MATHEMATICA Policy Research

REPORT

FINAL REPORT

Medicaid Emergency Psychiatric Services Demonstration Evaluation: Final Report

Volume 2: Technical Appendices

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STRUCTURE OF THE REPORT

This report consists of three volumes. This is Volume II. **Volume I** comprises an Executive Summary; background information about the demonstration; an overview of legislative requirements for the evaluation, our conceptual framework, and the evaluation design; a narrative description of the results of the primary statistical models; conclusions; and references. **Volume II** is a technical appendix that provides additional detail about qualitative and quantitative data collection and analysis methodology, and supplemental tables presenting additional details about results presented in Volume I as well as results of alternative statistical models. **Volume III** provides detailed qualitative summaries regarding the implementation of the demonstration in each of the 12 participating states.

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CONTENTS

EXHIBITS

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I. QUALITATIVE DATA COLLECTION AND ANALYSIS METHODS

In this chapter, we describe our approach to collecting and analyzing qualitative data to address ACA-mandated evaluation area B (discharge planning), better understand how the states and IMDs implemented the psychiatric EMC criteria and stabilization review requirements of the ACA, and gather information on care processes and the environmental context in which the MEPD was implemented to supplement and assist in interpreting quantitative results. We gathered data through review of state MEPD proposals, operational plans, and quarterly reports; introductory interviews with MEPD project directors and IMD officials; two rounds of site visits or interviews with staff at participating IMDs and associated EDs and general hospitals (from March to September 2014 and January to May 2015); reviews of medical records at the IMDs, EDs, and general hospitals; and telephone interviews with beneficiaries served by each of the 28 IMDs that participated in MEPD. We also implemented a systematic process to track contextual factors that might affect MEPD's results.

A. Site visits and staff interviews

1. Data collection

We assigned separate teams to lead qualitative data collection for each state participating in MEPD. In 2013, the teams reviewed documents and conducted preliminary discussions with state project directors and select IMD contacts to gather information on each state's demonstration project and larger mental health system, to inform development of our evaluation plan. As part of each of the two rounds of qualitative data collection, we conducted additional telephone interviews with the state project directors using a standardized protocol, to identify changes in implementation or in the mental health system since initiation of MEPD and to learn about contextual factors that could affect MEPD's results. We also used these calls to inform state personnel that we would begin working with the IMDs, EDs, and general hospitals to plan the site visits and to begin recruiting beneficiaries for our telephone survey. We asked state project directors and, in some cases, IMD administrators for suggestions of ED and general hospital representatives potentially willing to participate in the evaluation. We sought to identify EDs that had made a large number of referrals to the IMD and had established a strong relationship with it, and general hospitals that used scatter beds when psychiatric beds were not available. During these conversations, we learned that for 20 of the 28 IMDs, no general hospitals used scatter beds in lieu of psychiatric beds. For the remaining 8 IMDs, we contacted all general hospitals that state project directors, IMD administrators, or others in the state (for example, the state hospital association) told us used scatter beds; we successfully visited the six that confirmed they used scatter beds and were willing to participate in the evaluation.

After training Mathematica staff on site visit protocols in February 2014, we arranged and conducted site visits to 24 of the 26 IMDs participating in MEPD at that time (**Exhibit I.1**). We did not visit the IMD in Connecticut during the first round of site visits because we had visited it in 2013 to pilot the protocols. In addition, we were unable to arrange a visit to one of the IMDs in California in 2014, but successfully completed staff interviews by telephone. During the second round of data collection, in spring 2015, we arranged site visits to the IMDs we did not visit in 2014, including two IMDs and associated facilities in Missouri that joined the MEPD

Exhibit I.1. Facilities that participated in site visits and telephone interviews

State	IMD	General hospital[a]	ED[a]	Other	Notes
Alabama	EastPointe Hospital	NA	University of South Alabama Medical Center		The only facility in the area that used scatter beds, declined to participate. Scatter beds were rarely used in the catchment area of the other two participating IMDs in Alabama.
Alabama	Hill Crest Behavioral Health Services	NA	University of Alabama Birmingham Hospital		
Alabama	Mountain View Hospital	NA	DeKalb Regional Medical Center		
California	John Muir	NA	Contra Costa Regional Medical Center		
California	Heritage Oaks	NA	UC Davis Medical Center		
California	Sierra Vista	NA	UC Davis Medical Center		
California	Sutter Center for Psychiatry	NA	Sutter General Hospital		
Connecticut	Natchaug Hospital	NA	Windham Hospital	ValueOptions (ASO for CT Medicaid)	
District of Columbia	Psychiatric Institute of Washington	NA	George Washington University Hospital		
Illinois	Chicago Lakeshore Hospital	NA	None visited		The ED paired with Chicago Lakeshore under Illinois' implementation of the MEPD dropped out of MEPD and did not respond to our requests to participate in the evaluation.
Illinois	Riveredge Hospital	NA	Loyola Hospital		
Maine	Acadia Hospital	NA	None visited		An ED initially agreed to participate in the evaluation but then canceled just before the round one site visit and did not respond to our request to participate in round two interviews.
Maine	Spring Harbor Hospital	NA	Maine Medical Center		
Maryland	Adventist Behavioral Health	NA	Shady Grove Adventist Hospital		
Maryland	Brook Lane Health Services	NA	Meritus Medical Center		

State	IMD	General hospital[a]	ED[a]	Other	Notes
Maryland	Sheppard Pratt	NA	Greater Baltimore Medical Center	ValueOptions (ASO for MD Medicaid)	
Missouri	Royal Oaks Hospital	NA	Citizens Memorial Hospital		We contacted two suggested general hospitals, but both reported not using scatter beds; one reported that psychiatric admissions would be made to general medical units only in cases of co-occurring medical conditions, as appropriate.
Missouri	St. Louis Regional Psychiatric Stabilization Center	Barnes-Jewish Hospital	Barnes-Jewish Hospital		
Missouri	Two Rivers Hospital	St. Joseph Medical Center	Western Missouri Medical Center		
Missouri	Signature Psychiatric Hospital	NA	North Kansas City Hospital		During pre-site visit telephone calls, a general hospital that used scatter beds was not identified. However, during the site visit, North Kansas City Hospital ED staff said they did place patients in scatter beds.
Missouri	CenterPointe	Barnes-Jewish Hospital	Progress West, Barnes-Jewish Hospital		
North Carolina	Holly Hill Hospital	WakeMed Health and Hospitals	WakeMed Health and Hospitals	Alliance Behavioral Healthcare (local management entity for behavioral health)	
Rhode Island	Butler Hospital	NA	Memorial Hospital of Rhode Island	Providence Center (community mental health center)	
Washington	Fairfax Hospital	Providence Regional Medical Center-Everett Hospital	Providence Regional Medical Center-Everett Hospital		
Washington	Lourdes Counseling Center	Lourdes Medical Center	Lourdes Medical Center		
Washington	Navos Mental Health Solutions	Evergreen Health	Evergreen Health		
West Virginia	Highland Hospital	NA	Charleston Area Medical Center	Prestera Center, a comprehensive behavioral health center (by phone)	

State	IMD	General hospital[a]	ED[a]	Other	Notes
West Virginia	River Park Hospital	NA	Cabell Huntington Hospital	Prestera Center, a comprehensive behavioral health center (by phone)	

Note: With a few exceptions, we conducted in-person site visits during the first round of data collection in spring/summer 2014, and telephone interviews with staff during the second round of data collection in spring 2015.

[a]Participation in the evaluation was voluntary for EDs and general hospitals. We spoke with project directors and staff of IMDs, EDs, and general hospitals to determine whether scatter beds were being used for patients with EMCs.

in September 2013 and August 2014. We also revisited two facilities to complete medical record reviews that could not be completed during the first round. For facilities visited during the first round of data collection, we conducted a second round of interviews with facility staff by phone.

Facility staff interviewed included administrators, supervisors, physicians, and clinical care, intake, and discharge staff. During the first round of interviews, we spoke with them about how psychiatric EMCs are determined, inpatient admissions, assessment and stabilization processes, and discharge planning. During the second round of interviews, we asked about any changes in processes under the demonstration, changes in funding or arrangements in the state mental health care system, costs of the demonstration, and expected outcomes. In some cases, at the suggestion of state or IMD staff, we visited or interviewed additional service providers relevant to the demonstration, such as administrative service organizations and community mental health centers.

2. Analysis of site visit and staff interview data

Each site visit team prepared a state-specific summary of information provided by state project directors and facility staff (Volume III). Each summary includes information about the context in which the demonstration project operated and external factors that may affect MEPD results; perceived effects of MEPD on care processes and procedures; organizational experiences with the demonstration; and perceived outcomes.

Site visit teams took extensive notes during each telephone or in-person interview, recording answers to each of the interview questions. Each interview was audio recorded so note takers could use the recordings to verify the answers and prepare a detailed summary. Using Atlas.ti, we content-coded all interview summaries and conducted a thematic analysis by each research question specified in the ACA, as well as by other topics of interest. Systematic analysis of data at the state level allowed the team to develop a deep understanding of each state program, including the implementation and monitoring of its demonstration, processes of care under MEPD, facilitators and barriers to implementation, costs and cost savings of the demonstration, and various perspectives on whether the MEPD was expected achieve positive outcomes.

The state-level analyses formed the basis of a broader cross-site analysis in which we identified themes and patterns across the 12 participating states. To assist the team in synthesizing effects across states, we catalogued state-level findings from the qualitative analysis in a matrix that summarized findings by research question within ACA area. For each research question, we used codes to indicate whether the qualitative data suggested MEPD had a positive effect, a mixed effect, or no effect (**Exhibit I.2**). If all respondents in a state said MEPD had a potential positive effect on a research question, we coded the perceived effects for that state as positive or **O**. If respondents within a state disagreed in their perceptions, we coded the perceived effects as mixed, shown as ▬ in the chart. If all respondents in a state indicated that MEPD had no effect on a particular question, we coded the perceived effect as no effect, shown as **X.** This cross-state analysis helped us to interpret key outcomes for each of the research questions and generate operational lessons learned.

B. Medical record reviews

1. Data collection

To cross-validate information provided in interviews and help understand how MEPD processes were applied at the level of the individual beneficiary, we asked hospital contacts to prepare two patient rosters in advance of the in-person site visit so that we could conduct purposive sampling of 10 patient medical records while on-site. At IMDs and EDs, we asked for one roster of demonstration patients (or Medicaid beneficiaries with psychiatric EMCs) discharged 30 to 60 days before the site visit and a second roster of Medicaid beneficiaries discharged 30 to 60 days before the demonstration implementation date.[1] At general hospitals, we asked for similar rosters of patients admitted to nonpsychiatric units of the hospital.[2] Using purposive sampling of patients with characteristics of interest, such as long length of stay, suicidality, homicidality, complex psychiatric diagnoses, medical comorbidities, or co-occurring substance use, we selected five records for review from each roster.[3] To maintain patient confidentiality, we used a unique numbering system to identify the patients in our sample. We abstracted information about diagnosis, stabilization, and referral and discharge planning.

Over the two rounds of data collection, we reviewed 578 medical records at 28 IMDs and 25 EDs, covering all 12 states participating in MEPD (**Exhibit I.3**). We also reviewed records from 6 general hospitals in three of the four states in which we were able to identify general hospitals

[1] IMDs that did not admit Medicaid beneficiaries before the demonstration were asked to provide a roster of all patients discharged 30 to 60 days before the demonstration implementation date.

[2] General hospitals with fewer than five Medicaid beneficiaries with psychiatric EMCs in this time frame were also asked to provide a roster of non-Medicaid beneficiaries discharged during the designated periods.

[3] We based our selection on the admitting diagnosis and other characteristics noted on the patient roster. When rosters did not contain enough information, the IMD staff member helping us locate information in the records was sometimes able to provide additional information about the patients to aid in selection. If the staff member could not provide additional information and the records were readily available, site visit teams sometimes scanned the records to identify patients with the desired characteristics. If quick scanning of the records was not possible, site visitors selected records arbitrarily from among those listed on the roster.

Exhibit I.2. Perceived effects, by state, by research question within ACA-mandated evaluation area

Research questions	AL	CA	CT	DC	IL	ME	MD	MO	NC	RI	WA	WV
ACA Area A: Access to in-patient mental health services under the Medicaid program, average lengths of in-patient stays and ER visits												
A1: To what extent do admissions of Medicaid beneficiaries[a] with psychiatric EMCs to private IMDs increase as a result of MEPD?	O	-	O	O	O	X	X	O	O	O	X	O
A2: Do admissions of Medicaid beneficiaries with psychiatric EMCs to nonpsychiatric units of general hospitals (scatter beds) decrease as a result of MEPD?	X	X	X	X	X	X	X	-	X	X	X	X
A3: What is MEPD's effect on length of stay for Medicaid beneficiaries with psychiatric EMCs admitted to private IMDs compared with length of stay in these facilities before MEPD and to length of stay in general hospital psychiatric units?	X	-	O	X	-	-	X	X	X	X	X	-
A4: What is MEPD's effect on length of stay for Medicaid beneficiaries with psychiatric EMCs admitted to scatter beds in general hospitals?	X	X	X	X	X	X	X	X	NR	X	NR	X
A5: Are fewer Medicaid beneficiaries with psychiatric EMCs seen in ERs as a result of MEPD?	X	X	X	X	X	X	X	X	X	X	X	NR
A6: Does MEPD reduce psychiatric boarding time in EDs for Medicaid beneficiaries with psychiatric EMCs?	X	X	-	O	-	NR	O	-	O	-	X	-
ACA Area B: Assessment of discharge planning by participating hospitals												
B1: Has MEPD increased the proportion of individuals discharged with a continuing care plan from the participating hospitals?	O	X	NR	X	O	O	O	X	X	-	X	X
B2: Has MEPD increased the length of time spent developing a discharge plan for Medicaid beneficiaries with psychiatric EMCs in participating IMDs?	-	O	-	X	-	X	X	-	O	-	X	NR
B3: Has MEPD increased the proportion of Medicaid beneficiaries with psychiatric EMCs in participating IMDs who are discharged to community-based residences?	NR	NR	NR	NR	X	O	NR	NR	X	NR	X	X
B4: Has MEPD increased the level of detail (e.g., appointment times, names of providers) in the discharge plans for Medicaid beneficiaries with psychiatric EMCs in participating IMDs?	O	X	X	O	-	X	X	X	X	O	X	-

Research questions	AL	CA	CT	DC	IL	ME	MD	MO	NC	RI	WA	WV
B5: How does the discharge planning process in participating IMDs compare to the processes in nonpsychiatric units of general hospitals?	NA	NA	NA	NA	NA	NA	NA	X	X	NA	NR	NA
B6: Has MEPD reduced 30-day readmissions (all cause and psychiatric) for patients discharged from participating IMDs for a psychiatric EMC (compared to before MEPD and compared to nonpsychiatric units of general hospitals)?	NR	NR	O	NR	NR	O	NR	NR	X	NR	NR	NR
ACA Area C: Impact of the demonstration on mental health service costs												
C2: How do costs incurred by the states for IMD admissions of Medicaid beneficiaries with psychiatric EMCs change after MEPD's implementation?	NR	O	X	NR	X	X	O	NR	O	X	NR	X
C3: How do costs incurred by participating IMDs for inpatient admissions of Medicaid beneficiaries with psychiatric EMCs change after MEPD's implementation?	O	O	X	X	-	-	-	O	X	X	NR	-
C5: What additional administrative costs have been incurred by states and participating facilities to fully implement MEPD? (O = additional costs/staff time, X = no additional cost)	O	NR	O	O	O	X	O	O	X	O	O	O
Stabilization assessment and quality of care												
How have states and IMDs implemented stabilization assessment as mandated by the ACA?	X	X	X	X	X	X	X	-	O	X	X	X
How is quality of care in IMDs similar to or different than quality of care in EDs and general hospital scatter beds?	O	O	O	O	O	O	O	O	O	O	-	-

Source: Analysis of qualitative data collected through interviews with state demonstration project directors, facility staff, and beneficiaries.

O = Respondents reported potential effects from the demonstration.

X = Respondents reported no effects from the demonstration.

- = Respondents expressed differing views about potential effects from the demonstration.

NR = Not reported; respondents did not report about potential effects from the demonstration.

NA = Not applicable because we could not identify general hospitals that placed psychiatric patients in nonpsychiatric units (scatter beds) to participate in the evaluation

[a] Throughout this table, "Medicaid beneficiaries" refers to beneficiaries ages 21 to 64.

Exhibit I.3. Medical records reviewed, by facility type and pre- versus post-demonstration period

State	IMD			ED			GH		
	Number of facilities	Pre	Post	Number of facilities	Pre	Post	Number of facilities	Pre	Post
AL	3	14	15	3	15	16	NA	NA	NA
CA	4	21	20	3	8	15	NA	NA	NA
CT	1	5	5	1	5	5	NA	NA	NA
DC	1	5	5	1	5	5	NA	NA	NA
IL	2	10	10	1	5	5	NA	NA	NA
MD	3	15	15	3	15	15	NA	NA	NA
ME	2	10	10	1	5	10	NA	NA	NA
MO	5	24	25	5	25	25	2	10	10
NC	1	5	5	1	5	5	1	5	5
RI	1	5	5	1	5	5	NA	NA	NA
WA	3	13	15	3	15	15	3	11	11
WV	2	10	10	2	10	10	NA	NA	NA
Total	**28**	**137**	**140**	**25**	**118**	**131**	**6**	**26**	**26**

using scatter beds.[4] About half of all records reviewed were for patients discharged before MEPD and about half were for patients discharged during MEPD shortly before the site visit. We purposefully selected records that would include patient characteristics of interest. The qualitative record reviews provided a snapshot of policies and procedures of interest before and after implementation of MEPD, but, due to the non-random selection criteria, we did not conduct statistical tests comparing pre- and post-demonstration quantitative data elements extracted from the qualitative data (e.g., length of stay), and we caution against drawing conclusions from such comparisons based on the qualitative data.

2. Analysis of medical record review data

Upon completion of the medical record reviews, site visitors returned the completed abstraction tools to Mathematica's survey operations center for cleaning, review, entry into an electronic database, and secure storage. As data were received, operation center staff reviewed the forms for completeness, legibility, and accuracy of coding. When questions arose, they consulted with appropriate site visitors and project leadership to determine how information should be coded. Given the variability in the organization and content of medical records across facilities, not all desired information could be found in all records. Therefore, after entering the data into an electronic database, we ran frequencies and descriptive statistics on all variables to better assess the completeness and quality of the data. We excluded from further analysis questions for which 25 percent or more of records had missing or unusable data.

[4] In the fourth state, Alabama, the one general hospital identified as using scatter beds declined to participate in the voluntary evaluation.

To synthesize data from the medical record reviews with information from staff and beneficiary interviews, we mapped valid variables from the medical record review to the research questions by ACA area and other topics of interest. In some cases, relevant variables had to be constructed from the abstracted data (for example, lengths of stays were calculated based on admission and discharge dates and times). Some of the research questions involved comparing data from different sets of records, such as those from pre- and post-demonstration periods or from different types of facilities. For questions regarding care processes, we calculated the proportion of records with documentation that the specific process took place. For questions addressing length of time (for example, ED boarding time), we calculated the minimum, mean, median, maximum, and standard deviation; comparisons were based on median values.

The medical records reviewed were purposively sampled to ensure that we would obtain information about all processes and procedures of interest, and with respect to the full range of demonstration participants. For example, we purposely selected cases with co-occurring substance use disorders and medical comorbidities to better understand how these conditions affected care, and we sought to include both beneficiaries admitted for suicidality and those admitted for homicidality. To help understand how the sample compared to the overall population served by MEPD, we calculated frequencies of diagnostic categories for the pre- and post-demonstration periods for each type of facility (**Exhibit I.4**). The proportion of IMD records that included diagnoses of bipolar disorder, depressive disorders, and schizophrenia and other psychotic disorders was roughly similar to the distribution in the overall demonstration population (Volume I, Exhibit V.3).

Records reviewed in EDs were less likely to include diagnoses of bipolar disorder, schizophrenia, or other psychotic disorders than the overall demonstration population, and more likely to be missing diagnoses. The differences in the diagnostic distributions between the IMDs and EDs may occur because IMDs may make more precise diagnoses, as they have more specialized diagnostic expertise and time for more thorough assessments during longer inpatient stays. This hypothesis is consistent with our finding that 26 percent of inpatient discharge diagnoses differed from the diagnoses beneficiaries carried upon admission to the IMD (Volume I, Exhibit V.3).

The medical records reviewed in general hospitals were less likely to include diagnoses of depressive disorders and "other psychiatric diagnoses" than the overall demonstration population. This may be because the general hospitals recorded fewer psychiatric diagnoses than IMDs overall, with a higher proportion of missing diagnostic information.

The higher rate of "other psychiatric diagnoses" among patients whose medical records we reviewed compared to all MEPD participants (Volume I, Exhibit V.3) is likely an artifact of differences in diagnostic information available for the two groups. We abstracted all available psychiatric diagnoses from the medical records, whereas the MEPD payment and monitoring data presented in Volume I, Exhibit V.3 for all MEPD participants includes only primary inpatient admitting diagnoses. Most of the "other psychiatric diagnoses" may be secondary diagnoses.

Exhibit I.4. Psychiatric diagnoses documented in medical record notes from initial psychiatric evaluation, by facility type and time period

	IMD		ED		GH	
Type of diagnosis	Pre	Post	Pre	Post	Pre	Post
Documented psychiatric diagnoses						
Bipolar disorder or other mood disorder	36%	34%	20%	15%	31%	23%
Depressive disorders	28%	32%	31%	29%	19%	23%
Schizophrenia or other psychotic disorders	41%	31%	24%	25%	27%	46%
Other psychiatric diagnoses	24%	26%	23%	20%	19%	15%
None listed/unable to determine	1%	3%	25%	25%	12%	12%
Documented substance-related diagnoses						
Yes	49%	40%	29%	24%	42%	19%
No	51%	60%	70%	75%	58%	81%
Not documented/unable to determine	0%	0%	1%	1%	0%	0%
Documented chronic medical diagnoses						
Yes	72%	63%	31%	21%	46%	27%
No	26%	29%	27%	28%	8%	8%
Not documented/unable to determine	3%	8%	42%	51%	46%	65%

Note: We instructed reviewers to note all psychiatric diagnoses listed in the medical record; as a result, columns may sum to more than 100 percent. Categories for psychiatric diagnoses were created to align with ICD-9 codes used in our evaluation of quantitative data.

