-305.42, 305.50-305.52, 305.60-305.62, 305.70-305.72, 305.80-305.82, 305.90-305.92

Source: HEDIS Initiation and Engagement of Alcohol and other Drug Dependence Treatment Measure codes.

HEDIS= Healthcare Effectiveness Data and Information Set

Next we examined if the member was continuously eligible for MBHP for 44 days after discharge from each of the two detoxification stays. Stays that did not meet this criterion were excluded from the measure. After following the above steps we were left with 1,018 members (808 intervention and 210 comparison) with a post-intervention and baseline detoxification stay for AUD, OUD, or both and with continuous MBHP eligibility for 44 days after discharge from each stay.

b.   Identifying outcomes after discharge from detoxification stay

For each of the 1,018 members, we identified three outcomes following each of the two detoxification stays as follows:

1.   Initiation of treatment: We flagged that treatment was initiated after the detoxification stay if the member had an inpatient admission, outpatient visit, intensive outpatient encounter or partial hospitalization (Table D.4) with an AUD or OUD diagnosis (Table D.3) within 14 days of discharge from the detoxification stay.

Table D.4. Codes to Identify Inpatient, Outpatient, Intensive Outpatient and Partial Hospitalization Visits

CPT	HCPCS	UB Revenue
90804-90815, 98960-98962, 99078, 99201-99205, 99211-99215, 99217-99220, 99241-99245, 99341-99345, 99347-99350, 99384-99387, 99394-99397, 99401-99404, 99408, 99409, 99411, 99412, 99510, 90832, 90833, 90834, 90836, 90837,90838,90785	G0155, G0176, G0177, G0396, G0397, G0409-G0411, G0443, H0001, H0002, H0004, H0005, H0007, H0015, H0016, H0020, H0022, H0031, H0034-H0037, H0039, H0040, H2000, H2001, H2010-H2020, H2035, H2036, M0064, S0201, S9480, S9484, S9485, T1006, T1012 **Supplementary HCPCS codes provided by MBHP** 11982, 90791, 90792, 90832, 90833, 90834, 90836, 90837, 90847, 90853, 96372, 99201, 99202, 99203, 99204, 99205, 99211, 99212, 99213, 99214, 99215, 99217, 99218, 99219, 99220, 99384, 99385, 99386, 99394, 99395, 99396, 99402, 99404, 99495, G0101, G0155, G0177, G0463, G0467, H0015, H0020, H0040, H2011, H2012, H2015, H2016, H2019, S9484, S9485, T1015	0510, 0513, 0515-0517, 0519-0523, 0526-0529, 0900, 0902-0907, 0911-0917, 0919, 0944, 0945, 0982, 0983 1002 **Supplementary Revenue Codes provided by MBHP** 0100, 0120, 0124, 0250, 0301, 0430, 0510, 0513, 0519, 0521, 0724, 0760, 0762, 0900, 0902, 0906, 0907, 0912, 0913, 0914, 0915, 0942, 0944, 0945, 0961, 1001, 1002

CPT		POS
90801, 90802, 90845, 90847, 90849, 90853, 90857, 90862, 90875, 90876, 90791, 90792, 90785	*WITH*	03, 05, 07, 09, 11, 12, 13, 14, 15, 20, 22, 33, 49, 50, 52, 53, 57, 71, 72
90816-90819, 90821-90824, 90826-90829, 99221-99223, 99231-99233, 99238, 99239, 99251-99255, 90832, 90834, 90837, 90785	*WITH*	52, 53

Source: HEDIS Initiation and Engagement of Alcohol and other Drug Dependence Treatment Measure codes and additional codes provided by MBHP

HEDIS= Healthcare Effectiveness Data and Information Set; MBHP= The Massachusetts Behavioral Health Partnership

2. <u>Engagement with treatment</u>: We flagged that the member engaged with treatment after initiation of treatment if the member had 2 or more inpatient admissions, outpatient visits, intensive outpatient encounters or partial hospitalizations (Table D.4) with an AUD or OUD diagnosis (Table D.3) within 30 days of initiation of treatment.

3. <u>Initiation of medication use</u>: We flagged that medication use was initiated after discharge from the detoxification stay if:

    a. For members with an AUD detoxification stay (stay had AUD diagnoses codes only), the member had at least one AUD pharmacy claim (Table D.5) within 14 days of discharge.

    b. For members with an OUD detoxification stay (stay had OUD diagnoses codes only), the member had at least one OUD pharmacy claim OR a behavioral health claim for methadone treatment (Table D.6) within 14 days of discharge.

    c. For members with both an AUD and OUD detoxification stay (stay had both AUD and OUD diagnoses codes), the member met criterion 'a' or 'b' or both.