The high rates of co-occurring substance-related diagnoses and chronic medical conditions are consistent with our purposive sampling method and are likely overrepresented relative to the rate within the overall demonstration population.

These differences in diagnostic distributions should be kept in mind in reviewing results of the medical record reviews, as the results may not generalize to all demonstration participants. Similarly, findings based on comparisons between pre- and post-demonstration medical record reviews may result from differences in the samples of records reviewed rather than MEPD effects. Results of the medical record reviews, therefore, should not be interpreted in isolation, but rather must be considered in conjunction with information from other data sources, including state and facility staff interviews, beneficiary interviews, and quantitative analyses.

C. Interviews with Medicaid beneficiaries

1. Data collection

Medicaid beneficiaries who received inpatient services from a participating IMD under MEPD were recruited to take part in interviews regarding their experiences. We conducted two rounds of interviews in association with the two rounds of site visits. We conducted all

interviews by telephone, audio recording them when beneficiaries gave their consent to ensure the accuracy of the notes. If the beneficiary did not want the call audio recorded, or recording was otherwise not possible, we took notes to record the responses.

We asked IMDs participating in MEPD to assist us in recruiting Medicaid beneficiaries for the interviews. During inpatient discharge procedures, a social worker or other staff member would inform demonstration participants about the evaluation using scripts and fact sheets we provided, and ask them to voluntarily sign a form giving consent for Mathematica to contact them for the interview.[5] We sought to obtain 25 consent forms from each participating IMD during each round, with the intention of completing 5 interviews per IMD per round. We received consent forms from 22 IMDs in the first round and 15 IMDs in the second round of data collection, for a total of 605 forms (**Exhibit I.5**).[6]

Exhibit I.5. Medicaid beneficiaries interviewed, by IMD

State	IMD (number of demonstration beds)	Number of valid consents received	Number of interviews completed
AL	EastPointe Hospital (66)	45	5
AL	Hill Crest Behavioral Health Services (53)	14	4
AL	Mountain View Hospital (28)	15	2
CA	John Muir Behavioral Health Facility (37)	38	7
CA	Heritage Oaks Hospital (106)	43	8
CA	Sierra Vista Hospital (83)	33	5
CA	Sutter Center for Psychiatry (43)	51	6
CT	Natchaug Hospital (33)	23	2
DC	Psychiatric Institute of Washington (45)	11	1
IL	Chicago Lakeshore Hospital (56)	2	2
IL	Riveredge Hospital (210)	3	2
ME	Acadia Hospital (36)	15	5
ME	Spring Harbor Hospital (48)	20	7
MD	Adventist Behavioral Health (79)	17	2
MD	Brook Lane Health Services (20)	19	3
MD	Sheppard Pratt Health System (225)	15	2
MO	Centerpointe Hospital (57)	20	3
MO	Royal Oaks Hospital (8)	16	3
MO	Signature Psychiatric Hospital (24)	15	2
MO	St. Louis Regional Psychiatric Stabilization Center (25)	23	1
MO	Two Rivers Behavioral Health System (85)	17	2

[5] For patients assigned legal guardians for decision-making purposes, we instructed IMD staff to solicit consent and contact information from both the guardian and the patient.

[6] The decrease in the number of IMDs submitting consent forms for the second round of interviews was partially due to states and IMDs stopping or curtailing MEPD admissions during the recruitment period for the second round of interviews.

State	IMD (number of demonstration beds)	Number of valid consents received	Number of interviews completed
NC	Holly Hill Hospital (108)	43	7
RI	Butler Hospital (98)	6	1
WA	Fairfax Hospital (80)	14	3
WA	Lourdes Counseling Center (22)	6	2
WA	Navos Mental Health Solutions (40)	0	0
WV	Highland Hospital (34)	57	11
WV	River Park Hospital (28)	24	2
Total	**(1777)**	**605**	**100**

Note: Includes both the first and second rounds of interviews.

We designed the interview protocols to capture the beneficiaries' experiences with different stages of treatment, including use of emergency services, the inpatient admission process, inpatient treatment and stabilization, and discharge. We asked questions to compare the beneficiary's pre- and post-demonstration experiences and to compare experiences at the IMD to other facilities.

Audio recordings of the interviews were transcribed, and transcripts were subsequently cleaned of errors; all personal identifying information was removed during the cleaning process. We then systematically reviewed the interview transcripts to abstract information for the analysis.

As noted above, our goal was to interview 5 beneficiaries per facility during each round of data collection; however, we had difficulty reaching a substantial number of the beneficiaries who provided consent. We conducted a total of 51 interviews during the first round and 49 interviews during the second, for a total of 100 (**Exhibit I.5**). At least one beneficiary interview was conducted for each participating state and for all but one of the IMDs.

2. Analysis of interviews with beneficiaries

After the first round of beneficiary interviews, we systematically coded each interview using the same codes applied to interviews with state and facility personnel. In conducting preliminary analyses, however, we found that the codes were not as applicable to the beneficiary interviews and did not yield information that was particularly useful for the cross-informant analysis. This was partially due to the differing nature of the beneficiary interviews, which asked about beneficiaries' personal experiences receiving services, compared to the other interviews, which asked for details about how MEPD was implemented and its perceived effects. The personal nature of the questions may have also contributed to responses being less linearly related to the questions asked, making it more challenging to directly tie responses to the specific topical areas the protocol was intended to cover. A unique feature of the beneficiary interview protocol was that it included questions to capture experiences being treated in IMDs during MEPD and also asked for comparisons with beneficiaries' pre-demonstration experiences. Such comparisons were challenging for many beneficiaries, however, as they struggled to differentiate multiple hospitalization experiences; 18 percent of those interviewed had at least 10 hospitalizations for psychiatric emergencies over the past 5 years.

To address the challenges encountered in analyzing the first round of beneficiary interviews, we reorganized and shortened the protocol used for the second round of interviews. In addition, we changed our approach to analyzing the data. Given the challenges in using the coding scheme, and because the number of completed interviews was relatively small, we reviewed beneficiary interview transcripts in toto rather than coding them and pulling extracts. We utilized information from the transcripts in three ways: (1) site visit teams for each state incorporated beneficiary perspectives from their states into the state summaries (Volume III), (2) for relevant questions, such as discharge planning and quality of care, staff conducting the cross-state analyses incorporated beneficiary perspectives into background state-by-state summary tables using the codes developed for staff interviews described in Section A.2, and (3) a member of the interview team abstracted common information from all interviews on select pre-specified variables that could be quantified (for example, number of prior hospitalizations, length of stay, and counts of beneficiaries reporting certain experiences such as feeling safe to leave the hospital upon discharge).

Despite the changes we made to the interview protocol and analysis approach for the second round of interviews, some challenges in analyzing the beneficiary interview data remained. Most notably, beneficiaries often had difficulty remembering the information we requested about recent and previous experiences. For experiences before MEPD, both the length of time that had elapsed between the hospitalization and the interview and the number of intervening hospitalizations contributed to recall difficulties. In addition, recall and communication about previous and recent experiences may have been hampered by substance abuse or the nature of the psychiatric impairment. In many cases, we were unable to quantify a particular measure because the beneficiary could not provide a specific response; in such cases, we eliminated the beneficiary from the analysis of that particular measure. When a beneficiary provided a range in his or her response (for example, describing the length of stay as one to two weeks), we used the median value in aggregating the information across beneficiaries.

Some stakeholders suggested that those most likely to be served by MEPD were frequent users of emergency psychiatric services. As shown in **Exhibit I.6**, the majority of respondents (at least 63) had been hospitalized multiple times in the past five years, and over a third (38) had been hospitalized four or more times. Although many of the respondents were frequent users of emergency services, the index admission was the sole psychiatric emergency hospitalization in five years for 27 respondents. Forty-four beneficiaries interviewed reported having been hospitalized at least once before MEPD; these beneficiaries could potentially compare experiences before and after MEPD. Forty-three had not been hospitalized before MEPD, and 13 could not remember whether they had been hospitalized before MEPD.

As with all key informant interviews, the evaluation team recognizes that response bias, a form of selection bias, can occur if individuals who choose to participate differ from those who choose not to participate. Specifically, those who participated in the interviews may have been more likely to report positive effects of MEPD than those who did not participate. Given that IMD staff solicited beneficiary consent to be contacted for an interview, patients with more positive relationships with such staff may have been more likely to agree to participate.

Exhibit I.6. Psychiatric emergency hospitalizations in the past five years among beneficiary interview respondents

Number of hospitalizations	Percentage of respondents (N = 100)
1	27%
2	11%
3	14%
4 to 10	22%
More than 10	16%
Unable to recall	10%

In addition, due to logistical complexities in locating and making contact with individuals discharged to forensic facilities, homeless shelters, or other types of institutional care, patients with more positive discharge experiences (such as those discharged to their own homes in the community) may have been more likely to participate.

Forty-four percent of the beneficiaries we interviewed reported being hospitalized at the same IMD at least twice during MEPD. In contrast, only 22 percent of all demonstration participants had multiple hospitalizations in participating IMDs during MEPD (Volume I, Exhibit V.4). Beneficiaries hospitalized repeatedly in a participating IMD during MEPD would have had a statistically greater chance of being asked to participate in the interviews because they were more likely to be in the IMD when staff solicited consents. The opinions of beneficiaries with multiple IMD admissions and the quality of their experiences may differ in unknown ways from those experiencing a single IMD admission during MEPD.

We also did not interview any beneficiaries with guardians. Interviewees without guardians may have fewer impairments or different types of environmental circumstances than demonstration participants with guardians and may be less likely to have been involuntarily committed or to have experienced a hospitalization before MEPD. These differences could also result in biases in the information collected through the beneficiary interviews. For example, interviewees who entered the hospital voluntarily may have reported more positive experiences than those who were involuntarily committed. Interviewees may also have been less likely to have had previous hospitalizations with which to compare their demonstration experiences, or their previous experiences may have been more positive than others' because they did not lead to the determination that a guardian was needed; this could potentially weaken our ability to detect positive change from MEPD. Despite these potential sources of bias, the beneficiary interviews were important for (1) cross-validating information provided by state and facility staff and through medical record reviews, each of which is subject to unique biases, and (2) understanding how consumers reacted to intended service improvements.

D. Environmental scan

To gain a more complete understanding of the context in which the MEPD operated, we implemented a systematic process for tracking major national and state events that might affect the results of MEPD. Such events included, for example, those that might be expected to increase or decrease need for mental health services in MEPD states, as well as changes in their quality and availability. Systematically tracking such events over time assists in identifying possible

confounding factors that may influence process and outcome measures during the demonstration period and in considering alternative explanations for demonstration results.

To efficiently monitor such changes, we set up automated searches of newspapers and trade journals through Google Alert, Westlaw, and LexisNexis, which were conducted on at least a quarterly basis. We also conducted manual searches of the CMS website and the Health Policy Reference Center. Our automated and manual searches used combinations of the following key search terms: psychiatric, mental health, Medicaid, and Affordable Care Act. We reviewed the articles to identify relevant events such as changes in legislation, payment methodologies, and the number of inpatient psychiatric beds available in the demonstration areas.

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II. QUANTITATIVE DATA SOURCES AND ANALYTIC APPROACH

In this chapter, we describe the data we collected to support the quantitative analyses, the creation of the analytic files and operationalization of key concepts that apply to several research questions, and our regression model framework for how we quantitatively addressed several of the research questions.

A. Quantitative data obtained

In this section, we describe in more detail the quantitative data we obtained to support three broad groups of research questions: the MEPD's effects on admissions and lengths of stay in IMDs; mental health service use and costs in EDs, general hospitals, and community-based services; and psychiatric boarding time in EDs. We expended a great deal of effort to collect these data, but we encountered several impediments. Ultimately, we were unable to obtain or use data from every state or facility that participated in MEPD. The process of executing memoranda of understanding and business associate agreements with each state and/or facility was time-consuming and resource-intensive, and we were unable to collect all the data we had hoped to collect. Several facilities changed electronic health record (EHR) systems or moved from a paper-based to an electronic system during the evaluation, and they reported they could not access records that resided in the former system. The usability and reliability of the data submitted by states and facilities varied considerably. In many cases, upon careful review, we determined the data were not usable. The reasons they were not useable included an inability to identify Medicaid beneficiaries, inability to link the state/IMD data with Medicaid data, and anomalies in the study sample or in data elements which we were unable to resolve. In addition to complications with the IMD data, there were also significant reporting lags with the Medicaid data. In many states, we had, at most, six months of data in the demonstration time period. See **Exhibit II.1** for a description of the data we obtained and used from each state.

1. CMS MEPD payment and monitoring data

Mathematica received the CMS MEPD payment and monitoring data that included admissions from July 2012 to March 2014. These admission-level data included characteristics of the beneficiaries admitted to participating IMDs under MEPD, provider information, admission and discharge dates, and expenditures. We used these data to describe the implementation of the demonstration and as a check on data quality when analyzing data obtained directly from the IMDs.

2. IMD admissions and cost data from states and IMDs

Because of the IMD exclusion, IMD admissions for this targeted population and their associated costs do not appear in the Medicaid claims files. To conduct the analyses of IMD admissions, length of stay, and costs, and analyses of the percentage of consumers with Medicaid coverage admitted to IMDs as a consequence of MEPD relative to consumers admitted to the same IMDs through other means, we collected data directly from states and IMDs. The extent to which we were able to obtain data for the full evaluation time period varied as did the reliability and usability of the data obtained (**Exhibit II.1**).

Exhibit II.1. Summary of obtained data for MEPD evaluation

State	Medicaid data	IMD data	ED data
Alabama	2010–2012 (6 months during MEPD)	EastPointe: 2010–2014 Mountain View: 2010–2014: Invalid Medicaid identification numbers; Inconsistencies in data set, including issues relating to: (1) how to merge the financial and patient demographic/visit data sets, as some cases were present in one file but not the other; (2) identification inaccuracies, making the tracking of patients across visits impossible; and (3) computing "total payment" value (in some cases we had to devise specific methods to complete this task, and in some cases computation was not possible). As a result, we could not include this data in cost analyses. We could not resolve the invalid Medicaid identification numbers and linkage to Medicaid data challenges in sufficient time to potentially include Mountain View in the admissions or length of stay analyses. Hillcrest: None	DeKalb Regional Medical Center University of Alabama-Birmingham
California	2010–2012 (6 months during MEPD)	Sacramento County (Heritage Oaks, Sutter Center, and Sierra Vista): 2010–2014 Contra Costa County (John Muir): 2010–2014	University of California Davis
Connecticut	2010–2013 (1.5 years during MEPD)	Natchaug: 2012–2014 The pre-demonstration (2010- August 2012) data we received had the following problems: (1) Payment fields showed total amount paid but we could not determine whether Medicaid, IMD, a private insurer, self, or the state paid. Therefore, the cost information was not useable. (2) Medicaid identification and social security numbers were not included; therefore, we could not link to Medicaid and could not use it for analyses of admissions or ED visits. (3) We could not include this state in research question C4 (total costs) because we could not determine the population of adult Medicaid beneficiaries with psychiatric EMCs, which is defined as people who receive emergency or inpatient services (IMD inpatient is not available).	Windham Hospital
District of Columbia	2010–2011 (None during MEPD; only 1.5 years pre-MEPD)	Psychiatric Institute of Washington: 2010–2014	George Washington University

State	Medicaid data	IMD data	ED data
Illinois	2010–-2012 (None during MEPD--demonstration began in December 2012)	Chicago Lakeshore: 2010–2014: The data obtained included only admissions for which positive Medicaid payments were made. But because Illinois did not reimburse IMDs for admissions of Medicaid beneficiaries before MEPD, any admissions of Medicaid beneficiaries before MEPD would not be included in the data. Therefore, we could not include Illinois in the analyses of research questions C1–C3 (costs of IMD stays). Riveredge: 2013–2014 (no pre-MEPD data)	
Maine	None	Spring Harbor: 2010–2014 Acadia: 2010-2014 Data quality checks suggested the cost data for both IMDs were incomplete and of questionable quality. (The data obtained included only admissions for which positive Medicaid payments were made. But because Maine did not reimburse IMDs for admissions of Medicaid beneficiaries before MEPD, any admissions of Medicaid beneficiaries before MEPD would not be included in the data.) Due to the data quality issues, we could not include Maine in the analyses of research questions C1–C3 (costs of IMD stays).	Maine Medical Center Data had fewer than five visits in at least one treatment arm in at least one time period, so sample size too small to include in analyses.
Maryland	2010–2012 (6 months during MEPD)	Sheppard Pratt: 2010–2014 Brook Lane: 2010–2014 Adventist: 2010–2014	Greater Baltimore Medical Center Meritus Medical Center Shady Grove Adventist Hospital

State	Medicaid data	IMD data	ED data
Missouri	2010–2012 (6 months during MEPD)	Royal Oaks: 2012–2014: In the pre-demonstration time period, the field "payer type" had 78% missing information. As a result, we could not include these data in the cost analyses. Two Rivers: 2010–2014 (with caveat): There was no pre-demonstration payment information so we could not perform cost analyses. We did use the submitted medical records file to examine admissions and length of stay. We assumed that the medical record file included all admissions of adult Medicaid patients. (This was unclear because the financial file had 40% more records than the medical record file and we could not establish why this would be because we did not have the resources to continue to work with the IMD on the data). We speculate that it could be that the financial file included people not eligible for MEPD (people with substance abuse only or children, for example). St. Louis: none	BJC Health Care Citizens Memorial Hospital
North Carolina	2010–2012 (None during MEPD--demonstration began in December 2012)	Holly Hill: none	
Rhode Island	2010–2011 (No during MEPD; only one year pre-demonstration--demonstration began in September 2012)	Butler: 2010–2014: Rhode Island reported 245 admissions under the three-year demonstration. But the data the IMD provided included 8,800 admissions during the four-year evaluation period (two years pre- and two years post-demonstration). We requested data only for adult Medicaid beneficiaries who met eligibility criteria for MEPD, and we were unable to reconcile the discrepancy between the CMS MEPD payment and monitoring data and the data we received from the IMD. Moreover, the IMD data did not include payments made from sources other than Medicaid, Medicare, or unpaid claims, so we could not accurately calculate the total costs of care or determine the proportion of costs incurred by the federal and state government or the IMD. Due to these data quality issues, we could not include Rhode Island in analyses of inpatient admissions, length of stay, or costs of IMD admissions.	

State	Medicaid data	IMD data	ED data
Washington	2010–2013 (1.5 years during MEPD; however, nearly all of the Medicaid beneficiaries who experienced psychiatric EMCs were enrolled in a behavioral health managed care plan, which prevented us from accurately measuring mental health costs in claims data because Medicaid pays managed care costs on a capitated rather than fee-for-service basis).	Project resources and the timeline prohibited completion of acquisition of IMD data from the State of Washington Fairfax: none Navos: none Lourdes: none	Evergreen Health Medical Center Lourdes Medical Center Providence Regional Medical Center-Everett (Data had fewer than five visits in at least one treatment arm in at least one time period, so sample size too small to include in analyses.)
West Virginia	2010–2013 (1.5 years during MEPD)	Highland: 2010–2014: Payments from Medicaid in the pre-demonstration time period were not available, so we could not compare costs pre- versus post-demonstration. River Park: 2010–2014	Cabell Huntington Hospital Charleston Area Medical Center

3. Medicaid and Medicare data from CMS

We used Medicaid (Medicaid Analytic eXtract [MAX] and Alpha-MAX) and, for adults dually enrolled in Medicaid and Medicare, Medicare data to assess MEPD's effects on general hospital scatter bed admissions and length of stay, ER visits, and costs of the full range of mental health services. We also used Medicaid general hospital claims data to identify comparison group members for the participating IMDs. **Exhibit II.1** describes the years of Medicaid and Medicare data, by state, that we obtained.

4. Psychiatric boarding data from EDs

Although psychiatric boarding is not an ACA-mandated evaluation area, stakeholders frequently cite it among the rationales for and expected outcomes of this demonstration. Because of this high level of interest, we pursued avenues to assess MEPD's effects on psychiatric boarding time.[7] We obtained patient-level data on psychiatric boarding directly from the EDs participating in the site visits. For each of the 26 IMDs participating in MEPD at the time data collection began, we selected for site visits one ED that referred patients to the IMD. The selection was based on a combination of factors that included (1) number of referrals to the IMD, (2) relationship with IMD staff, (3) proximity to the IMD, (4) availability of needed administrative data, and (5) willingness to participate. We ultimately were able to obtain administrative data from 16 EDs in 9 of the 12 states (**Exhibit II.1**). The years of data, exact data elements, and reliability of the data provided by the EDs varied. As with the acquisition of IMD data, the acquisition of administrative data from EDs presented challenges. As mentioned, EDs were not required partners in implementing MEPD and had limited motivation to participate the evaluation. Several EDs did not have the data we requested in electronic format, did not have the resources to comply with the data request, declined to provide administrative data, failed to respond to requests regarding administrative data, or withdrew their participation in the evaluation before the site visit.

B. Analytic files

From the various data we obtained, we created several analytic files, constructed comparison groups, and calculated outcome and control variables to conduct the analyses. In this section, we provide a brief description of the structure and content of the analytic files.

A1–A5 analytic file. The quantitative analyses for research questions A1–A5 drew upon an episode-level analytic file summarizing treatment episodes for psychiatric EMCs among Medicaid beneficiaries comparable to those eligible for MEPD. The episode-level file contains one record per episode of treatment for a psychiatric EMC that was treated at an ED, general hospital, or IMD. Data about psychiatric EMCs treated in an ED were drawn from the Medicaid and Medicare inpatient and outpatient hospital claims. Data about psychiatric EMCs treated in a general hospital were drawn from Medicaid and Medicare inpatient claims, with revenue codes used to differentiate between stays that transpired in a psychiatric unit versus a scatter bed. Data about psychiatric EMCs treated in a participating IMD were drawn from IMD data. Treatment of

[7] Consistent with the literature on psychiatric boarding and the CMS quality measure we considered, we defined psychiatric boarding for the purposes of the evaluation as the length of time from a decision to admit an individual to an inpatient bed to ED departure time.

a single psychiatric EMC in more than one setting of care was collapsed into a single episode record (for example, an ER visit resulting in admission to a general hospital scatter bed or transfer to an IMD) by identifying overlapping dates of services for the same beneficiary across more than one setting of care.