Table D.5. Codes to Identify AUD Medication use

AUD medicines	NDCs
Acamprosate	51079-241, 60687-121, 68151-4760, 68462-435, 69189-0437, 0378-6333, 0456-3330
Naltrexone	65757-300, 16729-081, 42291-632, 43063-469, 43063-591, 47335-326, 50436-0105, 51224-206, 52125-727, 54868-5574, 63629-5304, 68084-291, 68094-853, 0406-1170, 0555-0902
Disulfiram	51285-523, 51285-524, 54868-5034, 47781-607, 60429-196, 64980-171, 64980-172, 68151-2694, 0054-0356, 0054-0357, 0093-5035, 0093-5036, 0378-4140, 0378-4141, 0603-3432, 0603-3433
Topiramate	0093-0155, 0093-7219, 0093-7220, 0093-7335, 0093-7336, 0093-7540, 0143-9755, 0143-9756, 0143-9757, 0143-9758, 0245-0707, 0245-0708, 0245-0709, 0245-0710, 0245-1071, 0245-1072, 0245-1073, 0245-1074, 0245-1075, 0378-6101, 0378-6102, 0378-6103, 0378-6105, 0615-7562, 0615-7563, 0615-7564, 0615-7565, 0832-0707, 0832-0708, 0832-0709, 0832-0710, 0832-1071, 0832-1072, 0832-1073, 0832-1074, 0832-1075, 0904-6016, 0904-6017, 0904-6018, 10544-489, 10544-628, 10544-847, 12634-452, 12634-453, 13668-031, 13668-032, 13668-033, 13668-034, 16252-568, 16252-569, 16590-817, 16590-824, 16590-825, 17772-101, 17772-102, 17772-103, 17772-104, 21695-128, 21695-129, 21695-130, 21695-162, 21695-205, 21695-348, 21695-349, 29300-115, 29300-116, 29300-117, 29300-118, 31722-278, 31722-279, 31722-280, 31722-281, 33261-106, 33261-400, 33261-480, 35356-469, 35356-470, 35356-471, 35356-472, 42549-619, 42549-620, 42549-621, 43063-094, 43063-114, 43063-189, 43063-417, 43063-436, 43063-538, 43063-573, 43063-605, 43063-612, 47335-707, 47335-710, 47335-711, 47335-712, 49349-116, 49349-118, 49349-142, 49349-365, 49349-395, 49349-402, 49349-705, 49349-778, 49349-802, 49349-820, 49349-907, 49349-942, 49349-993, 50268-750, 50268-751, 50268-752, 50268-753, 50436-994, 50436-995, 50458-639, 50458-640, 50458-641, 50458-642, 50458-645, 50458-647, 51079-726, 51079-727, 51079-728,51655-032,51655-608, 51655-609, 52125-047, 52125-061, 52125-089, 52125-463, 52125-852, 52125-876, 52125-914, 52959-441, 52959-643, 52959-994, 53808-092, 53808-093, 53808-096, 54868-467, 54868-519, 54868-534, 54868-601, 55154-537, 55289-433, 55700-210, 58118-070, 58118-071, 59115-124, 59115-125, 59115-126, 59115-127, 60429-769, 60429-770, 60429-771, 60429-772, 60505-276, 60687-108, 60723-031, 60723-032, 60723-033, 60760-278, 60760-279, 60760-280, 60760-287, 61786-293, 61786-298, 61919-172, 61919-185, 61919-190, 61919-691, 61919-817, 61919-823, 61919-824, 61919-825, 62756-707, 62756-710, 62756-711, 62756-712, 63187-059, 63187-060, 63187-077, 63187-118, 63187-228, 63187-230, 63187-283, 63187-479, 63304-778, 63304-779, 63304-780, 63629-329, 63629-332, 63629-399, 63629-494, 64725-070, 64725-071, 65841-647, 65841-648, 65841-649, 65841-650, 65841-651, 65841-652, 65862-171, 65862-172, 65862-173, 65862-174, 68084-342, 68084-344, 68084-345, 68258-300, 68258-705, 68258-715, 68382-004, 68382-005, 68382-138, 68382-139, 68382-140, 68382-141, 68387-558, 68387-559, 68387-560, 68462-108, 68462-109, 68462-110, 68462-153, 68788-896, 68788-949, 68788-953, 68788-973, 69097-122, 69097-123, 69097-124, 69097-125

Source: American Society of Addiction Medicine (ASAM) and National Drug Codes (NDCs) from NDC directory at U.S. Food and Drug Administration website (https://www.accessdata.fda.gov/scripts/cder/ndc/default.cfm)