C1–C3 analytic file. The analyses for the research questions that examined MEPD's effects on cost of IMD inpatient stays to the federal government (C1), states (C2), and IMDs (C3) relied upon the cost and payment data submitted by states and IMDs. The analytic file was organized as one record per IMD stay; beneficiaries with more than one IMD stay would be represented multiple times in the data set. It was constructed using IMD- or state-submitted data on costs and payments at participating IMDs. Because the intent of the analysis was to assess changes to costs incurred by various payers as a result of MEPD, we excluded states if they (or their IMDs) did not submit any IMD data (North Carolina and Washington); submitted data only for the demonstration period and not the pre-demonstration period (Connecticut and Missouri); or did not submit data regarding Medicaid beneficiary admissions during the pre-demonstration period for which the state did not provide reimbursement (Illinois and Maine). We excluded data from one state (Rhode Island) due to an inability to reconcile dramatic differences in the number of adult Medicaid beneficiaries meeting eligibility criteria for MEPD in their data with claims the state submitted to CMS to receive payment from MEPD funds. The final analytic file included data from 5 of the 12 states (Alabama, California, DC, Maryland, and West Virginia).

C4 analytic file. To investigate MEPD's effects on Medicaid and Medicare costs for the full range of mental health services (general hospital inpatient, emergency services, and ambulatory care), we created an analytic file of Medicaid and Medicare claims that is organized as one record per Medicaid beneficiary per quarter. Each record summarizes average monthly spending on mental health services per quarter. Although the file does not include Medicaid-paid spending on IMD stays for mental health treatment, it does include Medicare spending on these stays. We excluded six states (Connecticut, DC, Illinois, Maine, North Carolina, and Rhode Island) from these analyses due to lack of Medicaid data in the demonstration time period. One additional state (Washington) was excluded because almost all beneficiaries with serious mental illness (SMI) were enrolled in behavioral managed care plans, for which payment data were not available. The analytic file includes total payments for any claim on which the primary diagnosis was a mental health condition. We calculated total federal mental health costs as the sum of Medicare spending and the federal share of Medicaid spending, using each state's Federal Medical Assistance Percentages (FMAP) in the fiscal year to which the quarter belonged. The first quarter of our pre-MEPD evaluation period (July–Sept 2010) coincided with the final period during which FMAP rates were enhanced under the American Recovery and Reinvestment Act (ARRA). Had we used the ARRA-enhance FMAP rates, the federal costs in the pre-MEPD period would have been abnormally high, which would have confounded results regarding the change in federal costs during MEPD. Therefore, for the months that fell in the first pre-demonstration quarter, we used published "hold harmless" federal fiscal year (FFY) 2010 FMAP rates, which are the rates that would have applied had they not been enhanced under ARRA.

D1 analytic file. To examine the percentage of consumers with Medicaid coverage who were admitted to IMDs as a result of MEPD as compared to those admitted to these same facilities through other means, we utilized data obtained from the participating IMDs. We received all-payer admissions-level data from 7 IMDs and quarterly aggregate data on

admissions from 10 additional IMDs.[8] We created a quarterly aggregate analytic file that included data from at least one IMD in each of the 12 MEPD states. In total, these data included 274 quarterly observations from 17 participating IMDs, covering a four-year period that included two years before (pre-) and two years after (post-) the MEPD was implemented in each state.

We created each analytic file to mirror the MEPD and state-specific eligibility criteria. For example, the files include only adults 21 to 64 years old. If a state's MEPD criteria did not exclude dual Medicare-Medicaid enrollees or beneficiaries enrolled in managed care, we included such beneficiaries in the file.

C. Defining key concepts

In addition to creating analytic files to address the research questions, we defined and operationalized key concepts that apply to several research questions, created comparison groups, and developed an overarching regression modeling framework.

1. Psychiatric EMCs

Individuals were eligible for participation in MEPD if they were judged to have a psychiatric EMC, which was defined as being suicidal, homicidal, or dangerous to self or others. Even though the MEPD payment and monitoring data contained an indicator for psychiatric EMCs, the indicator did not exist in Medicaid or Medicare administrative data, and few of the participating IMDs or EDs had the indicator electronically available in their data systems. As a result, we defined proxies for psychiatric EMCs to identify the study population. Given the available data, our approach to identifying psychiatric EMCs relied on three broad categories of ICD-9 diagnosis codes: (1) mental health codes, (2) injury codes indicative of self-harm, and (3) substance abuse codes (see **Exhibit II.2**). ICD-9 V codes "describe encounters with circumstances other than disease or injury," and E codes are supplemental codes that explain the cause of an injury. These codes are likely underutilized. The standard method payers use to reimburse hospital stays will not calculate a payment if a V code is the principal diagnosis. Similar problems can occur with E codes. Due to concerns about the reliability of these codes, we included several other ICD-9 diagnosis codes in our definition (**Exhibit II.2**).

[8] We could not use patient-level data we received from other IMDs for this analysis because (1) the states or IMDs provided data only on Medicaid beneficiaries; (2) or the data did not include usable Medicaid indicators, so we could not compare Medicaid and non-Medicaid patients; and/or (3) the data did not include usable pre-demonstration data, so we could not conduct pre-post analyses. Some, but not all, of the IMDs whose patient-level data we could not use submitted aggregate data for this analysis. We also obtained aggregate data from some (but not all) of the IMDs that did not provide patient-level data.

Exhibit II.2. Diagnosis codes used to define a psychiatric EMC in the MEPD evaluation

Category	Clinical Classification Software (CCS) principal diagnosis category	ICD-9 codes
Mental health diagnoses		
Mood disorders	657	
Schizophrenia and other psychotic disorders	659	
Suicide and intentional self-injury	662	
Homicidal ideation		V62.85*
Any other mental health code	650, 651, 652, 653, 654, 655, 656, 658, 670	V62.85*
Injuries indicating self-harm		
Open wound to elbow, forearm, or wrist		881
Poisoning		960–977, 980–989
Asphyxiation		994.7
Substance abuse		
Alcohol-related disorders	660	
Substance-related disorders	661	
Screening and history of mental health and substance abuse codes	663	

Our psychiatric EMC definition differs slightly for ER visits and inpatient admissions to avoid including people with SMIs treated by the ED for physical health concerns that are unrelated to mental illness or suicidality, such as broken limbs or heart attacks. In contrast, physical health diagnoses may be included as non-primary diagnoses in inpatient settings because people with SMI very often have co-occurring physical health problems that must also be recorded and monitored or treated during admission. We present the criteria for the two types of settings in **Exhibit II.3** and **Exhibit II.4**, below.

Exhibit II.3. Psychiatric EMC definition in EDs

Eligibility criterion	Primary Dx code	Secondary Dx code
1	MUST BE mood disorder, schizophrenia or other psychotic disorder, suicide or intentional self-injury, or homicidal ideation	MAY BE any mental health diagnosis, alcohol-related disorder, or substance-related disorder; CANNOT BE a physical health diagnosis
2	OR MAY BE an open wound to the elbow, forearm, or wrist; poisoning; or asphyxiation	IF ACCOMPANIED BY any mental health diagnosis
3	OR MAY BE any mental health	IF ACCOMPANIED BY open wound to the elbow, forearm, or wrist; poisoning; or asphyxiation

Exhibit II.4. Psychiatric EMC definition in scatter beds, general hospital psychiatric units, and IMDs

Eligibility criterion	Primary Dx code	Other Dx code(s)
1	MUST BE mood disorder, schizophrenia or other psychotic disorder, suicide or intentional self-injury, or homicidal ideation	MAY BE any (no restriction on secondary diagnoses)
2	OR MAY BE open wound to elbow, forearm, or wrist; poisoning; or asphyxiation	IF ACCOMPANIED BY at least one mental health diagnosis

2. General hospital psychiatric units and scatter beds

We identified revenue codes that identified psychiatric units within general hospitals. We then defined a scatter bed as an inpatient stay in a general hospital (for a psychiatric EMC) that was not in a psychiatric unit.

D. Comparison group creation

Exhibit II.5 describes how we defined the intervention and comparison group for the seven research questions that seek to identify the effect of MEPD. For most questions, the comparison groups focused on the Medicaid beneficiary's residence relative to the participating IMD (that is, inside or outside the IMD's catchment area). For research question A3, the service setting of the comparison and intervention groups also differed (that is, we compared beneficiaries admitted to IMDs to beneficiaries admitted to general hospital psychiatric units). For question A6, we compared ED patients with and without Medicaid. For questions relying on the use of Medicaid data, we excluded several states from efforts to construct comparison groups because they did not have sufficient data to include in the analyses (**Exhibit II.5**). Among the states that had Medicaid data in both the pre-demonstration and demonstration time period, several implemented MEPD across the full state, which prohibited us from identifying a comparison group not expected to be affected by MEPD. This limited the number of states for which we could construct comparison groups to address the admissions, length of stay, and total cost research questions (A1, A2, A4, A5, and C4) to one or two states: California and Connecticut.[9] Before we could construct comparison groups in these two states, we had to identify the areas where MEPD was implemented. We refer to these areas as "catchment" areas and expected that Medicaid beneficiaries living within these catchment areas could be affected by MEPD and that Medicaid beneficiaries living outside of these catchment areas would not be affected by MEPD. Below, we describe our process of identifying catchment areas.

[9] Alabama, Missouri, and Washington had sufficient data for at least one of these research questions, but gave inconsistent responses in the MEPD application and interviews about whether the demonstration targeted the entire state or not. Through discussions with the state's qualitative data team leader and (when possible) examining a map of the residential zip code of patients who had been admitted to participating IMDs, we determined that the demonstration likely targeted the entire state for these three states.

Exhibit II.5. Summary of MEPD comparison groups, by research question

Research questions	Research question description	Treatment group	Comparison group	States with a comparison group	States without a comparison group because the catchment area is the entire state	States with insufficient data to include in analyses (no comparison group created)
A1	To what extent do admissions of Medicaid beneficiaries with psychiatric EMCs to private IMDs increase as a result of MEPD?	Medicaid beneficiaries who live in the catchment area of a participating IMD and received services for a psychiatric EMC from an ED, general hospital, or participating IMD	Medicaid beneficiaries who do not live in the catchment area of a participating IMD and received services for a psychiatric EMC from an ED, general hospital, or participating IMD	CA	AL*, MD, MO*, WV	DC, IL, ME, NC, RI, WA, CT
A2	Do MEPD admissions of Medicaid beneficiaries with psychiatric EMCs to nonpsychiatric units of general hospitals (scatter beds) decrease as a result of MEPD?					
A5	Are fewer Medicaid beneficiaries with psychiatric EMCs seen in ERs as a result of MEPD?					
A3	What is MEPD's effect on length of stay for Medicaid beneficiaries with psychiatric EMCs admitted to private IMDs compared with length of stay in these facilities before MEPD and to length of stay in general hospital psychiatric units?	Medicaid beneficiaries who received services for a psychiatric EMC from a participating IMD	Medicaid beneficiaries who live inside the catchment area of a participating IMD and received services for a psychiatric EMC from a psychiatric unit in a general hospital	AL, CA, CT, MD, MO, WV	Not applicable	DC, IL, ME, NC, RI, WA
A4	What is MEPD's effect on length of stay for Medicaid beneficiaries with psychiatric EMCs admitted to scatter beds in general hospitals?	Medicaid beneficiaries who live in the catchment area of a participating IMD and received services for a psychiatric EMC from a scatter bed in a general hospital	Medicaid beneficiaries who do not live in the catchment area of a participating IMD and received services for a psychiatric EMC in a scatter bed in a general hospital	CA, CT	AL*, MD, MO*, WA*, WV	DC, IL, ME, NC, RI
A6	Does MEPD reduce psychiatric boarding time in EDs for Medicaid beneficiaries with psychiatric EMCs?	Medicaid beneficiaries who received services for a psychiatric EMC from an ED	Non-Medicaid beneficiaries who received services for a psychiatric EMC from an ED	AL, CA, CT, DC, MD, MO, WA, WV	Not applicable	IL, ME, NC, RI

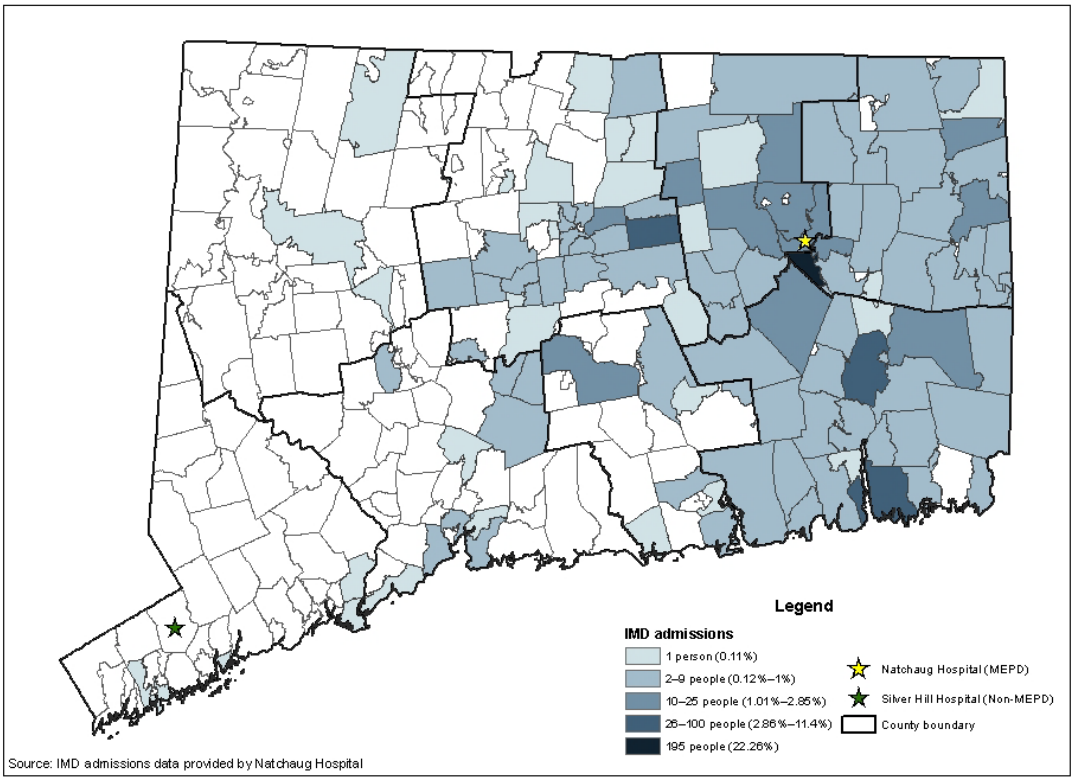
Research questions	Research question description	Treatment group	Comparison group	States with a comparison group	States without a comparison group because the catchment area is the entire state	States with insufficient data to include in analyses (no comparison group created)
C4	What is MEPD's effect on overall mental health costs to Medicaid and Medicare for care provided to beneficiaries with psychiatric EMCs?	Medicaid beneficiaries who live in the catchment area of a participating IMD and received services for a psychiatric EMC from an ED, general hospital, or participating IMD	Medicaid beneficiaries who do not live in the catchment area of a participating IMD and received services for a psychiatric EMC from an ED, general hospital, or participating IMD	CA	AL*, MD, MO*, WA*, WV	DC, IL, ME, NC, RI

*Alabama, Missouri, and Washington stated in their MEPD applications that the target demographic area of the demonstration was a section of the state, but also stated during the qualitative interviews that the entire state was affected. After a discussion with the state qualitative lead and/or examining maps of the residential zip code for patients admitted to participating IMD, we determined that beneficiaries from all over the state were affected by MEPD.

1. Identifying the catchment areas of participating IMDs

Some states, such as California, allowed only beneficiaries who lived in certain counties to participate in MEPD. For these states, we defined the catchment area as the counties that were eligible to participate in the demonstration. For the rest of the states, including Connecticut, we defined the catchment area as the geographic areas the state said, in its MEPD application or evaluation interview, was targeted by the demonstration. Some states gave inconsistent responses in their application and interviews about the targeted area. When this occurred, we determined the true catchment area through discussions with our qualitative evaluation state leads and (when possible) examining a map of the residential zip codes of beneficiaries who had been admitted to participating IMDs to see which geographic areas were most represented (**Exhibit II.6**).

Exhibit II.6. Map of residential zip codes of patients who were admitted for psychiatric EMCs to the participating IMD in Connecticut



2. Comparison groups in California and Connecticut

In California, Medicaid beneficiaries were eligible for MEPD if they lived in one of two counties: Contra Costa and Sacramento. Because California has many counties outside of the catchment area, we conducted a matching process to select the subset of the non-catchment counties most similar to the two catchment counties. We used MAX and IMD data and the Area Health Resources File (AHRF) to match counties on a series of county-level characteristics, including the number of psychiatric EMCs, the availability of outpatient psychiatrists, and the availability of a hospital with an ED. Next, we selected the subset of non-catchment counties that matched the two catchment counties exactly on a set of high-priority characteristics. Because Contra Costa and Sacramento counties differed from each other in these characteristics, we

matched each of them to their own set of non-catchment counties. Of the 56 non-catchment counties in California, 5 matched to Contra Costa (Kern, Riverside, San Bernardino, Stanislaus, and Tulare) and 6 matched to Sacramento (Alameda, Fresno, Los Angeles, San Diego, San Francisco, and Santa Clara). We dropped Tulare, because it appeared to be an outlier on several matching variables. Finally, we conducted balance tests between the two catchment counties in California and the 10 matched non-catchment counties to see whether they were similar, on average, in terms of the high-priority variables, which suggested that two-thirds of the key matching variables were a good match. A detailed description of the balance tests and the results is in **Exhibit II.7**.

Exhibit II.7. California balance test for high-priority variables

Variable name	Mean for catchment counties (n = 2)	Mean for matched counties (n = 10)	Standardized bias for matched counties	Mean for all non-catchment counties (n = 56)	Standardized bias for all non-catchment counties
High-priority variables that must match exactly					
Health professional shortage area	1.00	1.00	0.00	0.95	-0.24
Has county-operated health plan	0.00	0.00	0.00	0.20	0.50
Had fewer than 100 psychiatric EMCs	0.00	0.00	0.00	0.23	0.55
Outpatient psychiatrist available	1.00	1.00	0.00	0.84	-0.44
Psychiatric partial hospital program available	0.50	0.60	0.24	0.21	-0.68
Psychiatric care, bed setup available	1.00	1.00	0.00	0.30	-1.47
Hospital with ED available	1.00	1.00	0.00	0.84	-0.44
High-priority variables that need not match exactly					
Percentage of county residents who live in an urban area	98.55	95.63	-0.10	70.33	-0.98
Percentage of county residents who are Medicaid eligible and ages 21 to 64	11.48	13.55	0.46	13.87	0.54
Percentage of county residents who are white and non-Hispanic	48.10	37.85	-0.53	57.41	0.48
County residents per outpatient psychiatrist	10,960	15,276	0.24	16,773	0.33
County residents per hospital with psychiatric partial hospital program	725,061	410,383	-1.04	114,166	-2.02
County residents per psychiatric care, beds setup	38,919	16,034	-1.92	5,012	-2.85
County residents per hospital with ED available	167,747	176,802	0.07	106,436	-0.50
Average Midi-Cal expenditure on specialty mental health services for ages 18 to 59	3,735	4,259	0.29	4,087	0.20

Source: Medicaid Analytic eXtract data, 2014–15 Area Health Resource File, Arnquist and Harbage (2013), admissions data provided by IMDs participating in MEPD.

Connecticut reported in its MEPD application and its evaluation interview that the demonstration targeted only the three counties in the eastern part of the state. We confirmed this

information by mapping the residential zip codes of beneficiaries that were admitted to the participating IMD in Connecticut (**Exhibit II.6**). Because Connecticut has only two non-catchment counties, we could not conduct further matching to select the comparison counties with the most similar characteristics, but we did compare the characteristics of the non-catchment counties to the catchment counties to assess their similarity (**Exhibit II.8**).

Exhibit II.8. High-priority variables for Connecticut counties

	Connecticut counties				
Variable name	Fairfield (comparison)	Litchfield (comparison)	New London (catchment)	Tolland (catchment)	Windham (catchment)
Health professional shortage area	1	1	1	0	1
Had fewer than 100 psychiatric EMCs	0	0	0	0	0
Outpatient psychiatrist available	1	1	1	1	1
Psychiatric partial hospital program available	1	1	1	0	0
Psychiatric care, bed setup available	1	1	1	0	1
Hospital with ED available	1	1	1	1	1
Percentage of county residents who live in an urban area	95.4	58.6	74.2	61.8	50.2
Percentage of county residents who are Medicaid eligible and ages 21 to 64	4.3	4.7	6.0	3.4	7.7
Percentage of county residents who are white and non-Hispanic	66.2	91.3	78.3	87.5	85.4
County residents per outpatient psychiatrist	5,915	13,566	12,457	30,538	118,428
County residents per hospital with psychiatric partial hospital program	311,278	187,530	137,085	0	0
County residents per psychiatric care, bed setup	4,839	15,628	7,616	0	7,840
County residents per hospital with ED available	155,639	93,765	137,085	151,539	117,599

Source: Medicaid Analytic extract data, 2014–15 Area Health Resource File, admissions data provided by IMDs participating in MEPD.

E. Analytic approach by research question

In addition to creating analytic files, operationalizing key constructs, and constructing comparison groups, we developed a regression model framework to guide the analyses. In this section, for each research question or group of research questions, we synthesize the information previously presented on analytic files and available data and describe the specific analytic approach we used to address the questions.

1. IMD and scatter bed admissions and ER visits

To examine MEPD's effects on IMD and scatter bed admissions and ER visits, we used the episode-level analytic file that included claims data from Medicaid (inpatient and outpatient), Medicare (inpatient and outpatient), and participating IMDs. The outcome variables were binary indicators of whether an individual experiencing a psychiatric EMC was admitted to or visited a participating IMD, scatter bed, or ER as part of the treatment he or she received during the episode.