Table D.6. Codes to Identify OUD Medication use

OUD medicines	NDCs (in Rx claims)
Naltrexone	65757-300, 16729-081, 42291-632, 43063-469, 43063-591, 47335-326, 50436-0105, 51224-206, 52125-727, 54868-5574, 63629-5304, 68084-291, 68094-853, 0406-1170, 0555-0902
Buprenorphine	0054-0176, 0054-0177, 0054-0188, 0054-0189, 0093-5378, 0093-5379, 0093-5720, 0093-5721, 0228-3153, 0228-3154, 0228-3155, 0228-3156, 0378-0923, 0378-0924, 0406-1923, 0406-1924,12496-120, 12496-121, 35356-004, 42291-174, 42291-175, 43063-184, 49349-421, 49349-554, 50383-287, 50383-294, 50383-924, 50383-930, 52125-649, 52125-678, 54123-114, 54123-914, 54123-929, 54123-957, 54123-986, 54569-639, 54569-640, 54569-657, 54868-570, 54868-575, 55154-496, 55700-147, 59385-012, 59385-014, 59385-016, 63481-161, 63481-207, 63481-348, 63481-519, 63481-685, 63481-820, 63481-952, 63629-402, 63629-403, 63629-409, 63629-507, 65162-415, 65162-416
Methadone treatment	Service code='H0020' and modifier='UA' (In behavioral health claims)

Source: American Society of Addiction Medicine (ASAM) and National Drug Codes (NDCs) from NDC directory at U.S. Food and Drug Administration website (https://www.accessdata.fda.gov/scripts/cder/ndc/default.cfm).

Methadone treatment codes provided by MBHP.

MBHP= The Massachusetts Behavioral Health Partnership

3.   Control variables

The control variables included in the ValueOptions regression models are listed in Table D-7 along with the specifications for the variables.

Table D.7. Impact analysis model control variable specifications—ValueOptions

Variable name	Specification
Intervention period	Categorical variable indicating time period of assessment. For 6-monthly regressions, categories include: 0-6 months post-enrollment, 7-12 months post-enrollment, 13-18 month post-enrollment, 0-6 months pre-enrollment, 7-12 months pre-enrollment, 13-18 month pre-enrollment (reference) For 18-monthly regressions, categories include: 0-18 months post-enrollment and 0-18 months pre-enrollment (reference)
Treatment indicator	Categorical variable indicating treatment status. Categories include: comparison group member (reference); participant
Interaction between intervention period and treatment	Interaction between intervention period and treatment indicator variables.
Calendar time index	Categorical variables indicating the first month of each observation period (six-month, or 18-month) for the member
Age	Continuous variable indicating age on the begin date of the intervention period
Age squared	Continuous variable measuring age as defined above squared
Sex	Categorical variable of member's sex. Categories include: female (reference); male
CDPS categories	Indicators for CDPS categories
Cardiovascular, extra low	Categorical variable indicating whether member had hypertension
Infectious, low	Categorical variable indicating whether member had Poliomyelitis, oral candida, herpes zoster, parasitic intestinal infections
Cardiovascular, low	Categorical variable indicating whether member had endocardial disease, myocardial infarction, angina, coronary atherosclerosis, or dysrhythmias

Variable name	Specification
Nervous system, low	Categorical variable indicating whether member had epilepsy, Parkinson's disease, cerebral palsy, migraine, or cerebral degeneration
Gastrointestinal, low	Categorical variable indicating whether member had ulcer, hernia, GI hemorrhage, intestinal infectious disease, or intestinal obstruction
Gastrointestinal, Medium	Categorical variable indicating whether member had regional enteritis and ulcerative colitis, chronic liver disease and cirrhosis, enterostomy
Psychiatric, medium	Categorical variable indicating whether member had bipolar affective disorder
Psychiatric, low	Categorical variable indicating whether member had other depression, panic disorder, or phobic disorder
Pulmonary, low	Categorical variable indicating whether member had viral pneumonias, chronic bronchitis, asthma, COPD, or emphysema
Pulmonary, medium	Categorical variable indicating whether member had other bacterial pneumonias, chronic obstructive asthma, adult respiratory distress syndrome
Skeletal, very low	Categorical variable indicating whether member had osteoporosis, musculoskeletal anomalies, thoracic and lumbar disc degeneration
Skin, very low	Categorical variable indicating whether member had cellulitis, burn, lupus erythematosus
Substance abuse, low	Categorical variable indicating whether member had opioid, barbiturate, cocaine, or amphetamine abuse or dependence, or drug psychoses
Medicaid Rx categories	
MRX2	Cardiac
MRX3	Psychosis/Bipolar/Depression
MRX14	Seizure disorders

Super low sub-category for skin, nervous system, skeletal, pulmonary, eye, renal, metabolic, infectious, gastrointestinal, and genital CDPS categories;

Not well-defined sub-category for nervous system, skeletal, pulmonary, gastrointestinal, metabolic, and cardiovascular CDPS categories*

Note: We created CDPS flags following UCSD's (University of California San Diego) CDPS + MRx methodology. Please see the CDPS website for programs for further information regarding the individual flags.

* See http://cdps.ucsd.edu/CDPS_Medicare_App.pdf for descriptions of ICD-9 codes for super-low and not well-defined CDPS categories.

CDPS = Chronic Illness and Disability Payment System; ICD-9 = International Classification of Diseases, Ninth Revision.

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APPENDIX E:

REFERENCES NOTED IN APPENDICES A-D

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