Due to data limitations, our analysis included only five participating states and their IMDs: Alabama (one IMD), California (three IMDs), Maryland (three IMDs), Missouri (one IMD), and West Virginia (two IMDs). As described earlier, in California, we were able to identify a suitable comparison group consisting of beneficiaries who resided outside the catchment areas of participating IMDs, so we used a logistic difference-in-differences model to analyze the effects of MEPD. Control variables included age and age squared, gender, race, dual Medicare-Medicaid enrollment, category of psychiatric EMC (primarily for mood disorder, schizophrenia, or other), and an indicator for whether the person had experienced a psychiatric EMC in the previous 12 months. There were a number of demographic and diagnostic differences between individuals residing inside the catchment area of a participating IMD (intervention group) and individuals residing outside the catchment area (comparison group) (**Exhibit II.9**). Beneficiaries in the intervention group were younger, more likely to be female, more likely to be white, and less likely to be dually eligible for Medicare and Medicaid. They were more likely to have mood disorders, less likely to have a diagnosis of schizophrenia, and less likely to have had a prior episode of psychiatric EMC in the previous 12 months.

Exhibit II.9. IMD and scatter bed admissions and ER visits analyses sample characteristics: difference-in-differences analysis in California

	Comparison mean (n = 7,284)	Intervention mean (n = 36,134)	Statistical significance
Age (years)	41.01 (11.31)	39.08 (11.37)	***
Female (percent)	41.43 (49.26)	50.40 (50.00)	***
Dual Eligible (percent)	45.78 (49.82)	31.50 (46.46)	***
Category of Psychiatric EMC (percent)			
Mood disorder	33.41 (47.17)	43.23 (49.54)	***
Schizophrenia	51.41 (49.98)	43.29 (49.55)	***
Other	15.17 (35.87)	13.48 (34.16)	***
Race (percent)			
White	45.72 (49.82)	54.74 (49.78)	***
Black	26.03 (43.88)	25.67 (43.68)	
Asian	5.70 (23.18)	6.49 (24.64)	**

	Comparison mean (n = 7,284)	Intervention mean (n = 36,134)	Statistical significance
Other	1.14 (10.63)	1.55 (12.37)	***
Hispanic	21.41 (41.02)	11.55 (31.96)	***
Psychiatric EMC in previous 12 months (percent)	59.19 (49.15)	53.32 (49.89)	***

Source: Analysis of Medicaid, Medicare, and IMD data obtained from CMS and California. The data includes six months of data during MEPD.

Note: Standard deviation in parentheses. The intervention group is MEPD-eligible beneficiaries who live inside the IMDs' catchment areas. The comparison group is MEPD-eligible beneficiaries who live outside the IMDs' catchment areas. Some patients were missing demographic information; calculations based on available data. The data includes 6 months of data during MEPD.

*p<0.1, **p<0.05, ***p<0.01 between intervention and comparison groups.

For the remaining four states, we were not able to identify suitable comparison groups, so we pooled the states and used a pre-post logistic regression model to estimate the effects of MEPD. Control variables in this analysis included all the control variables used for California, as well as an additional psychiatric EMC category (suicidal behavior) and an indicator of whether the beneficiary resided in a rural area. The characteristics of the study sample are illustrated in **Exhibit II.10**.

Exhibit II.10. IMD and scatter bed admissions and ER visits analyses sample characteristics: pooled pre- post analysis population

	Mean (n = 154,391)	Standard deviation
Age (years)	40.15	11.39
Female (percent)	50.03	50.00
Dual eligible (percent)	30.02	45.83
Category of psychiatric EMC (percent)		
Mood disorder	56.39	49.59
Schizophrenia	31.65	46.51
Suicide	7.66	26.59
Other	2.30	14.98
Race (percent)		
White	67.69	46.77
Black	30.28	45.95
Asian	5.18	7.18
Other	0.32	5.62
Latino	1.20	10.90
Psychiatric EMC in previous 12 months (percent)	50.92	49.99
Rural (percent)	28.59	45.18

Source: Analysis of Medicaid, Medicare, and IMD data obtained from CMS and four participating states (Alabama, Maryland, Missouri, and West Virginia).

Note: Some patients were missing demographic information; calculations based on available data.

Our analysis was further limited by the fact that we had only six months of demonstration period data for all but one included state. If the effects of MEPD were realized with a lag, we may not have had sufficient data to enable us to measure the effect.

To calculate the effects of MEPD on probability of admission to an IMD in California, we estimated the following logistic difference-in-differences regression model:

$$\Pr\left(IMD\,admission\right) = F[\beta 0 + \beta 1 * INTERVENTION + \beta 2 * POST + \beta 3 * \left(INTERVENTION * POST\right) + \beta i * CONTROLS + \varepsilon]$$

Where

- *IMD admission* indicates the beneficiary was admitted to an IMD during a psychiatric EMC.
- $F\left(z\right) = e^{z} / \left(1 - e^{z}\right)$ is the cumulative logistic function.
- *INTERVENTION* is an indicator variable equal to 1 if the beneficiary is in the intervention group (resides inside the catchment area of a participating IMD).
- *POST* is an indicator variable equal to 1 if the episode took place on or after the state-specific demonstration start date.
- *CONTROLS* are covariates included in the model to account for differences in beneficiaries' demographic characteristics. We included as controls age, age squared, gender, race, dual Medicare-Medicaid enrollment, primary diagnosis category, and an indicator for having had a psychiatric EMCs in the previous 12 months.

For Alabama, Maryland, Missouri, and West Virginia, we estimated the following logistic pre-post regression model:

$$\Pr\left(IMD\,admission\right) = F\left(\beta 0 + \beta 1 * POST + \beta_s * State_s + \beta i * CONTROLS + \varepsilon\right)$$

Where

IMD admission, the function *F*, and *POST* are as above. In this regression model, we also included rural residence as a control, and $State_s$ is a set of state fixed effects (omitting one). Standard errors were clustered by state.

To calculate the effects of MEPD on probability of admission to a scatter bed or visit to an ER, we estimated these same models, but substituted *scatter bed admission* or *ER visit* for *IMD admission*, where *scatter bed admission* and *ER visit* indicates the beneficiary was admitted to a scatter bed or ER during a psychiatric EMC.

2. IMD length of stay

To examine MEPD's effects on length of stay in participating IMDs, we used the same analytic file as for research questions A1 and A2, in which we combined Medicaid and Medicare data with data on participating IMD admissions to create an episode-level file. The number of

episodes (not unique beneficiaries) included in this analysis was 136,846. The characteristics of the study sample are illustrated in **Exhibit II.11**. We created a comparison group that consists of Medicaid beneficiaries who live inside the catchment area of a participating IMD and received services for a psychiatric EMC from a psychiatric unit in a general hospital. The intervention group is Medicaid beneficiaries who live inside the catchment area and received services from a participating IMD for a psychiatric EMC. We calculated the outcome—length of stay—as the difference between admission date and discharge date[10] for stays in these facilities.

Exhibit II.11. IMD length of stay analyses sample characteristics: difference-in-differences analysis

	Comparison (n = 123,720)	Intervention (n = 13,126)	Statistically significant
Age (years)	40.73 (11.34)	39.15 (11.34)	***
Female (percent)	48.85 (49.99)	53.12 (49.90)	***
Dual eligible (percent)	41.77 (49.33)	32.02 (46.66)	***
Diagnosis (percent)			
Schizophrenia	37.32 (48.37)	36.70 (48.20)	
Suicide	3.17 (17.51)	0.05 (2.14)	***
Other	0.02 (1.42)	0.00 (0.00)	
Mood disorder	59.49 (49.09)	63.26 (48.21)	***
Race/Ethnicity (percent)			
Black	29.96 (45.36)	27.23 (44.52)	***
Asian	0.72 (8.43)	1.93 (13.77)	***
Other	0.38 (6.16)	0.59 (7.69)	***
White	68.26 (46.55)	65.77 (47.45)	***
Hispanic	1.68 (12.86)	4.47 (20.66)	***
Psychiatric EMC in previous 12 months (percent)	54.22 (49.82)	48.67 (49.98)	***
Rural (percent)	28.53 (45.15)	12.84 (33.46)	***

Source: Mathematica analysis of Medicaid, Medicare, and participating IMD data, covering July 2010 to December 2012 in six states (Alabama, California, Connecticut, Maryland, Missouri, and West Virginia).

Note: Standard deviation in parentheses. The intervention group includes MEPD-eligible beneficiaries who lived inside the IMDs' catchment areas and were admitted to an IMD. The comparison group includes MEPD-

[10] Admissions in which the release of the beneficiary occurred on the same day he or she was admitted had a length of stay of zero; admissions in which the release of the beneficiary occurred after one night had a length of stay of one.

eligible beneficiaries who lived inside the IMDs' catchment areas and were admitted to a psychiatric unit. Some patients were missing demographic information; calculations based on available data.

*p<0.1, **p<0.05, ***p<0.01 between intervention and comparison groups.

Six of the 12 demonstration states (Alabama, California, Connecticut, Maryland, Missouri, and West Virginia) have sufficient data for this analysis; however, 3 of the 6 states have data only through the first six months of MEPD (**Exhibit II.12**). Because we found no stays in general hospital psychiatric units for the comparison group in the later years of data, we restricted the analyses to the two years of pre-demonstration data and six months of demonstration data.[11]

Exhibit II.12. Medicaid data available for use in IMD analysis of length of stay

Number of months of demonstration-period Medicaid data	Number of states
0 months[a]	5
6 months	3
18 months	2
24 months	1

[a]States with zero months of Medicaid data during MEPD were excluded from the analysis. We did not have IMD data for one of these states, as well as for one additional state, so six states were excluded from the analysis.

To calculate the effects of MEPD on length of stay, we estimated the following regression using an ordinary least squares (OLS) model:

$$LOS = \beta 0 + \beta 1 * A3\_INTERVENTION + \beta 2 * POST + \beta 3 * (A3\_INTERVENTION * POST) + \beta 4 * STATE\_XX + \beta i * CONTROLS + \varepsilon$$

Where

- LOS is the continuous length of stay variable.
- A3_INTERVENTION is the indicator variable that equals 1 if the episode is in the intervention group.
- POST is the indicator variable that equals 1 if the episode took place on or after the state-specific demonstration start date.
- STATE_XX is a dummy variable for each state included in the analysis. These state variables were used to control for differences across states.
- CONTROLS are covariates included in the model to account for differences in beneficiaries' demographic characteristics. We included as controls age, gender, race, dual Medicare-Medicaid enrollment, rural location, primary diagnosis category, and number of psychiatric EMCs in the previous 12 months.

We calculated robust standard errors clustered by the state in which the beneficiary lived.

[11] There were no significant differences between the models run on the limited evaluation period versus models run on the entire evaluation period.

3. Scatter bed length of stay

To examine MEPD's effect on length of stay in scatter beds, we again used the episode-level analytic file. We calculated length of stay as the difference between admission date and discharge date[12] for stays in scatter beds in general hospitals. The intervention group included Medicaid beneficiaries who lived in the catchment area of a participating IMD and received services for a psychiatric EMC in a scatter bed in a general hospital. The comparison group included Medicaid beneficiaries who did not live in the catchment area of a participating IMD and received services for a psychiatric EMC in a scatter bed in a general hospital.

Due to the availability of data and the feasibility of creating a comparison group, we used data pooled from California and Connecticut for the difference-in-differences analysis, and data pooled across 5 other states (Alabama, Maryland, Missouri, Washington, and West Virginia) for the pre-post analysis. We used data from up to two years before and after (2010–2014) the demonstration began, depending on data availability. Data availability imposed considerable limitations on the analyses, even when we had sufficient data to include a state in the analyses. We had limited months of data for many of the analysis states. Five states did not have Medicaid data available in the demonstration time period so we could not include them in this analysis. One state we excluded from the IMD length of stay analysis in the previous section due to lack of IMD data had Medicaid data. We were able to include this state in the scatter bed length of stay analysis because it relies solely on Medicaid data.

For the difference-in-differences analysis, we estimated the following regression using an OLS model:

$$LOS = \beta 0 + \beta 1 * A4\_INTERVENTION + \beta 2 * POST + \beta 3 * (A3\_INTERVENTION * POST) + \beta 4 * STATE\_XX + \beta I * CONTROLS + \varepsilon$$

Where

- LOS is the continuous length of stay variable.
- A4_INTERVENTION is the indicator that equals 1 if the episode is in the intervention group.
- POST is the indicator variable that equals 1 if the episode took place on or after the state-specific demonstration start date.
- STATE_XX is a dummy variable for each state included in the analysis. These state variables were used to control for differences between states.
- CONTROLS are covariates included in the model to account for differences in beneficiaries' demographic characteristics. We included as controls age, gender, race, dual Medicare-Medicaid enrollment, rural location, primary diagnosis category, and number of psychiatric EMCs in previous 12 months.

[12] Admissions in which release of the beneficiary occurred on the same day he or she was admitted have a length of stay of zero; admissions in which the beneficiary stayed one night have a length of stay of one.

The number of episodes (not unique beneficiaries) included in this analysis was 2,478. We calculated robust standard errors clustered by the state in which the beneficiary lived. To potentially capture any pre-existing trends in the outcomes of interest, and to allow for flexibility in looking for delayed effects due to demonstration ramp-up time, we recalculated the same model with a few modifications: using an alternative time indicator of quarterly dummy variables for the intervention time period, using another alternative time indicator of quarterly dummy variables for the entire evaluation period, and using a three-way interaction of the intervention and time indicators. Unadjusted demographic characteristics are in **Exhibit II.13**.

Exhibit II.13. Sample characteristics for scatter bed length of stay analyses

	Difference-in-differences sample			Pre-post sample	
	Comparison (n = 2,057)	Intervention (n = 421)	Statistical significance	Mean (n = 5,728)	Standard deviation
Age (years)	45.25 (11.80)	41.95 (12.21)	***	41.32	11.40
Female (percent)	52.07 (49.97)	54.16 (49.89)		63.41	48.17
Dual eligible (percent)	61.55 (48.66)	33.25 (47.17)	***	28.13	44.96
Diagnosis (percent)					
Schizophrenia	33.01 (47.04)	24.94 (43.32)	***	11.85	32.33
Suicide	48.86 (50.00)	53.68 (49.92)	*	66.25	47.29
Other	0.00 (0.00)	0.24 (4.87)	**	0.12	3.49
Mood disorder	18.13 (38.54)	21.14 (40.88)		21.77	41.27
Race/Ethnicity (percent)					
Black	22.42 (41.71)	17.20 (37.78)	**	16.96	37.50
Asian	5.12 (22.04)	6.14 (24.04)		1.01	9.99
Other	0.90 (9.46)	1.72 (13.02)		1.48	12.06
White	49.95 (50.01)	63.64 (48.16)	***	78.09	41.37
Hispanic	21.61 (41.17)	11.30 (31.70)	***	2.47	15.51
Psychiatric EMC in previous 12 months (percent)	31.36 (46.41)	24.23 (42.90)	***	23.52	42.41
Rural (percent)	0.15 (3.82)	0.95 (9.71)	***	32.50	46.84

Source: Analysis of Medicaid and Medicare data, covering July 2010 to June 2014 in California and Connecticut for the difference-in-differences sample, and covering July 2010 to December 2013 in five states (Alabama, Maryland, Missouri, Washington, and West Virginia) for the pre-post sample.

Note: Standard deviation in parentheses. The intervention group includes MEPD-eligible beneficiaries who lived inside the IMDs' catchment areas. The comparison group includes MEPD-eligible beneficiaries who lived outside the IMDs' catchment. Some patients were missing demographic information; calculations based on available data.

*p<0.1, **p<0.05, ***p<0.01 between intervention and comparison groups.

For the pre-post analysis, we estimated the following regression using an OLS model:

$$LOS = \beta 0 + \beta 1 * POST + \beta 2 * STATE\_XX + \beta i * CONTROLS + \varepsilon$$

Where:

- LOS is the continuous length of stay variable.
- POST is the indicator variable that equals 1 if the episode took place on or after the state-specific demonstration start date.
- STATE_XX is a dummy variable for each state included in the analysis. These state variables are used to control for differences between states.
- CONTROLS are covariates included in the model to account for differences in beneficiaries' demographic characteristics. We included as controls age, gender, race, dual Medicare-Medicaid enrollment, rural location, primary diagnosis category, and number of psychiatric EMCs in the previous 12 months.

The number of episodes (not unique beneficiaries) included in this analysis is 5,728. We calculated robust standard errors clustered by the state in which the beneficiary lived. To potentially capture any pre-existing trends in the outcomes of interest, and to allow for flexibility in looking for delayed effects due to demonstration ramp-up time, we recalculated the same model with a few modifications: using an alternative time indicator of quarterly dummy variables for the intervention time period, using another alternative time indicator of quarterly dummy variables for the entire evaluation period, and adding the second alternative time indicator (using it as a continuous variable instead of categorical) and the interaction term with POST to the model. Unadjusted demographic characteristics are presented in **Exhibit II.13**.

4. ED boarding time

To examine MEPD's effects on boarding time, we obtained visit-level data from 16 EDs across 9 of the 12 states. We selected EDs for our analysis based on the volume of Medicaid beneficiaries they referred to participating IMDs, willingness to fulfill the qualitative data collection requirements,[13] and ability to provide quantitative data. These data included 35,069 ED visits among patients 21 to 64 years old presenting to the ED for psychiatric EMCs from 2010 to 2014, covering two years before and two years after the date the first patient enrolled in MEPD in each state. Within these data, we defined the intervention group as MEPD-eligible beneficiaries who visited the ED. The comparison group consisted of other adult patients who visited the ED with a psychiatric EMC but were uninsured or had insurance but were not eligible for MEPD.[14]

[13] This included access to the EHRs and a sufficient number of Medicaid beneficiaries ages 21to 64.

[14] Patients with insurance who were not eligible for the demonstration included individuals with Medicare, private insurance, Medicaid managed care in states where patients with Medicaid managed care were not eligible for MEPD, and dual Medicare-Medicaid enrollment in states where dual Medicare-Medicaid enrollees were not eligible for the demonstration.

Our sample for the boarding time analysis was limited: 10 EDs from 6 of the 12 states submitted boarding time data[15] for a total of 4,263 ED visits with an inpatient discharge.[16] After excluding outliers[17] and EDs with fewer than 5 observations within the intervention or comparisons group before or during MEPD, our final sample for the boarding time analysis included 4,139 observations from 6 EDs across 4 states. Two-thirds of the observations (67.6 percent) in this sample came from one ED; 3 of them accounted for 94.2 percent of observations in this analysis. Unadjusted demographic characteristics are in **Exhibit II.14**.

By contrast, a larger portion of the ED visit data we collected included ED length of stay: of all 35,069 psychiatric EMC visits in our data, 30,278 included length of stay. After excluding outliers[18] as well as data from EDs with fewer than 5 visits within the intervention or comparison group before or during MEPD, our final sample for the length of stay analysis included 26,803 observations from 14 EDs in 8 of the 12 states. As with boarding time, the distribution of the length of stay data was disproportionately weighted toward a smaller group of EDs, although to a lesser degree: 20 percent of observations came from one ED; 3 EDs comprised more than one-half (52.4 percent) of all observations. Two factors account for the larger sample for the length of stay analysis: first, EDs more commonly record length of stay; second, because length of stay is relevant for all ED visits, we did not have to limit our sample to those that resulted in inpatient discharges.

We defined boarding time as the number of hours spent in the ED waiting for a psychiatric inpatient bed to become available after confirming the need for specialized inpatient treatment. Length of stay, which we examined as a proxy for boarding time, reflects the total hours from the time patients enter and leave the ED.[19] To assess the effect of MEPD on ED boarding time and ED length of stay, we used a difference-in-differences model[20] with ED-fixed effects to control for fixed ED-level characteristics, such as hospital size. We also controlled for patient demographic[21] and payer information.

[15] Consistent with the literature on psychiatric boarding and the CMS quality measure we considered, psychiatric boarding was defined as the length of time from a decision to admit an individual to an inpatient bed to ED departure time.

[16] We limited the ED boarding time analysis to ED visits with an inpatient discharge status because boarding time can be calculated only for patients who require an inpatient psychiatric stay.

[17] Outliers include visits with boarding time of fewer than 0 hours or more than 240 hours.

[18] Outliers include visits with length of stay of fewer than 0 hours or more than 480 hours.

[19] Total time spent in the ED includes time that does not constitute boarding, such as: (1) time required to complete the psychiatric assessment and determine the existence of a psychiatric EMC (which includes time for the specialist doing the assessment to arrive at the ED, which previous reports suggest can be lengthy); (2) time to complete toxicology screens to determine the presence of alcohol or other substances and, if present, for the substances to clear the person's system; (3) time for additional assessments, such as brain imaging, and medical clearance; and (4) time waiting for vehicles or escorts to transport the patient to the IMD. Even so, not all EDs have data needed to calculate overall time a patient spends in the ED and, among those that do, some use paper rather than electronic records, creating additional challenges in using the data for this evaluation.

[20] This model identifies the effect of the MEPD by quantifying the difference in the change in boarding time/length of stay before and after the demonstration between the comparison and intervention groups.

[21] Our demographic control variables included age, race, sex, and payer.

Exhibit II.14. Summary statistics for intervention and comparison groups for ED boarding time and ED length of stay analyses

	Boarding time			Length of stay		
	Comparison mean (N = 2,438)	Intervention mean (N = 1,701)	Statistical significance	Comparison mean (N = 14,152)	Intervention mean (N = 12,651)	Statistical significance
Age	37.71 (11.67)	39.82 (11.59)	***	38.77 (11.92)	38.76 (11.27)	
Female	45.53 (49.81)	46.44 (49.89)		45.41 (49.79)	46.06 (49.85)	
Dual Medicare Eligibility	0.00 (0.00)	8.00 (27.13)	***	1.99 (13.95)	20.57 (40.42)	***
Race/Ethnicity						
White	46.43 (49.88)	30.16 (45.91)	***	63.72 (48.08)	54.53 (49.8)	***
Black	45.08 (49.77)	63.37 (48.19)	***	27.29 (44.55)	31.7 (46.53)	***
Native America/Pacific Islander	1.23 (11.03)	0.47 (6.84)	**	1.6 (12.56)	1.57 (12.41)	
Hispanic	0.29 (5.35)	0.06 (2.42)	*	1.5 (12.15)	2.81 (16.52)	***
Other/Mixed	0.7 (8.32)	0.47 (6.84)		1.72 (12.99)	2.04 (14.13)	*
Unknown/Missing	6.28 (24.26)	5.47 (22.74)		4.17 (19.99)	7.36 (26.11)	***

Source: Mathematica analysis of data obtained from Emergency Departments, 2010-2014. Boarding time data were drawn from 6 EDs across 4 states. Length of stay data were drawn from 14 EDs in 8 states.

Note: The intervention group was MEPD-eligible beneficiaries. The comparison group was non-MEPD eligible beneficiaries with psychiatric EMCs. Non-MEPD eligible patients included adults ages 21 to 64 enrolled in insurance other than Medicaid, Medicaid enrollees who did not meet the state MEPD eligibility criteria (such as requirements about managed care or dual Medicare-Medicaid enrollment), and patients who self-paid for care.

*p<0.1, **p<0.05, ***p<0.01.

5. IMD admissions cost to the federal government, states, and IMDs

To estimate the cost of IMD inpatient stays to the federal government, states, and IMDs, we used payment and cost information the states submitted and/or IMDs reported. For covered stays, we used the actual payment received to measure the cost of care to the state. For unpaid stays, we asked the IMDs to provide both the actual resource costs of providing care, if available, and what the payment for the stay would have been if Medicaid or an insurance company had covered it. Where possible, we used actual costs to the IMD to measure the costs of unpaid stays; when such information was not available, we used the cost that would have been paid by Medicaid (or another payer). We included data from five states (Alabama, California, DC, Maryland, and West Virginia) in these analyses. We present a summary of the states excluded from the sample in **Exhibit II.15**.

Exhibit II.15. States excluded from IMD cost analyses

State	Reason for exclusion
Connecticut	No cost data in pre-demonstration period
Illinois	No data on Medicaid beneficiary stays in the pre-demonstration period unless the state made a payment[a]
Maine	No data on Medicaid beneficiary stays in the pre-demonstration period unless the state made a payment[a]
Missouri	No cost data in pre-demonstration period
North Carolina	No IMD data
Rhode Island	Incomplete cost data and inability to reconcile data quality issues
Washington	No IMD data

[a]We excluded any state where it appeared that the IMD submitted data only on stays with a positive Medicaid payment. Because we are trying to measure cost-shifting, if we were to include only the subset of stays in the pre-demonstration period with a positive Medicaid payment, we could potentially bias our estimate of average Medicaid costs in the pre-demonstration period upward because we would be missing many Medicaid beneficiary stays where the state did not pay at all ("true" zeros that were missing in the pre-demonstration period).

From the data sources, we were able to identify the total payments for an IMD stay made by Medicaid (excluding managed care organizations and out-of-state Medicaid) and by other state agencies or funds. We further divided Medicaid payments into the state and federal shares, and assumed states paid 100 percent of the costs in the pre-demonstration period. When the state or IMD reported the information, we created variables to measure unpaid or charity costs, which were implicitly paid by the IMD itself. When total cost of care was reported and unpaid costs were not, we calculated the unpaid costs as the total costs less the payments received from all sources.

We included data from 10 IMDs in five states in this analysis, including 12,149 psychiatric EMC IMD admissions. For a state to be included, we had to have all-payer payment data for both the pre-demonstration (July 2010–July 2012) and demonstration (July 2012–July 2014) evaluation periods from at least one participating IMD in the state. We were unable to collect cost data from IMDs not participating in MEPD. As a result, we do not have a comparison group and, therefore, conducted pre-post analyses only. Due to differences in how states categorized costs as well as the cost data provided, we present results from these analyses separately by state. Unadjusted sample characteristics are provided in **Exhibit II.16**.

Exhibit II.16. Sample characteristics for cost of IMD stay analyses

	Mean or Percentage				
	Alabama	California	District of Columbia	Maryland	West Virginia
Age in years (mean)	40.94	39.63	45.91	37.65	40.85
IMD length of stay (mean)	10.11	8.22	7.60	10.17	17.56
Female	48.38	52.84	45.71	54.75	41.02
Race/ethnicity					
White	41.25	53.90	7.91	57.32	91.63
Non-Hispanic Black	56.94	26.00	89.11	36.84	7.35
Non-Hispanic Asian or Other Pacific Islander	0.48	5.95	0.37	2.26	0.00
Non-Hispanic Other	1.14	2.20	0.18	0.64	0.51
Hispanic	0.19	11.96	2.43	2.94	0.51
Dual	31.65	1.19	58.67	*	46.22

Source: Analysis of IMD data obtained directly from states or IMDs, 2010-2014.

Note: Dual status was not provided in Maryland.

We had three cost outcome variables: federal Medicaid costs, state costs, and costs to the IMDs. When we had data from both before and during the MEPD, and when data included both \$0 and >\$0, we conducted a pre-post two part model. The first part of the model is a logistic regression analysis predicting the likelihood of any costs in that time period. The second part of the model is a general linear model of non-zero costs using the gamma scale family and a log link function (Buntin and Zaslavsky 2004). When we had data from both before and during MEPD, and when data only included >\$0, we conducted a pre-post general linear model using the gamma scale family and a log link function. We estimated the following regression model for each state separately for each cost outcome.

$$Costs = \beta 0 + \beta 1 * POST + \beta i * CONTROLS + \varepsilon$$

Where

- POST is the indicator variable that equals 1 if the episode took place on or after the state-specific demonstration start date.
- CONTROLS are covariates. We included as controls age, length of IMD stay, gender, race, and dual Medicare-Medicaid enrollment.
- Standard errors are robust for clustering at the facility level.

When we had data from only during MEPD (because >95% of costs were \$0 in the pre-demonstration period) and data included both \$0 and >\$0, we conducted a post-only two part model. The first part of the model is a logistic regression analysis predicting the likelihood of any costs in that time period. The second part of the model is a general linear model of non-zero costs using the gamma scale family and a log link function. In this model, the constant term $(\beta 0)$ represents the effect of interest, assessing whether the costs incurred in the post period were different than \$0. When we only had data from during MEPD (because >95% of costs were \$0 in the pre-demonstration period), and when data only included >\$0, we conducted a post-only

general linear model using the gamma scale family and a log link function. When we had less than 5% of $0s during MEPD when we would have run a pre-post two part model, we ran a post-only general linear model. In this model, the constant term $(\beta 0)$ represents the effect of interest, assessing whether the costs incurred in the post period were different than $0. We estimated the following regression model for each state separately for each cost outcome.

$$Costs = \beta 0 + \beta 1 * CONTROLS + \varepsilon$$

Where

- CONTROLS are covariates. We included as controls age, length of IMD stay, gender, race, and dual Medicare-Medicaid enrollment.
- Standard errors are robust for clustering at the facility level.

6. Total Medicaid and Medicare cost of mental health services

To estimate MEPD's effects on the total cost of mental health services, we summarized average monthly costs in a given quarter of mental health services covered by Medicaid and by Medicare. The analytic file was organized as one record per Medicaid beneficiary per quarter; each record summarized average monthly costs that quarter for mental health services covered by Medicaid and by Medicare. The primary source of data on comprehensive mental health costs among beneficiaries was the MAX files, with data abstracted from the Inpatient Hospital (IP), Long-Term Care (LT), Other Services (OT), and Person Summary (PS) files. In general, the MAX data include claims and encounter records for all Medicaid-funded services that qualify for federal matching funds. The MAX files exclude Medicaid-covered services that do not qualify for federal matching dollars, including inpatient facility costs at IMDs. To apportion payments for MAX claims for mental health services into the component paid by the state and paid by the federal government, we applied the FMAP rates in effect in each state in the year that the service was rendered (Volume I, Appendix E).

To capture the Medicare-funded costs of comprehensive mental health services delivered to individuals dually enrolled in Medicaid and Medicare, we used the research identifiable files (RIF), including inpatient, outpatient, carrier, and home health agency claims files. In general, Medicare is the primary payer for acute care services (including inpatient stays, outpatient visits, and professional service fees); Medicaid covers any patient cost-sharing for which the beneficiary is responsible. Medicare pays for IMD services up to a 190-day life-time limit, so some Medicare costs for IMD stays were likely included in the C4 analyses (they were not included in the federal costs recorded for the C1 analyses).

All MEPD states had Medicare claims data for both before and during MEPD. However, in several states, Medicaid data were not available for the demonstration period at the time the analytic file was created; we excluded these states (DC, IL, ME, NC, and RI) from the analysis. Washington was excluded because almost all individuals with SMI were enrolled in behavioral managed care plans, for which payment data were not available. Connecticut was excluded because, due to problems with data submitted by the IMD, we could not determine the full population of adult Medicaid beneficiaries with psychiatric EMCs (defined as beneficiaries who received emergency or inpatient services from either a general hospital or IMD—we cannot

determine beneficiaries who were admitted to the IMD); therefore, the cost file was missing any beneficiaries who were admitted directly to the IMD and was not, therefore, representative of the full MEPD population.

All states included in these analyses (AL, CA, MD, MO, and WV) had 24 months (eight quarters) of pre-demonstration cost data. States had different amounts of demonstration period data available, ranging from 6 months (two quarters) after MEPD began (AL, CA, MD, and MO) to 17 or 18 months (six quarters) after MEPD began (WV).

Beneficiaries living in MEPD states who had a psychiatric EMC at any point in the evaluation time period were included in the analyses of total costs for mental health care services. Costs included total payments for any claim on which the primary diagnosis was a mental health condition, as defined by Agency for Healthcare Research and Quality's 2015 CCS. We included all diagnoses in the CCS level 5 (mental illness), except for developmental disorders (intellectual disabilities or learning disorders); disorders usually diagnosed in infancy, childhood, or adolescence (elimination disorders or pervasive developmental disorders); and alcohol and substance-related disorders.

Our analyses included only FFS Medicaid and Medicare claims, as managed care payments do not appear in claims data. Therefore, we excluded from the cost analysis any months in which a beneficiary was enrolled in either a Medicaid or Medicare managed care plan that potentially included behavioral health services. For Medicaid beneficiaries, the exclusion applies to any months they were enrolled in a comprehensive managed care plan or a managed behavioral health plan. For Medicaid beneficiaries dually enrolled in Medicare, the exclusion applied to any months they were enrolled in a Medicare Advantage plan. Because the data and analyses included only fee-for-service costs, we were not able to assess effects of MEPD on managed care costs. In states where managed care beneficiaries were included in the demonstration, MEPD may have had an effect on costs but we were not able to measure it due to data limitations.

We generated two outcome variables defined below.[22]

$$total\ mental\ health\ costs\ PBPM = \frac{all\ Medicaid\ and\ Medicare\ mental\ health\ claims\ in\ each\ quarter}{number\ of\ months\ during\ which\ Medicaid\ data\ were\ available\ in\ that\ quarter}$$

$$total\ federal\ mental\ health\ costs\ PBPM = \frac{\begin{array}{l}(all\ Medicaid\ claims\ for\ the\ quarter * FMAP) + \\ (all\ Medicare\ mental\ health\ claims\ in\ each\ quarter)\end{array}}{number\ of\ months\ during\ which\ Medicaid\ data\ were\ available\ in\ that\ quarter}$$

Five states provided data for this analysis, comprising 531,387 person-quarters of data and 117,118 individual beneficiaries. The intervention group consisted of Medicaid beneficiaries who lived in the catchment area of a participating IMD and received services for a psychiatric EMC from an ED, general hospital, or participating IMD. The comparison group, which was

[22] For months falling in the first pre-demonstration quarter (July–Sept 2010) we used the "hold harmless" FFY 2010 FMAP rates for states that did not include ARRA enhanced federal matching funds. This was done to avoid major shifts in federal costs between the first pre-demonstration quarter and other pre-demonstration quarters due to federal payment policies unrelated to MEPD.

available in one state (CA), consisted of Medicaid beneficiaries who did not live in the catchment area of a participating IMD and received services for a psychiatric EMC from an ED, general hospital, or participating IMD. Unadjusted sample characteristics are presented in **Exhibit II.17**.

Exhibit II.17. Sample characteristics for total cost analyses

	California (n=56,326)						
	Inter-vention	Compar-ison	Statistical significance	Alabama (n=10,642)	Maryland (n=12,601)	Missouri (n=27,104)	West Virginia (n=10,445)
Age in years at beginning of demonstration (mean, SD)	40.83	42.84	***	40.83	40.30	41.77	41.57
Female	52.47	46.26	***	64.16	53.77	51.82	54.23
Race/ethnicity							
White	52.93	47.68	***	63.92	53.16	79.06	95.61
Non-Hispanic Black	26.19	22.71	***	34.71	43.06	18.87	4.11
Non-Hispanic Asian or Other Pacific Islander	7.64	5.88	***	0.33	1.40	0.33	0.06
Non-Hispanic Other	1.45	1.10	***	0.36	0.26	0.38	0.07
Hispanic	11.79	22.63	***	0.68	2.13	1.36	0.16
Dual Medicare enrollment	25.03	39.65	***	30.61	30.88	30.19	21.85

Source: Analysis of Medicaid and Medicare data obtained from CMS for five participating states (2010-2013). West Virginia had nearly 1.5 years of data during MEPD, while the remaining states had 6 months of data.

*p <0.1; **p < 0.05; *** p < 0.01

We assessed the average marginal effects of MEPD on total mental health costs and total federal mental health costs per beneficiary per month using a two-part model. The first part of the model is a logistic regression analysis predicting the likelihood of any costs in that person quarter. The second part of the model is a general linear model of non-zero costs using the gamma scale family and a log link function (Buntin and Zaslavsky 2004) accounting for the non-normal distribution of costs.

For CA, we used the following difference-in-differences equation with each of the two cost outcomes.

$$Costs = \beta 0 + \beta 1 * intervention + \beta 2 * POST + \beta 3 * (intervention * POST) + \beta i * CONTROLS + \varepsilon$$

Where

- Intervention is the indicator that equals 1 if the episode was experienced by a beneficiary in the intervention group.
- POST is the indicator variable that equals 1 if the episode took place on or after the state-specific demonstration start date.
- CONTROLS are covariates. We included age, gender, race, dual Medicare-Medicaid enrollment, and quarter.

For each of the remaining states (AL, MD, MO, and WV), we conducted pre-post analyses for each of the two cost outcomes.

$$Costs = \beta 0 + \beta 1 * POST + \beta i * CONTROLS + \varepsilon$$

Where

- POST is the indicator variable that equals 1 if the episode took place on or after the state-specific demonstration start date.

- CONTROLS are covariates. We included age, gender, race, dual Medicare-Medicaid enrollment, and quarter.

7. Change in percentage of Medicaid beneficiaries admitted to IMDs (Area D)

To investigate ACA-mandated area D, we used patient-level and aggregate IMD data. The sample includes 274 IMD stays from 17 IMDs. We requested visit-level data covering two years before and two years during the MEPD from 29 participating IMDs. We received data from 22 IMDs; of these, 5 did not submit usable data,[23] 11 submitted aggregated quarterly data,[24] and 6 submitted visit-level data. Our final analysis included 274 observations of quarterly data from 17 IMDs across 12 states. Fifteen IMDs each submitted 16 quarters of data spanning July 2010 through June 2014. The remaining 2 IMDs implemented MEPD two quarters later than the other IMDs; each had 17 quarters of data spanning October 2010 through December 2014. We constructed the MEPD admissions ratio by calculating the proportion of all beneficiaries presenting with psychiatric emergencies who were eligible for MEPD for each quarter during the observation period.

We utilized an ITS model to investigate whether MEPD was associated with changes in the MEPD admissions ratio during the demonstration period. This model includes an indicator for the demonstration period, a linear quarterly time trend during the observed period, and an additional time trend beginning at MEPD implementation that allows the slope of the estimated time trend line to vary before and during MEPD. We included IMD fixed effects to control for time-invariant IMD characteristics (for example, number of hospital beds) that might otherwise influence our estimates of how the MEPD admissions ratio changed over time.

[23] Some of the reasons the data were not included were invalid Medicaid ID numbers, absent data from non-Medicaid payers, or data did not cover the entire study period.

[24] We requested aggregate quarterly data from IMDs if they were unwilling to send all-payer visit-level data, or if the all-payer visit-level data they sent did not permit us to calculate the MEPD admissions ratio for reasons of data content and quality.

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III. SUPPLEMENTAL TABLES

Exhibit III.1. Adjusted probability of IMD admissions in California: difference-in-differences full regression results

	Coefficient	Standard error
Intervention group	5.89***	0.19
Demonstration period	-0.18	0.45
Intervention group * Demonstration period	-0.18	0.45
Age	0.10***	0.02
Age squared	0.00***	0.00
Female	0.16***	0.06
Dual eligible	-0.86***	0.06
Diagnosis		
Schizophrenia	-0.39***	0.06
Other	-3.59***	0.26
Mood disorder	-	-
Race/Ethnicity		
Black	-0.05	0.07
Asian	-0.31***	0.12
Other	-0.61**	0.25
Hispanic	-0.10	0.09
White	-	-
Psychiatric EMC in previous 12 months	0.20***	0.06
Constant	-8.27***	0.41
R-squared	**0.50**	
Sample size	**41,486**	

Source: Mathematica analysis of Medicaid, Medicare, and IMD data obtained from CMS and California.

Note: Exhibit presents coefficient and standard error estimates from logistic models of IMD admission. The intervention group was MEPD-eligible beneficiaries who lived inside the IMDs' catchment areas. The comparison group was MEPD-eligible beneficiaries who lived outside the IMDs' catchment areas. Dashes indicate a reference category. The analyses included 6 months of data during MEPD.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.2. Adjusted probability of IMD admissions in California: difference-in-differences alternative regression model results

	Alternative model 1		Alternative model 2		Alternative model 3	
	Marginal effect	Standard error	Marginal effect	Standard error	Marginal effect	Standard error
Intervention group	0.22***	0.01	0.22***	0.01	0.22***	0.01
Demonstration period	-	-	-	-	-0.12***	0.02
Intervention group * Demonstration period	-	-	-	-	-0.12***	0.02
Quarter Since Demo						
1	-0.05***	0.02	-	-	-	-
2	-0.08***	0.02	-	-	-	-
Intervention group * Quarter Since Demo :						
1	-0.05***	0.02	-	-	-	-
2	-0.08***	0.02	-	-	-	-
Quarter Since Demo (continuous)	-	-	-0.04***	0.01	-	-
Intervention group * Quarter Since Demo	-	-	-0.04***	0.01	-	-
Quarter (continuous)	-	-	-	-	-0.03	0.02
Intervention group * Quarter (continuous)	-	-	-	-	-0.03	0.02
Demonstration period * Quarter (continuous)	-	-	-	-	-0.05**	0.02
Intervention group * Demonstration period * Quarter (continuous)	-	-	-	-	-0.04**	0.02
R-squared	**0.50**		**0.50**		**0.50**	
Sample size	**41,486**		**41,486**		**41,486**	

Source: Mathematica analysis of Medicaid, Medicare, and IMD data obtained from CMS and California. The analyses includes 6 months of data during MEPD.

Note: Exhibit presents average marginal effect and standard error estimates from logistic models of IMD admissions. The intervention group was MEPD-eligible beneficiaries who lived inside the IMDs' catchment areas. The comparison group was MEPD-eligible beneficiaries who lived outside the IMDs' catchment areas. Control variables included age, age squared, gender, race, dual Medicare-Medicaid enrollment, rural residence, category of psychiatric EMC (mood disorder, schizophrenia, or other), and an indicator for whether the person had experienced a psychiatric EMC within the previous twelve months. Alternative model 1 allows for the effect of MEPD to change each quarter in a nonlinear way. Alternative model 2 allows for linear effects during the demonstration period. Alternative model 3 allows for different linear effects before and during the demonstration period. All models include interactions to assess for differential effects of MEPD. Dashes indicate that a variable was not included in the associated model.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.3. Adjusted probability of IMD admissions: pooled pre-post analyses full regression results

	Coefficient	Standard error
Demonstration period	0.32	0.38
Age	-0.02	0.04
Age squared	0.00	0
Sex	0.15	0.13
Dual eligible	-0.22	0.67
Diagnosis		
Schizophrenia	0.13	0.22
Suicide	-4.63***	0.75
Other	-0.22	0.29
Mood disorder	-	-
Race/Ethnicity		
Black	-0.24	0.24
Asian	0.74**	0.31
Other	0.25	0.38
Latino	0.56**	0.24
White	-	-
Psychiatric EMC in previous 12 months	0.14*	0.08
Rural	-0.72***	0.24
Constant	-2.61**	1.20
R-squared	**.03**	
Sample size	**149,844**	

Source: Mathematica analysis of Medicaid, Medicare, and IMD data obtained from CMS and four participating states (Alabama, Maryland, Missouri, and West Virginia). One state has 1.5 years of demonstration data and the remaining states have 6 months of demonstration data.

Note: Exhibit presents coefficient and standard error estimates from logistic models of IMD admission. This model includes state-level fixed effects. The intervention group is MEPD-eligible beneficiaries who live inside the IMDs' catchment areas. The comparison group is MEPD-eligible beneficiaries who live outside the IMDs' catchment areas. Dashes indicate a reference category.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.4. Adjusted probability of IMD admissions: pooled pre-post analyses alternative model results

	Alternative model 1		Alternative model 2		Alternative model 3	
	Marginal effect	Standard error	Marginal effect	Standard error	Marginal effect	Standard error
Demonstration period	-	-	-	-	0.01	0.01
Quarter Since Demo Began:						
1	0.00	0.01	-	-	-	-
2	0.00	0.01	-	-	-	-
3	0.05***	0.02	-	-	-	-
4	0.07***	0.02	-	-	-	-
5	0.09***	0.02	-	-	-	-
6	0.10***	0.02	-	-	-	-
Quarter Since Demo Began (continuous)	-	-	0.01***	0.00	-	-
Quarter (continuous)	-	-	-	-	0.00	0.00
Demonstration period * Quarter (continuous)	-	-	-	-	0.02***	0.00
R-squared	**0.05**		**0.04**		**0.05**	
Sample size	**149,844**		**149,844**		**41,486**	

Source: Mathematica analysis of Medicaid, Medicare, and IMD data obtained from CMS and four participating states (Alabama, Missouri, Maryland, and West Virginia). One state has 1.5 years of demonstration data and the remaining states have 6 months of demonstration data.

Note: Exhibit presents average marginal effects and standard errors from logistic models of IMD admission. These models include state-level fixed effects. Control variables include age, age squared, gender, race, dual Medicare-Medicaid enrollment, rural residence, category of psychiatric EMC (mood disorder, schizophrenia, suicide, or other), and an indicator for whether the person had experienced a psychiatric EMC within the previous twelve months. Alternative model 1 allows for the effect of MEPD to change each quarter in a nonlinear way. Alternative model 2 allows for linear effects during the demonstration period. Alternative model 3 allows for different linear effects before and during the demonstration period. Dashes indicate that a variable was not included in the associated model.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.5. Adjusted probability of scatter admissions in California: difference-in-differences full regression results

	Coefficient	Standard error
Intervention group	0.01	0.08
Demonstration period	0.75***	0.05
Intervention group * Demonstration period	0.11	0.14
Age	-0.06***	0.02
Age squared	0.00***	0.00
Female	0.31***	0.05
Dual eligible	0.86***	0.05
Diagnosis		
Schizophrenia	0.28***	0.06
Other	1.74***	0.06
Mood disorder	-	-
Race/Ethnicity		
Black	0.12**	0.06
Asian	0.24**	0.10
Other	0.10	0.21
Hispanic	0.19***	0.06
White	-	-
Psychiatric EMC in previous 12 months	-1.04***	0.05
Constant	-3.47***	0.32
R-squared	**0.16**	
Sample size	**41,486**	

Source: Mathematica analysis of Medicaid, Medicare, and IMD data obtained from CMS and California. The analyses includes 6 months of data during MEPD.

Note: Exhibit presents average marginal effects and standard errors from logistic model of scatter bed admission. The intervention group group is MEPD-eligible beneficiaries who live inside the IMDs' catchment areas. The comparison group is MEPD-eligible beneficiaries who live outside the IMDs' catchment areas. Dashes indicate a reference category.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.6. Adjusted probability of scatter bed admissions in California: difference-in-differences alternative regression model results

	Alternative model 1		Alternative model 2		Alternative model 3	
	Marginal effect	Standard error	Marginal effect	Standard error	Marginal effect	Standard error
Intervention group	0.01	0.01	0.01	0.01	0.01	0.01
Demonstration period	-	-	-	-	0.01	0.01
Intervention group * Demonstration period	-	-	-	-	0.00	0.01
Quarter Since Demo:						
1	0.04***	0.01	-	-	-	-
2	0.05***	0.01	-	-	-	-
Intervention group*Quarter Since Demo:						
1	0.01	0.01	-	-	-	-
2	0.00	0.01	-	-	-	-
Quarter Since Demo (continuous)	-	-	0.03***	0.01	-	-
Intervention group * Quarter Since Demo	-	-	0.00	0.01	-	-
Quarter (continuous)	-	-	-	-	0.02	0.01
Intervention group * Quarter (continuous)	-	-	-	-	-0.01	0.02
Demonstration period * Quarter (continuous)	-	-	-	-	0.01	0.01
Intervention group * Demonstration period*Quarter (continuous)	-	-	-	-	-0.01	0.02
R-squared	**0.16**		**0.16**		**0.17**	
Sample size	**41,486**		**41,486**		**41,486**	

Source: Mathematica analysis of Medicaid, Medicare, and IMD data obtained from CMS and California. The analysis includes 6 months of data during MEPD.

Note: Exhibit presents average marginal effects and standard errors from logistic model of scatter bed admission. The intervention group is MEPD-eligible beneficiaries who live inside the IMDs' catchment areas. The comparison group is MEPD-eligible beneficiaries who live outside the IMDs' catchment areas. Control variables include age, age squared, gender, race, dual Medicare-Medicaid enrollment, category of psychiatric EMC (mood disorder, schizophrenia, or other), and an indicator for whether the person had experienced a psychiatric EMC within the previous twelve months. Alternative model 1 allows for the effect of MEPD to change each quarter in a nonlinear way. Alternative model 2 allows for linear effects during the demonstration period. Alternative model 3 allows for different linear effects before and during the demonstration period. Dashes indicate that a variable was not included in the associated model.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.7. Adjusted probability of scatter bed admissions: pooled pre-post analyses full regression results

	Coefficient	Standard error
Demonstration period admission	0.33***	0.09
Age	0.00	0.02
Age squared	0.00	0.00
Sex	0.36**	0.15
Dual eligible	-0.88*	0.46
Diagnosis		
Schizophrenia	-0.02	0.17
Suicide	2.89***	0.64
Other	1.24	0.85
Mood disorder	-	-
Race/Ethnicity		
Black	-0.06	0.15
Asian	0.15	0.32
Other	-0.10	0.47
Hispanic	-0.01	0.17
White	-	-
Psychiatric EMC in previous 12 months	-1.09***	0.06
Rural	0.22	0.13
Constant	-4.58***	1.11
R-squared	**0.22**	
Sample size	**149,844**	

Source: Mathematica analysis of Medicaid, Medicare, and IMD data obtained from CMS and four participating states. One state has 1.5 years of demonstration data and the remaining states have 6 months of demonstration data.

Note: Exhibit presents coefficient and standard error estimates from logistic models of scatter bed admission. The model includes state-level fixed effects. The intervention group group was MEPD-eligible beneficiaries who lived inside the IMDs' catchment areas. The comparison group was MEPD-eligible beneficiaries who lived outside the IMDs' catchment areas. Dashes indicate that a variable was not included in the associated model.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.8. Adjusted probability of scatter bed admissions: pooled pre-post analyses alternative model results

	Alternative model 1		Alternative model 2		Alternative model 3	
	Average marginal effect	Standard error	Average marginal effect	Standard error	Average marginal effect	Standard error
Demonstration period	-	-	-	-	0.00	0.00
Quarter Since Demo Began:						
1	0.00***	0	-	-	-	-
2	0.01**	0	-	-	-	-
3	0.00	0.01	-	-	-	-
4	0.01	0.01	-	-	-	-
5	0.01**	0.01	-	-	-	-
6	0.02***	0.01	-	-	-	-
Quarter Since Demo (continuous)	-	-	0.00***	0.00	-	-
Quarter (continuous)	-	-	-	-	0.00*	0.00
Demonstration period*Quarter (continuous)	-	-	-	-	0.00	0.00
R-squared	**0.22**		**0.22**		**0.22**	
Sample size	**149,844**		**149,844**		**149,844**	

Source: Mathematica analysis of Medicaid, Medicare, and IMD data obtained from CMS and four participating states (Alabama, Maryland, Missouri, and West Virginia). One state has 1.5 years of demonstration data and the remaining states have 6 months of demonstration data.

Note: Exhibit presents average marginal effects and standard errors from logistic models of scatter bed admission. These model include state-level fixed effects. Control variables include age, age squared, gender, race, dual Medicare-Medicaid enrollment, rural residence, category of psychiatric EMC (mood disorder, schizophrenia, suicide, or other), and an indicator for whether the person had experienced a psychiatric EMC within the previous twelve months. Alternative model 1 allows for the effect of MEPD to change each quarter in a nonlinear way. Alternative model 2 allows for linear effects during the demonstration period. Alternative model 3 allows for different linear effects before and during the demonstration period. Dashes indicate that a variable was not included in the associated model.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.9. Full regression results for difference-in-differences analysis of IMD length of stay

	Coefficient	Standard error
Intervention group	3.57*	1.46
Demonstration period	-0.17	0.09
Intervention group * Demonstration period	-1.33	0.84
Age	-0.31***	0.01
Age squared	0.00***	0.00
Female	0.10	0.13
Dual eligible	2.43***	0.58
Diagnosis		
Schizophrenia	3.02***	0.27
Suicide	0.25	0.19
Other	0.63	1.97
Mood disorder	-	-
Race/ethnicity		
Black	-0.30	0.15
Asian	1.64**	0.48
Other	0.38*	0.17
Hispanic	0.15	0.36
White	-	-
Psychiatric EMC in previous 12 months	0.55**	0.20
Rural	-0.60*	0.23
Constant	13.16***	0.33
R-squared	**0.07**	
Sample size	**134,637**	

Source: Mathematica analysis of Medicaid, Medicare, and participating IMD data from six participating states (Alabama, California, Connecticut, Maryland, Missouri, and West Virginia), covering July 2010 to December 2012.

Note: Exhibit presents results from an ordinary least squares (OLS) regression model. This model includes state-level fixed effects. The intervention group includes MEPD-eligible beneficiaries who lived inside the IMDs' catchment areas and were admitted to an IMD. The comparison group includes MEPD-eligible beneficiaries who lived inside the IMDs' catchment areas and were admitted to a psychiatric unit. Dashes indicate a reference category.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.10. Alternative model results for difference-in-differences analysis of IMD length of stay

	Alternative model 1		Alternative model 2		Alternative model 3	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Intervention group	3.39*	1.44	4.33*	1.93	4.52*	1.85
Demonstration period	-	-	-	-	0.23	0.36
Intervention group * Demonstration period	-	-	-	-	-2.59	1.54
Quarter Since Demo	-0.06	0.03	-	-	-	-
Intervention group*Quarter Since Demo	-0.24	0.21	-	-	-	-
Quarter	-	-	-0.03	0.01	-0.02	0.01
Intervention group*Quarter	-	-	-0.17	0.12	-0.21*	0.10
Demonstration period*Quarter	-	-	-	-	-0.02	0.04
Intervention group*Demonstration period*Quarter	-	-	-	-	0.24	0.16
R-squared	**0.07**		**0.07**		**0.07**	
Sample size	**134,647**		**134,647**		**134,647**	

Source: Mathematica analysis of Medicaid, Medicare, and participating IMD data from six participating states (Alabama, California, Connecticut, Maryland, Missouri, and West Virginia), covering July 2010 to December 2012.

Note: Exhibit presents results of an ordinary least squares (OLS) regression model. This model includes state-level fixed effects. Model control variables include: age, age squared, gender, race/ethnicity, dual Medicare-Medicaid enrollment, rural location, primary diagnosis, and number of psychiatric EMCs in 12 months before current admission. Dashes indicate that a parameter was not included in the model and is not applicable. Alternative model 1 allows for the effect of MEPD to change each quarter in a nonlinear way. Alternative model 2 allows for linear effects during the demonstration period. Alternative model 3 allows for different linear effects before and during the demonstration period. The models also test for differential effects for intervention and comparison groups. Dashes indicate that a variable was not included in the associated model.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.11. Full regression results for difference-in-differences analysis of scatter bed length of stay

	Coefficient	Standard error
Intervention group	-1.30	0.60
Demonstration period	-1.26**	0.06
Intervention group * Demonstration period	0.01	0.67
Age	-0.03	0.02
Age squared	0.00	0.00
Female	-0.27*	0.03
Dual eligible	1.52*	0.17
Diagnosis		
Schizophrenia	3.76**	0.16
Suicide	-1.80**	0.07
Other	-1.83	0.70
Mood disorder	-	-
Race/ethnicity		
Black	0.03	0.05
Asian	3.65***	0.02
Other	0.80	0.08
Hispanic	0.01	0.07
White	-	-
Psychiatric EMC in previous 12 months	1.54	0.29
Rural	-0.40	0.15
Constant	5.74	0.99
R-squared	**0.10**	
Sample size	**2,401**	

Source: Mathematica analysis of Medicaid and Medicare data, covering July 2010 to June 2014, in California and Connecticut.

Note: Exhibit presents results from an ordinary least squares (OLS) regression model. The intervention group includes MEPD-eligible beneficiaries who lived inside the IMDs' catchment areas. The comparison group includes MEPD-eligible beneficiaries who lived outside the IMDs' catchment areas. The model also include state-level fixed effects. Dashes indicate a reference category.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.12. Alternative model results for difference-in-differences analysis of scatter bed length of stay

	Alternative model 1		Alternative model 2		Alternative model 3	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Intervention group	-1.68	0.54	-1.73**	0.14	-1.21	0.79
Demonstration period	-	-	-	-	0.51	3.52
Intervention group * Demonstration period	-	-	-	-	-7.78*	0.94
Quarter Since Demo	-0.56	0.34	-	-	-	-
Intervention group*Quarter Since Demo	0.40	0.15	-	-	-	-
Quarter	-	-	-0.23*	0.02	-0.17***	0.00
Intervention group*Quarter	-	-	0.06	0.13	-0.01	0.04
Demonstration period*Quarter	-	-	-	-	-0.09	0.38
Intervention group*Demonstration period*Quarter	-	-	-	-	0.77*	0.08
R-squared	**0.10**		**0.10**		**0.10**	
Sample size	**2,401**		**2,401**		**2,401**	

Source: Mathematica analysis of Medicaid and Medicare data, covering July 2010 to June 2014, in California and Connecticut.

Note: Exhibit presents results from an ordinary least squares (OLS) regression model. In the difference-in-differences model, the intervention group includes MEPD-eligible beneficiaries who lived inside the IMDs' catchment areas. The comparison group includes MEPD-eligible beneficiaries who lived outside the IMDs' catchment. Control variables for both models include: age, age squared, gender, race/ethnicity, dual Medicare-Medicaid enrollment, rural location, primary diagnosis, number of psychiatric EMCs in 12 months before current admission, and state-level fixed effects. Alternative model 1 allows for the effect of MEPD to change each quarter in a nonlinear way. Alternative model 2 allows for linear effects during the demonstration period. Alternative model 3 allows for different linear effects before and during the demonstration period. The models also test for differential effects for intervention and comparison groups. Dashes indicate that a variable was not included in the associated model.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.13. Full regression results from pooled pre-post analyses of scatter bed length of stay

	Coefficient	Standard error
Demonstration period	0.01	0.22
Age	-0.06	0.08
Age squared	0.00	0.00
Female	-0.43	0.28
Dual eligible	1.55	0.82
Diagnosis		
Schizophrenia	1.61	0.94
Suicide	-1.42*	0.60
Other	-2.32***	0.42
Mood disorder	-	-
Race/ethnicity		
Black	-0.31	0.31
Asian	1.37	1.68
Other	0.18	0.23
Hispanic	0.28	0.51
White	-	-
Psychiatric EMC in previous 12 months	0.45	0.39
Rural	-0.46**	0.12
Constant	4.25**	1.30
R-squared	**0.06**	
Sample size	**5,554**	

Source: Mathematica analysis of Medicaid and Medicare data, covering July 2010 to December 2013, in five states (Alabama, Maryland, Missouri, Washington, and West Virginia).

Note: Exhibit presents results from an ordinary least squares (OLS) regression model. The intervention group includes MEPD-eligible beneficiaries who lived inside the IMDs' catchment areas. This model also includes state-level fixed effects. Dashes indicate a reference category.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.14. Alternative model results of pooled pre-post analyses of scatter bed length of stay

	Alternative model 1		Alternative model 2		Alternative model 3	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Demonstration period	-	-	-	-	-1.06	0.60
Quarter Since Demo	0.02	0.05	-	-	-	-
Quarter	-	-	0.00	0.03	-0.03	0.04
Demonstration period * Quarter	-	-	-	-	0.11*	0.08
R-squared	**0.06**		**0.06**		**0.06**	
Sample size	**5,554**		**5,554**		**5,554**	

Source: Mathematica analysis of Medicaid and Medicare data, covering July 2010 to December 2013, in five states (Alabama, Maryland, Missouri, Washington, and West Virginia).

Note: Exhibit presents results from an ordinary least squares (OLS) regression model. The intervention group includes MEPD-eligible beneficiaries who lived inside the IMDs' catchment areas. Model control variables include: age, age squared, gender, race/ethnicity, dual Medicare-Medicaid enrollment, rural location, primary diagnosis, and number of psychiatric EMCs in 12 months before current admission. These models also include state-level fixed effects. Dashes indicate that a variable was not included in the associated model. Alternative model 1 allows for the effect of MEPD to change each quarter in a nonlinear way. Alternative model 2 allows for linear effects during the demonstration period. Alternative model 3 allows for different linear effects before and during the demonstration period.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.15. Adjusted probability of ER visits in California: difference-in-differences full regression results

	Coefficient	Standard error
Intervention group	-2.08***	0.07
Demonstration period	-0.56***	0.09
Intervention group * Demonstration period	0.57***	0.13
Age	-0.02	0.02
Age squared	0.00	0.00
Female	-0.20***	0.06
Dual eligible	-0.32***	0.06
Diagnosis		
Schizophrenia	0.07	0.06
Other	0.74***	0.11
Mood disorder	-	-
Race/Ethnicity		
Black	-0.14**	0.07
Asian	-0.20*	0.12
Other	0.24	0.29
Hispanic	-0.05	0.09
White	-	-
Psychiatric EMC in previous 12 months	0.29***	0.06
Constant	4.78***	0.40
R-squared	**0.10**	
Sample size	**41,486**	

Source: Mathematica analysis of Medicaid, Medicare, and IMD data obtained from CMS and California. The data includes 6 months of data during MEPD.

Note: Exhibit presents coefficients and standard errors from a logistic model of ER visits. The intervention group is MEPD-eligible beneficiaries who live inside the IMDs' catchment areas. The comparison group is MEPD-eligible beneficiaries who live outside the IMDs' catchment areas. Dashes indicate a reference category.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.16. Adjusted probability of ER visits in California: difference-in-differences alternative regression model results

	Alternative model 1		Alternative model 2		Alternative model 3	
	Average marginal effect	Standard error	Average marginal effect	Standard error	Average marginal effect	Standard error
Intervention group	-0.08***	0.01	-0.08***	0.01	-0.08***	0.01
Demonstration period	-	-	-	-	0.06***	0.01
Intervention group * Demonstration period	-	-	-	-	0.04***	0.02
Quarter Since Demo:						
1	-0.01	0.01	-	-	-	-
2	0.01	0.01	-	-	-	-
Intervention*Quarter Since Demo:						
1	0.00	0.01	-	-	-	-
2	0.02*	0.01	-	-	-	-
Quarter Since Demo (continuous)	-	-	0.00	0.01	-	-
Intervention group*Quarter Since Demo	-	-	0.01*	0.01	-	-
Quarter (continuous)	-	-	-	-	0.01	0.02
Intervention group*Quarter (continuous)	-	-	-	-	0.02	0.02
Demonstration period*Quarter (continuous)	-	-	-	-	0.03*	0.02
Intervention*Demonstration period*Quarter (continuous)	-	-	-	-	0.03*	0.02
R-squared	**0.10**		**0.01**		**0.12**	
Sample size	**41,486**		**41,486**		**41,486**	

Source: Mathematica analysis of Medicaid, Medicare, and IMD data obtained from CMS and participating states (2010 through 2012).

Note: Exhibit presents average marginal effects and standard errors from logistic models of ER visits. Control variables include age, age squared, gender, race, dual Medicare-Medicaid enrollment, category of psychiatric EMC (mood disorder, schizophrenia, or other), and an indicator for whether the person had experienced a psychiatric EMC within the previous 12 months. The intervention group is MEPD-eligible beneficiaries who live inside the IMDs' catchment areas. The comparison group is MEPD-eligible beneficiaries who live outside the IMDs' catchment areas. Alternative model 1 allows for the effect of MEPD to change each quarter in a nonlinear way. Alternative model 2 allows for linear effects during MEPD period. Alternative model 3 allows for different linear effects before and during MEPD period. All models include interactions to assess for differential effects of MEPD. Dashes indicate that a variable was not included in the associated model.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.17. Adjusted probability of ER visits: pooled pre-post analyses full regression results

	Coefficient	Standard error
Demonstration period	0.28***	0.10
Age	0.01	0.01
Age squared	0.00	0.00
Sex	-0.09***	0.02
Dual eligible	0.18	0.35
Diagnosis		
Schizophrenia	-0.15***	0.04
Suicide	1.17***	0.28
Other	5.93***	1.28
Mood disorder	-	-
Race/Ethnicity	.	.
Black	0.18	0.16
Asian	0.01	0.06
Other	0.06	0.13
Hispanic	-0.07*	0.09
White	-	-
Psychiatric EMC in previous 12 months	0.11	0.08
Rural	-0.48**	0.24
Constant	1.59*	0.13
R-squared	**0.03**	
Sample size	**149,844**	

Source: Mathematica analysis of Medicaid, Medicare, and IMD data obtained from CMS and four participating states (Alabama, Maryland, Missouri, and West Virginia). One state has 1.5 years of demonstration data and the remaining states have 6 months of demonstration data.

Note: Exhibit presents coefficients and standard errors from logistic model of ER visits. Analysis includes state-level fixed effects. Dashes indicate a reference category.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.18. Adjusted probability of ER visits: pooled pre-post analyses alternative model results

	Alternative model 1		Alternative model 2		Alternative model 3	
	Average marginal effect	Standard error	Average marginal effect	Standard error	Average marginal effect	Standard error
Demonstration period	-	-	-	-	0.02*	0.01
Quarter Since Demo:						
1	0.02	0.01	-	-	-	-
2	0.04*	0.02	-	-	-	-
3	0.06	0.04	-	-	-	-
4	0.07*	0.04	-	-	-	-
5	0.06	0.04	-	-	-	-
6	0.05	0.04	-	-	-	-
Quarter Since Demo (continuous)	-	-	0.01	0.01	-	-
Quarter (continuous)	-	-	-	-	0.00	0.00
Demonstration period*Quarter (continuous)	-	-	-	-	0.01	0.01
R-squared	**0.03**		**0.03**		**0.03**	
Sample size	**149,844**		**149,844**		**149,844**	

Source: Mathematica analysis of Medicaid, Medicare, and IMD data obtained from CMS and four participating states. One state has 1.5 years of demonstration data and the remaining states have 6 months of demonstration data.

Note: Exhibit presents average marginal effects and standard errors from logistic model of ER visits. Control variables include age, age squared, gender, race, dual Medicare-Medicaid enrollment, rural residence, category of psychiatric EMC (mood disorder, schizophrenia, suicide, or other), and an indicator for whether the person had experienced a psychiatric EMC within the previous twelve months. Analysis includes state-level fixed effects. Alternative model 1 allows for the effect of MEPD to change over time in a nonlinear way. Alternative model 2 allows for linear effects during MEPD period. Alternative model 3 allows for linear effects before and during MEPD period. Dashes indicate that a variable was not included in the associated model.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.19. Adjusted mean ED boarding time: difference-in-differences full regression results

	Coefficient	Standard error
Intervention group	-0.43	0.29
Demonstration period	0.02	1.74
Intervention group * Demonstration period	0.97	0.64
Female	-0.41	0.46
Age	0.02	0.02
Dual eligible	-1.60	1.81
Race/Ethnicity		
Black	-0.69	1.43
Native America/Pacific Islander	-1.28	3.83
Hispanic	-2.43	0.89**
Other or Mixed	3.09	0.72***
Unknown or Missing	0.52	0.27
White	-	-
Constant	9.84	0.64***
R-squared	**0.09**	
Sample size	**4,139**	

Source: Mathematica analysis of data obtained from Emergency Departments, 2010-2014. Boarding time data includes 4,139 ER visits from 6 ERs across 4 states.

Note: Exhibit presents regression results from ordinary least squares (OLS) regressions. Standard errors are robust for clustering at the facility level.This model incudes ER-level fixed effects. The intervention group was MEPD-eligible beneficiaries. The comparison group is non-MEPD eligible beneficiaries with a psychiatric EMC. Non-MEPD eligible patients included adults enrolled in insurance other than Medicaid, Medicaid enrollees who did not meet the state MEPD eligibility criteria (such as requirements about managed care or dual Medicare-Medicaid enrollment), and patients who self-paid for care. Dashes indicate a reference category.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.20. Adjusted mean ED length of stay: difference-in-differences full regression results

	Coefficient	Standard error
Intervention group	0.66	0.69
Demonstration period	1.14	1.11
Intervention group * Demonstration period	-0.49	0.79
Female	-0.70***	0.21
Age	0.01	0.01
Dual eligible	0.70	0.45
Race/Ethnicity		
Black	-0.16	0.41
Native American/Pacific Islander	1.40*	0.71
Hispanic	-1.41	1.61
Other or Mixed	-0.23	0.96
Unknown or Missing	1.38	0.74
White	-	-
Constant	19.05***	0.27
R-squared	**0.1**	
Sample size	**26,803**	

Source: Mathematica analysis of data obtained from14 EDs across nine states, covered 2010-2014.

Notes: Exhibit presents regression results from ordinary least squares (OLS) regressions. Standard errors, shown in parentheses, are robust for clustering at the facility level. The model excludes EDs with fewer than five observations in the intervention or comparison group, before or during MEPD. The intervention group is MEPD-eligible beneficiaries. The comparison group is non-MEPD eligible beneficiaries with a psychiatric EMC. Non-MEPD eligible patients include adults enrolled in insurance other than Medicaid, Medicaid enrollees who do not meet the state MEPD eligibility criteria (such as requirements about managed care or dual Medicare-Medicaid enrollment), patients who self-pay for care, and facility level fixed effects. Dashes indicate a reference category.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.21. Adjusted mean ED boarding time: difference-in-differences alternative model results

	Alternative model 1		Alternative model 2		Alternative model 3	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Intervention group	-0.69***	0.14	-0.5*	0.25	-1.75*	0.86
Demonstration period	-0.90	1.86	-0.01	1.64	1.11	2.78
Intervention group * Demonstration period	1.24	0.73	0.99	0.61	1.61	1.11
Constant	10.07***	0.71	1.40	0.77	8.57	2.98**
Facility fixed effects	Yes		No		No	
State fixed effects	No		Yes		No	
R-squared	**0.05**		**0.09**		**0.01**	
Sample size	**3,689**		**4,253**		**4,253**	

Source: Mathematica analysis of data obtained from Emergency Rooms, 2010-2014. Alternative Model 1 includes five EDs across three states. Alternative Models 2 and 3 include 10 ERs across six states.

Notes: Exhibit presents regression results from ordinary least squares (OLS) regressions. Standard errors, shown in parentheses, are robust for clustering at the facility level. The intervention group is MEPD-eligible beneficiaries. The comparison group is non-MEPD eligible beneficiaries with a psychiatric EMC. Non-MEPD eligible patients include adults enrolled in insurance other than Medicaid, Medicaid enrollees who do not meet the state MEPD eligibility criteria (such as requirements about managed care or dual Medicare-Medicaid enrollment), and patients who self-pay for care. Control variables include patient age, gender, race/ethnicity, and dual Medicare-Medicaid enrollment. Alternative Model 1 excludes data from one additional ED that had a data system change during MEPD, which could have affected the boarding time calculation. Alternative Model 2 includes data from all EDs in the sample and uses state fixed effects. Alternative Model 3 replicates Model 2 without the fixed effects.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.22. Adjusted mean ED length of stay: difference-in-differences alternative model result

	Coefficient	Standard error
Intervention group	0.37	0.74
During MEPD	0.37	0.75
Intervention group * Demonstration period	0.04	0.77
Constant	19.11***	0.28
R-squared	**0.13**	
Sample size	**22,364**	

Source: Mathematica analysis of data obtained from 12 Emergency Departments across eight states, 2010-2014.

Notes: Exhibit presents regression results from ordinary least squares (OLS) regressions. Standard errors, shown in parentheses, are robust for clustering at the facility level. This alternative model excludes 2 EDs that had a data system change during MEPD, which could have affected the length of stay calculation. The intervention group is MEPD-eligible beneficiaries. The comparison group is non-MEPD eligible beneficiaries with a psychiatric EMC. Non-MEPD eligible patients include adults enrolled in insurance other than Medicaid, Medicaid enrollees who do not meet the state MEPD eligibility criteria (such as requirements about managed care or dual Medicare-Medicaid enrollment), and patients who self-pay for care. Control variables include facility fixed-effects, as well as patient age, gender, race/ethnicity, and dual Medicare-Medicaid enrollment.

*p<0.1, **p<0.05, ***p<0.01.

Exhibit III.23. Adjusted costs of IMD stays: full regression results

	Federal Medicaid costs[a]		State Medicaid costs[b]		IMD costs[c]	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Alabama[d]						
Logit						
Demonstration period	1.64***[,f]	0.22	2.95***[,e,f]	0.47	[i]	
Black	0.46**	0.18	0.62**	0.28		
Asian/Pacific Islander	0.00		0.00			
Non-Hispanic Other	-0.04	0.88	0.98	1.43		
Hispanic	0.00		0.00			
Female	0.09	0.18	0.52*	0.28		
Age	0.00	0.01	-0.02	0.01		
Length of Stay	0.23	0.18	0.85***	0.24		
Dual	-0.48**	0.21	-2.24***	0.32		
Constant	0.19	0.46	1.02	0.67		
GLM						
Demonstration Period	2.57***[,f]	0.03	-0.35***[,e,f]	0.05	-0.40***[,i]	0.04
Black	0.00	0.03	0.03	0.03	0.03	0.04
Asian/Pacific Islander	-0.14	0.17	-0.08	0.29	0.32**	0.13
Non-Hispanic Other	-0.17	0.14	-0.39*	0.23	0.06	0.21
Hispanic	-0.11	0.32	0.24**	0.10	0.07*	0.04
Female	0.00	0.03	-0.02	0.03	0.03	0.04
Age	0.00	0.00	0.00	0.00	-0.00***	0.00
Length of Stay	0.87***	0.04	1.10***	0.05	1.45***	0.03
Dual	-0.06	0.04	-0.43***	0.08	-0.27***	0.05
Constant	3.57***	0.11	5.43***	0.13	4.87***	0.10
N	1045		1045		1052	
California						
GLM						
Demonstration Period	[h]		-0.69***[,i]	0.02		
Black	0.01	0.02	0.00	0.00		
Asian/Pacific Islander	0.05*	0.03	0.02	0.02		
Non-Hispanic Other	0.02	0.02	0.00	0.01		
Hispanic	0.03	0.04	0.03	0.02		
Female	0.01	0.01	0.00	0.01		
Age	-0.00**	0.00	-0.00**	0.00		
Length of Stay	1.11***	0.02	1.14***	0.02		
Dual	-0.39	0.48	-0.23	0.28		
Constant	5.74***	0.02	6.39***	0.01		
N	1589		3457			
District of Columbia						
Logit						
Demonstration period	[g]		0.08[f]	0.15	[g]	
Black	0.71***	0.25	0.67***	0.22	-0.18	0.39
Asian/Pacific Islander	0.00		0.47	1.02	0.00	

Non-Hispanic Other	0.00		0.00		0.00	
Hispanic	0.57	0.46	0.33	0.41	-0.25	0.82
Female	0.04	0.13	-0.06	0.12	-0.04	0.22
Age	0.00	0.01	0.01*	0.01	0.02	0.01
Length of Stay	-0.04	0.13	-0.04	0.11	0.59***	0.18
Dual	-1.39***	0.14	-1.53***	0.15	0.64***	0.24
Constant	1.08**	0.45	0.89**	0.45	-4.81***	0.79
GLM						
Demonstration Period	[g]		-1.07***,[f]	0.06	[g]	
Black	-0.05	0.07	-0.09	0.08	0.37*	0.21
Asian/Pacific Islander	0.50*	0.28	0.46	0.32		
Non-Hispanic Other	0.04	0.07	-0.18	0.15		
Hispanic	0.02	0.13	0.12	0.17	0.48**	0.22
Female	-0.05**	0.03	-0.07**	0.03	-0.14	0.10
Age	0.00	0.00	0.00***	0.00	0.00	0.00
Length of Stay	0.98***	0.04	0.90***	0.04	1.05***	0.09
Dual	-0.83***	0.04	-0.93***	0.04	-0.10	0.10
Constant	6.13***	0.11	6.51***	0.14	6.10***	0.34
N	1257		1639		1258	
Maryland						
GLM						
Demonstration Period	[h]		-0.57***,[i]	0.04		
Black	0.00	0.02	0.00	0.01		
Asian/Pacific Islander	-0.08	0.05	-0.08**	0.04		
Non-Hispanic Other	0.07	0.05	0.01	0.04		
Hispanic	-0.16***	0.03	-0.11***	0.02		
Female	0.00	0.01	0.00	0.01		
Age	-0.00***	0.00	0.00	0.00		
Length of Stay	1.16***	0.02	1.13***	0.01		
Dual						
Constant	5.64***	0.12	6.24***	0.06		
N	2599		4829			
West Virginia						
Logit						
Demonstration period			0.31	0.23		
Black	-0.57	0.43	-0.70**	0.34		
Asian/Pacific Islander						
Non-Hispanic Other	-1.38	1.26	-1.34	1.16		
Hispanic	0.00		0.00			
Female	0.21	0.22	0.07	0.18		
Age	0.00	0.01	0.00	0.01		
Length of Stay	-0.47***	0.18	-0.49***	0.14		
Dual	-3.48***	0.22	-3.23***	0.19		
Constant	2.88***	0.56	2.72***	0.55		
GLM						
Demonstration Period	[g]		-1.38***,[f]	0.09		
Black	-0.06	0.11	0.00	0.09		

Asian/Pacific Islander					
Non-Hispanic Other	0.36	0.23	0.37	0.25	
Hispanic					
Female	-0.07	0.04	-0.11**	0.04	
Age	0.00	0.00	0.00	0.00	
Length of Stay	0.99***	0.03	1.00***	0.03	
Dual	-0.94***	0.16	-1.00***	0.13	
Constant	5.86***	0.10	6.40***	0.15	
N	734		971		

Note: The dependent variable was the cost per stay. Exhibit presents models listed in f, g, h, i below. Standard errors are robust for clustering at the facility level.

[a] Federal costs included the federal share of Medicaid claims (which should have been zero for all states because of the IMD exclusion) plus the federal share of MEPD IMD claims (which was equivalent to the federal medical assistance percentage [FMAP] rate applied to each state's Medicaid claims) (Appendix E).

[b] State costs included the state share of Medicaid and MEPD IMD claims, plus costs paid out of other state funds.

[c] IMD costs included unpaid claims, costs paid through charitable contributions, and other costs absorbed by the IMDs. Data obtained for IMDs in California and Maryland included only federal and state costs. We did not computer the changes in cost for IMD in West Virginia because there were only seven observations with non-zero costs.

[d] For Alabama, although the unadjusted, untransformed state costs decreased and IMD and total costs increased after MEPD implementation, results of the adjusted model (Exhibit X.3) found significant results in the opposite direction. This suggests that the distribution of one or more of the covariates included in the adjusted model (patient age, gender, race/ethnicity, dual Medicare-Medicaid enrollment status, and length of stay) differed between the pre- and post-periods and were partially responsible for differences in the costs presented here.

[e] Federal Medicaid costs for Alabama in the pre-demonstration period are for pre-hospitalization screenings and physician rounds associated with IMD stays. We used the FMAP rate to divide these costs into federal and state shares.

[f] When we had pre and post demonstration data available, and when data included both $0 and >$0, we conducted a pre-post two part model. The first part of the model is a logistic regression analysis predicting the likelihood of any costs in that time period. The second part of the model is a general linear model of non-zero costs using the gamma scale family and a log link function (Buntin and Zaslavsky 2004). The effect shown in the table is the marginal effect of the demonstration period (pre-post model).

[g] When we only had post demonstration data available (because >95% of costs were $0 in the pre demonstration period), and when data included both $0 and >$0, we conducted a post-only two part model. The first part of the model is a logistic regression analysis predicting the likelihood of any costs in that time period. The second part of the model is a general linear model of non-zero costs using the gamma scale family and a log link function. In this model, the constant term represents the effect of interest, assessing whether the costs incurred in the post period were different than $0. The effect shown in the table is the overall adjusted mean (post only model), testing whether the mean is significantly different from $0.

[h] When we only had post demonstration data available (because >95% of costs were $0 in the pre demonstration period), and when data only included >$0, we conducted a post-only general linear model using the gamma scale family and a log link function. When we had less than 5% of $0s in the post-period when we would have run a pre-post two part model, we ran a post-only general linear model. In this model, the constant term represents the effect of interest, assessing whether the costs incurred in the post period were different than $0 (post only model), testing whether the mean is significantly different from $0.

[i] When we had pre and post demonstration data available, and when data only included >$0, we conducted a pre-post general linear model using the gamma scale family and a log link function. The effect shown in the table is the marginal effect of the demonstration period (pre-post model).

*p<0.10, **p<0.05, ***p<0.01

Exhibit III.24. Adjusted total mental health spending in California: difference-in-differences full regression results

	Total MH spending		Total federal MH spending	
	Marginal effect	Standard error	Marginal effect	Standard error
Logit				
Intervention group	-0.18***	0.03	-0.18***	0.03
Demonstration period	0.13***	0.02	0.13***	0.02
Intervention group*Demonstration period	0.18***	0.06	0.18***	0.06
Non-Hispanic Black	-0.22***	0.03	-0.22***	0.03
Non-Hispanic Asian or Other Pacific Islander	0.29***	0.06	0.29***	0.06
Non-Hispanic Other	-0.16	0.12	-0.16	0.12
Hispanic	-0.11***	0.04	-0.11***	0.04
Female	-0.01	0.03	-0.01	0.03
Dual eligible	0.67***	0.03	0.67***	0.03
Quarter 1	0.02	0.02	0.02	0.02
Quarter 3	-0.16***	0.02	-0.16***	0.02
Quarter 4	-0.35***	0.02	-0.35***	0.02
Age in years at beginning of demonstration	0.00	0.00	0	0.00
Constant	0.22***	0.06	0.22***	0.06
GLM				
Intervention group	-0.26***	0.04	-0.25***	0.04
Demonstration period	0.17***	0.03	0.06**	0.03
Intervention group*Demonstration period	0.26***	0.08	0.29***	0.08
Non-Hispanic Black	0.12***	0.03	0.12***	0.03
Non-Hispanic Asian or Other Pacific Islander	0.08	0.05	0.08	0.05
Non-Hispanic Other	-0.21	0.15	-0.23	0.15
Hispanic	-0.03	0.04	-0.03	0.04
Female	-0.08***	0.03	-0.08***	0.03
Dual eligible	0.29***	0.03	0.83***	0.03
Quarter 1	0.04**	0.02	0.04*	0.02
Quarter 3	-0.07***	0.02	-0.03	0.02
Quarter 4	-0.18***	0.02	-0.14***	0.02
Age in years at beginning of demonstration	-0.00***	0.00	-0.00***	0.00
Constant	7.29***	0.06	6.61***	0.06

Source: Mathematica analysis of Medicaid and Medicare data obtained from CMS for California (2010-2012), which had six months of demonstration data.

Note: N=83,660 person quarters. Exhibit presents average marginal effects of MEPD on total mental health costs and total federal mental health costs per beneficiary per month using a two part model. The first part of the model is a logistic regression analysis predicting the likelihood of any costs in that person quarter. The second part of the model is a general linear model of non-zero costs using the gamma scale family and a log link function (Buntin and Zaslavsky 2004) since costs are not normally distributed. Control variables included age, race, gender, dual Medicare-Medicaid enrollment status, and quarter. Quarter 2 was used as a reference group based on unadjusted costs; white race was also used as a reference group. We used robust standard errors to address heteroscedasticity. The intervention group was Medicaid beneficiaries ages 21–64 who had received services for a psychiatric EMC from an ED, general hospital, or participating IMD at any time during the four-year evaluation period, and who lived within the MEPD catchment area. The comparison group was beneficiaries meeting the same criteria but who lived outside of the MEPD catchment area.

*p<0.10, **p<0.05, ***p<0.01

Exhibit III.25. Total Medicaid and Medicare mental health costs in California: alternative regression model results

	Alternative model 1		Alternative model 2		Alternative model 3	
	Marginal effect	Standard error	Marginal effect	Standard error	Marginal effect	Standard error
Intervention group	-9.42	122.14	3.03	124.02	-5.46	127.66
Demonstration period	-	-	-	-	677.00***	90.15
Intervention group * Demonstration period	-	-	-	-	153.65*	93.18
Quarter Since Demo						
1	258.78***	66.74	-	-	-	-
2	580.49***	152.12	-	-	-	-
Intervention group * Quarter Since Demo						
1	87.35	71.00	-	-	-	-
2	372.75**	153.42	-	-	-	-
Quarter Since Demo (continuous)	-	-	344.81***	93.39	-	-
Intervention group * Quarter Since Demo	-	-	215.88**	94.15	-	-
Quarter (continuous)	-	-	-	-	262.88**	133.64
Intervention group * Quarter (continuous)	-	-	-	-	284.40**	133.46
Demonstration period * Quarter (continuous)	-	-	-	-	298.64**	133.69
Intervention group * Demonstration period * Quarter (continuous)	-	-	-	-	275.22**	133.56
Sample size	83,660		83,660		83,660	

Source: Mathematica analysis of Medicaid and Medicare data obtained from CMS for California (2010-2012), which had six months of demonstration data.

Note: Exhibit presents average marginal effects of MEPD on total mental health costs per beneficiary per month using a two part model. The first part of the model is a logistic regression analysis predicting the likelihood of any costs in that person quarter. The second part of the model is a general linear model of non-zero costs using the gamma scale family and a log link function (Buntin and Zaslavsky 2004) to account for the non-normal distribution of costs. N's reflect person-quarters. Control variables included age, race, gender, dual Medicare-Medicaid enrollment status, and quarter. We used robust standard errors to address heteroscedasticity. The intervention group was Medicaid beneficiaries ages 21–64 who had received services for a psychiatric EMC from an ED, general hospital, or participating IMD at any time during the four-year evaluation period, and who lived within the MEPD catchment area. The comparison group was beneficiaries meeting the same criteria but who lived outside of the MEPD catchment area. Alternative model 1 allows for the effect of MEPD to change each quarter in a nonlinear way. Alternative model 2 allows for linear effects during the demonstration period. Alternative model 3 allows for different linear effects before and during MEPD. All models include interactions to assess for differential effects of MEPD. Dashes indicate that a variable was not included in the associated model.

*p<0.10, **p<0.05, ***p<0.01

Exhibit III.26. Total federal Medicaid and Medicare mental health costs in California: alternative regression model results

	Alternative model 1		Alternative model 2		Alternative model 3	
	Marginal effect	Standard error	Marginal effect	Standard error	Marginal effect	Standard error
Intervention group	13.80	93.75	26.53	96.84	16.38	97.93
Demonstration period	-	-	-	-	455.74***	70.73
Intervention group * Demonstration period	-	-	-	-	138.30*	72.41
Quarter Since Demo						
1	143.15***	51.58	-	-	-	-
2	398.71***	127.21	-	-	-	-
Intervention group * Quarter Since Demo						
1	73.11	54.78	-	-	-	-
2	323.39**	128.21	-	-	-	-
Quarter Since Demo (continuous)	-	-	219.80***	74.34	-	-
Intervention group * Quarter Since Demo	-	-	173.57**	74.82	-	-
Quarter (continuous)	-	-	-	-	217.06*	114.01
Intervention group * Quarter (continuous)	-	-	-	-	249.25**	114.04
Demonstration period * Quarter (continuous)	-	-	-	-	244.69**	113.83
Intervention group * Demonstration period * Quarter (continuous)	-	-	-	-	242.49**	113.84
Sample size	83,660		83,660		83,660	

Source: Mathematica analysis of Medicaid and Medicare data obtained from CMS for California (2010-2012), which had six months of demonstration data.

Note: Exhibit presents average marginal effects of MEPD on total federal mental health costs per beneficiary per month using a two part model. The first part of the model is a logistic regression analysis predicting the likelihood of any costs in that person quarter. The second part of the model is a general linear model of non-zero costs using the gamma scale family and a log link function (Buntin and Zaslavsky 2004) to account for the non-normal distribution of costs. N's reflect person-quarters. Control variables included age, race, gender, dual Medicare-Medicaid enrollment status, and quarter. We used robust standard errors to address heteroscedasticity. The intervention group was Medicaid beneficiaries ages 21–64 who had received services for a psychiatric EMC from an ED, general hospital, or participating IMD at any time during the four-year evaluation period, and who lived within the MEPD catchment area. The comparison group was beneficiaries meeting the same criteria but who lived outside of the MEPD catchment area. Alternative model 1 allows for the effect of MEPD to change each quarter in a nonlinear way. Alternative model 2 allows for linear effects during the demonstration period. Alternative model 3 allows for different linear effects before and during MEPD. All models include interactions to assess for differential effects of MEPD. Dashes indicate that a variable was not included in the associated model.

*p<0.10, **p<0.05, ***p<0.01

Exhibit III.27. Adjusted total mental health spending in Alabama: pre-post full regression results

	Total MH spending		Total federal MH spending	
	Marginal effect	SE	Marginal effect	SE
Logit				
Demonstration period	0.10***	0.02	0.10***	0.02
Non-Hispanic Black	0.13***	0.03	0.13***	0.03
Non-Hispanic Asian or Other Pacific Islander	0.26	0.25	0.26	0.25
Non-Hispanic Other	-0.10	0.23	-0.10	0.23
Hispanic	0.06	0.18	0.06	0.18
Female	-0.16***	0.03	-0.16***	0.03
Dual eligible	0.16***	0.03	0.16***	0.03
Quarter 1	-0.03*	0.02	-0.03*	0.02
Quarter 3	-0.06***	0.02	-0.06***	0.02
Quarter 4	-0.11***	0.02	-0.11***	0.02
Age in years at beginning of demonstration	0.00***	0.00	0.00***	0.00
Constant	0.40***	0.06	0.40***	0.06
GLM				
Demonstration period	0.06***	0.02	0.05**	0.02
Non-Hispanic Black	0.16***	0.03	0.15***	0.03
Non-Hispanic Asian or Other Pacific Islander	-0.08	0.19	-0.11	0.18
Non-Hispanic Other	0.08	0.27	0.12	0.28
Hispanic	-0.10	0.14	-0.09	0.13
Female	-0.38***	0.03	-0.38***	0.03
Dual eligible	0.50***	0.03	0.76***	0.03
Quarter 1	0.02	0.02	0.02	0.02
Quarter 3	-0.12***	0.02	-0.12***	0.02
Quarter 4	-0.17***	0.02	-0.18***	0.02
Age in years at beginning of demonstration	0.01***	0.00	0.01***	0.00
Constant	6.25***	0.05	5.89***	0.05

Source: Mathematica analysis of Medicaid and Medicare data obtained from CMS for Alabama (2010-2012), which had six months of demonstration data.

Note: N= 84,982 person quarters. Exhibit presents average marginal effects of MEPD on total mental health costs and total federal mental health costs per beneficiary per month using a two part model. The first part of the model is a logistic regression analysis predicting the likelihood of any costs in that person quarter. The second part of the model is a general linear model of non-zero costs using the gamma scale family and a log link function (Buntin and Zaslavsky 2004) since costs are not normally distributed. Control variables included age, race, gender, dual Medicare-Medicaid enrollment status, and quarter. Quarter 2 was used as a reference group based on unadjusted costs; white race was also used as a reference group. We used robust standard errors to address heteroscedasticity. The intervention group was Medicaid beneficiaries ages 21–64 who had received services for a psychiatric EMC from an ED, general hospital, or participating IMD at any time during the four-year evaluation period, and who lived within the MEPD catchment area. The comparison group was beneficiaries meeting the same criteria but who lived outside of the MEPD catchment area.

*p<0.10, **p<0.05, ***p<0.01

Exhibit III.28. Adjusted total mental health spending in Alabama: pre-post analyses alternative model results

	Alternative model 1		Alternative model 2		Alternative model 3	
	Marginal effect	Standard error	Marginal effect	Standard error	Marginal effect	Standard error
Demonstration period	-	-	-	-	-2.86	15.89
Quarter Since Demo Began:						
1	59.04***	13.62	`	-	-	-
2	35.96***	13.43	-	-	-	-
Quarter Since Demo Began (continuous)	-	-	27.08***	7.37	-	-
Quarter (continuous)	-	-	-	-	8.84***	3.05
Demonstration period * Quarter (continuous)	-	-	-	-	-23.39	15.12
Sample size	84,982		84,982		84,982	

Source: Mathematica analysis of Medicaid and Medicare data obtained from CMS for Alabama (2010-2012), which had six months of demonstration data.

Note: Exhibit presents average marginal effects of MEPD on total mental health costs and total federal mental health costs per beneficiary per month using a two part model. The first part of the model is a logistic regression analysis predicting the likelihood of any costs in that person quarter. The second part of the model is a general linear model of non-zero costs using the gamma scale family and a log link function (Buntin and Zaslavsky 2004) since costs are not normally distributed. N's reflect person quarters. Control variables included age, race, gender, dual Medicare-Medicaid enrollment status, and quarter. We used robust standard errors to address heteroscedasticity. Alternative model 1 allows for the effect of MEPD to change each quarter in a nonlinear way. Alternative model 2 allows for linear effects during the demonstration period. Alternative model 3 allows for different linear effects before and during MEPD. All models include interactions to assess for differential effects of MEPD. The intervention group was Medicaid beneficiaries ages 21–64 who had received services for a psychiatric EMC from an ED, general hospital, or participating IMD at any time during the four-year evaluation period, and who lived within the MEPD catchment area.

*p<0.10, **p<0.05, ***p<0.01

Exhibit III.29. Adjusted total federal mental health spending in Alabama: pre-post analyses alternative model results

	Alternative model 1		Alternative model 2		Alternative model 3	
	Marginal effect	Standard error	Marginal effect	Standard error	Marginal effect	Standard error
Demonstration period	-	-	-	-	-1.44	12.87
Quarter Since Demo Began:						
1	44.93***	11.09	-	-	-	-
2	25.71**	10.74	-	-	-	-
Quarter Since Demo Began (continuous)	-	-	19.86***	5.84	-	-
Quarter (continuous)	-	-	-	-	6.43***	2.43
Demonstration period * Quarter (continuous)	-	-	-	-	-19.40	12.48
Sample size	84,982		84,982		84,982	

Source: Mathematica analysis of Medicaid and Medicare data obtained from CMS for Alabama (2010-2012), which had six months of demonstration data.

Note: Exhibit presents average marginal effects of MEPD on total mental health costs and total federal mental health costs per beneficiary per month using a two part model. The first part of the model is a logistic regression analysis predicting the likelihood of any costs in that person quarter. The second part of the model is a general linear model of non-zero costs using the gamma scale family and a log link function (Buntin and Zaslavsky 2004) since costs are not normally distributed. N's reflect person quarters. Control variables included age, race, gender, dual Medicare-Medicaid enrollment status, and quarter. We used robust standard errors to address heteroscedasticity. Alternative model 1 allows for the effect of MEPD to change each quarter in a nonlinear way. Alternative model 2 allows for linear effects during the demonstration period. Alternative model 3 allows for different linear effects before and during MEPD. All models include interactions to assess for differential effects of MEPD. The intervention group was Medicaid beneficiaries ages 21–64 who had received services for a psychiatric EMC from an ED, general hospital, or participating IMD at any time during the four-year evaluation period, and who lived within the MEPD catchment area.

*p<0.10, **p<0.05, ***p<0.01

Exhibit III.30. Adjusted total mental health spending in Maryland: pre-post full regression results

	Total MH spending		Total federal MH spending	
	Marginal effect	SE	Marginal effect	SE
Logit				
Demonstration period	0.02	0.03	0.02	0.03
Non-Hispanic Black	-0.21***	0.04	-0.21***	0.04
Non-Hispanic Asian or Other Pacific Islander	0.26*	0.15	0.26*	0.15
Non-Hispanic Other	0.03	0.28	0.03	0.28
Hispanic	-0.06	0.13	-0.06	0.13
Female	-0.07**	0.04	-0.07**	0.04
Dual eligible	1.37***	0.03	1.37***	0.03
Quarter 1	0.01	0.02	0.01	0.02
Quarter 3	0.02	0.02	0.02	0.02
Quarter 4	-0.05**	0.02	-0.05**	0.02
Age in years at beginning of demonstration	0.01***	0.00	0.01***	0.00
Constant	-0.63***	0.07	-0.63***	0.07
GLM				
Demonstration period	-0.07***	0.02	-0.09***	0.03
Non-Hispanic Black	0.04	0.03	0.07**	0.03
Non-Hispanic Asian or Other Pacific Islander	0.10	0.12	0.05	0.12
Non-Hispanic Other	0.18	0.30	0.14	0.31
Hispanic	0.11	0.10	0.09	0.10
Female	-0.11***	0.03	-0.08***	0.03
Dual eligible	-0.11***	0.03	0.37***	0.03
Quarter 1	0.04	0.03	0.04	0.03
Quarter 3	0.05**	0.03	0.07**	0.03
Quarter 4	-0.10***	0.03	-0.11***	0.03
Age in years at beginning of demonstration	0.00***	0.00	0.00***	0.00
Constant	7.65***	0.06	6.98***	0.06

Source: Mathematica analysis of Medicaid and Medicare data obtained from CMS for Maryland (2010-2012), which had six months of demonstration data.

Note: N=53,852 person quarters. Exhibit presents average marginal effects of MEPD on total mental health costs and total federal mental health costs per beneficiary per month using a two part model. The first part of the model is a logistic regression analysis predicting the likelihood of any costs in that person quarter. The second part of the model is a general linear model of non-zero costs using the gamma scale family and a log link function (Buntin and Zaslavsky 2004) since costs are not normally distributed. Control variables included age, race, gender, dual Medicare-Medicaid enrollment status, and quarter. Quarter 2 was used as a reference group based on unadjusted costs; white race was also used as a reference group. We used robust standard errors to address heteroscedasticity. The intervention group was Medicaid beneficiaries ages 21–64 who had received services for a psychiatric EMC from an ED, general hospital, or participating IMD at any time during the four-year evaluation period, and who lived within the MEPD catchment area. The comparison group was beneficiaries meeting the same criteria but who lived outside of the MEPD catchment area.

*p<0.10, **p<0.05, ***p<0.01

Exhibit III.31. Adjusted total mental health spending in Maryland: pre-post analyses alternative model results

	Alternative model 1		Alternative model 2		Alternative model 3	
	Marginal effect	Standard error	Marginal effect	Standard error	Marginal effect	Standard error
Demonstration period	-	-	-	-	44.06	54.78
Quarter Since Demo Began:						
1	-109.51**	47.12	-	-	-	-
2	-75.38*	39.34	-	-	-	-
Quarter Since Demo Began (continuous)	-	-	-51.04**	20.72	-	-
Quarter (continuous)	-	-	-	-	-21.89***	7.90
Demonstration period * Quarter (continuous)	-	-	-	-	33.80	40.87
Sample size	53,852		53,852		53,852	

Source: Mathematica analysis of Medicaid and Medicare data obtained from CMS for Maryland (2010-2012), which had six months of demonstration data.

Note: Exhibit presents average marginal effects of MEPD on total mental health costs and total federal mental health costs per beneficiary per month using a two part model. The first part of the model is a logistic regression analysis predicting the likelihood of any costs in that person quarter. The second part of the model is a general linear model of non-zero costs using the gamma scale family and a log link function (Buntin and Zaslavsky 2004) since costs are not normally distributed. N's reflect person quarters. Control variables included age, race, gender, dual Medicare-Medicaid enrollment status, and quarter. We used robust standard errors to address heteroscedasticity. Alternative model 1 allows for the effect of MEPD to change each quarter in a nonlinear way. Alternative model 2 allows for linear effects during the demonstration period. Alternative model 3 allows for different linear effects before and during MEPD. All models include interactions to assess for differential effects of MEPD. The intervention group was Medicaid beneficiaries ages 21–64 who had received services for a psychiatric EMC from an ED, general hospital, or participating IMD at any time during the four-year evaluation period, and who lived within the MEPD catchment area.

*p<0.10, **p<0.05, ***p<0.01

Exhibit III.32. Adjusted total federal mental health spending in Maryland: pre-post analyses alternative model results

	Alternative model 1		Alternative model 2		Alternative model 3	
	Marginal effect	Standard error	Marginal effect	Standard error	Marginal effect	Standard error
Demonstration period	-	-	-	-	34.09	45.17
Quarter Since Demo Began:						
1	-100.07***	36.90	-	-	-	-
2	-69.66**	32.77	-	-	-	-
Quarter Since Demo Began (continuous)	-	-	-46.56***	16.74	-	-
Quarter (continuous)	-	-	-	-	-18.89***	6.06
Demonstration period * Quarter (continuous)	-	-	-	-	30.15	33.37
Sample size	53,852		53,852		53,852	

Source: Mathematica analysis of Medicaid and Medicare data obtained from CMS for Maryland (2010-2012), which had six months of demonstration data.

Note: Exhibit presents average marginal effects of MEPD on total mental health costs and total federal mental health costs per beneficiary per month using a two part model. The first part of the model is a logistic regression analysis predicting the likelihood of any costs in that person quarter. The second part of the model is a general linear model of non-zero costs using the gamma scale family and a log link function (Buntin and Zaslavsky 2004) since costs are not normally distributed. N's reflect person quarters. Control variables included age, race, gender, dual Medicare-Medicaid enrollment status, and quarter. We used robust standard errors to address heteroscedasticity. Alternative model 1 allows for the effect of MEPD to change each quarter in a nonlinear way. Alternative model 2 allows for linear effects during the demonstration period. Alternative model 3 allows for different linear effects before and during MEPD. All models include interactions to assess for differential effects of MEPD. The intervention group was Medicaid beneficiaries ages 21–64 who had received services for a psychiatric EMC from an ED, general hospital, or participating IMD at any time during the four-year evaluation period, and who lived within the MEPD catchment area.

*p<0.10, **p<0.05, ***p<0.01

Exhibit III.33. Adjusted total mental health spending in Missouri: pre-post full regression results

	Total MH spending		Total federal MH spending	
	Marginal effect	Standard error	Marginal effect	Standard error
Logit				
Demonstration period	0.16***	0.01	0.16***	0.01
Non-Hispanic Black	-0.09***	0.02	-0.09***	0.02
Non-Hispanic Asian or Other Pacific Islander	0.56***	0.20	0.56***	0.20
Non-Hispanic Other	0.04	0.16	0.04	0.16
Hispanic	-0.05	0.09	-0.05	0.09
Female	0.09***	0.02	0.09***	0.02
Dual eligible	0.62***	0.02	0.62***	0.02
Quarter 1	-0.02*	0.01	-0.02*	0.01
Quarter 3	-0.04***	0.01	-0.04***	0.01
Quarter 4	-0.07***	0.01	-0.07***	0.01
Age in years at beginning of demonstration	0.00***	0.00	0.00***	0.00
Constant	0.58***	0.04	0.58***	0.04
GLM				
Demonstration period	0.03**	0.01	0.01	0.01
Non-Hispanic Black	0.25***	0.02	0.25***	0.02
Non-Hispanic Asian or Other Pacific Islander	0.05	0.12	0.05	0.12
Non-Hispanic Other	0.07	0.13	0.09	0.13
Hispanic	0.12*	0.06	0.12**	0.06
Female	-0.19***	0.01	-0.19***	0.01
Dual eligible	0.12***	0.02	0.41***	0.02
Quarter 1	-0.01	0.01	-0.01	0.01
Quarter 3	0.01	0.01	0.03**	0.01
Quarter 4	-0.11***	0.01	-0.11***	0.01
Age in years at beginning of demonstration	0.00***	0.00	0.00***	0.00
Constant	7.13***	0.03	6.68***	0.03

Source: Mathematica analysis of Medicaid and Medicare data obtained from CMS for Missouri (2010-2012), which had six months of demonstration data.

Note: N=204,622 person quarters. Exhibit presents average marginal effects of MEPD on total mental health costs and total federal mental health costs per beneficiary per month using a two part model. The first part of the model is a logistic regression analysis predicting the likelihood of any costs in that person quarter. The second part of the model is a general linear model of non-zero costs using the gamma scale family and a log link function (Buntin and Zaslavsky 2004) since costs are not normally distributed. Control variables included age, race, gender, dual Medicare-Medicaid enrollment status, and quarter. Quarter 2 was used as a reference group based on unadjusted costs; white race was also used as a reference group. We used robust standard errors to address heteroscedasticity. The intervention group was Medicaid beneficiaries ages 21–64 who had received services for a psychiatric EMC from an ED, general hospital, or participating IMD at any time during the four-year evaluation period, and who lived within the MEPD catchment area. The comparison group was beneficiaries meeting the same criteria but who lived outside of the MEPD catchment area.

*p<0.10, **p<0.05, ***p<0.01

Exhibit III.34. Adjusted total mental health spending in Missouri: pre-post analyses alternative model results

	Alternative model 1		Alternative model 2		Alternative model 3	
	Marginal effect	Standard error	Marginal effect	Standard error	Marginal effect	Standard error
Demonstration period	-	-	-	-	48.83***	15.66
Quarter Since Demo Began:						
1	45.84***	13.98	-	-	-	-
2	98.92***	13.04	-	-	-	-
Quarter Since Demo Began (continuous)	-	-	48.72***	7.43	-	-
Quarter (continuous)	-	-	-	-	3.55	2.98
Demonstration period * Quarter (continuous)	-	-	-	-	52.84***	12.44
Sample size	204,622		204,622		204,622	

Source: Mathematica analysis of Medicaid and Medicare data obtained from CMS for Missouri (2010-2012), which had six months of demonstration data.

Note: Exhibit presents average marginal effects of MEPD on total mental health costs and total federal mental health costs per beneficiary per month using a two part model. The first part of the model is a logistic regression analysis predicting the likelihood of any costs in that person quarter. The second part of the model is a general linear model of non-zero costs using the gamma scale family and a log link function (Buntin and Zaslavsky 2004) since costs are not normally distributed. N's reflect person quarters. Control variables included age, race, gender, dual Medicare-Medicaid enrollment status, and quarter. We used robust standard errors to address heteroscedasticity. Alternative model 1 allows for the effect of MEPD to change each quarter in a nonlinear way. Alternative model 2 allows for linear effects during the demonstration period. Alternative model 3 allows for different linear effects before and during MEPD. All models include interactions to assess for differential effects of MEPD. The intervention group was Medicaid beneficiaries ages 21–64 who had received services for a psychiatric EMC from an ED, general hospital, or participating IMD at any time during the four-year evaluation period, and who lived within the MEPD catchment area.

*p<0.10, **p<0.05, ***p<0.01

Exhibit III.35. Adjusted total federal mental health spending in Missouri: pre-post analyses alternative model results

	Alternative model 1		Alternative model 2		Alternative model 3	
	Marginal effect	Standard error	Marginal effect	Standard error	Marginal effect	Standard error
Demonstration period	-	-	-	-	27.28**	11.79
Quarter Since Demo Began:						
1	22.37**	10.45	-	-	-	-
2	47.61***	9.93	-	-	-	-
Quarter Since Demo Began (continuous)	-	-	23.02***	5.49	-	-
Quarter (continuous)	-	-	-	-	1.05	2.14
Demonstration period * Quarter (continuous)	-	-	-	-	24.96**	9.77
Sample size	204,622		204,622		204,622	

Source: Mathematica analysis of Medicaid and Medicare data obtained from CMS for Missouri (2010-2012), which had six months of demonstration data.

Note: Exhibit presents average marginal effects of MEPD on total mental health costs and total federal mental health costs per beneficiary per month using a two part model. The first part of the model is a logistic regression analysis predicting the likelihood of any costs in that person quarter. The second part of the model is a general linear model of non-zero costs using the gamma scale family and a log link function (Buntin and Zaslavsky 2004) since costs are not normally distributed. N's reflect person quarters. Control variables included age, race, gender, dual Medicare-Medicaid enrollment status, and quarter. We used robust standard errors to address heteroscedasticity. Alternative model 1 allows for the effect of MEPD to change each quarter in a nonlinear way. Alternative model 2 allows for linear effects during the demonstration period. Alternative model 3 allows for different linear effects before and during MEPD. All models include interactions to assess for differential effects of MEPD. The intervention group was Medicaid beneficiaries ages 21–64 who had received services for a psychiatric EMC from an ED, general hospital, or participating IMD at any time during the four-year evaluation period, and who lived within the MEPD catchment area.

*p<0.10, **p<0.05, ***p<0.01

Exhibit III.36. Adjusted total mental health spending in West Virginia: pre-post full regression results

	Total MH spending		Total federal MH spending	
	Marginal effect	Standard error	Marginal effect	Standard error
Logit				
Demonstration period	0.08***	0.02	0.08***	0.02
Non-Hispanic Black	-0.04	0.08	-0.04	0.08
Non-Hispanic Asian or Other Pacific Islander	-0.55	0.63	-0.55	0.63
Non-Hispanic Other	-1.11*	0.58	-1.11*	0.58
Hispanic	-0.17	0.39	-0.17	0.39
Female	0.24***	0.03	0.24***	0.03
Dual eligible	0.17***	0.03	0.17***	0.03
Quarter 1	-0.01	0.01	-0.01	0.01
Quarter 3	-0.08***	0.01	-0.08***	0.01
Quarter 4	-0.07***	0.01	-0.07***	0.01
Age in years at beginning of demonstration	0.00**	0.00	0.00**	0.00
Constant	0.18***	0.06	0.18***	0.06
GLM				
Demonstration period	0.12***	0.02	0.10***	0.02
Non-Hispanic Black	0.08	0.07	0.09	0.07
Non-Hispanic Asian or Other Pacific Islander	0.50	0.33	0.57*	0.33
Non-Hispanic Other	-0.07	0.56	-0.05	0.55
Hispanic	0.02	0.23	0.00	0.21
Female	-0.27***	0.03	-0.27***	0.03
Dual eligible	0.06	0.04	0.25***	0.04
Quarter 1	0.00	0.02	0.00	0.02
Quarter 3	0.01	0.02	0.02	0.02
Quarter 4	-0.12***	0.02	-0.13***	0.02
Age in years at beginning of demonstration	0.01***	0.00	0.01***	0.00
Constant	6.81***	0.07	6.50***	0.07

Source: Mathematica analysis of Medicaid and Medicare data obtained from CMS for West Virginia (2010-2013), which had 1.5 years of demonstration data.

Note: N=104,271 person quarters. Exhibit presents average marginal effects of MEPD on total mental health costs and total federal mental health costs per beneficiary per month using a two part model. The first part of the model is a logistic regression analysis predicting the likelihood of any costs in that person quarter. The second part of the model is a general linear model of non-zero costs using the gamma scale family and a log link function (Buntin and Zaslavsky 2004) since costs are not normally distributed. Control variables included age, race, gender, dual Medicare-Medicaid enrollment status, and quarter. Quarter 2 was used as a reference group based on unadjusted costs; white race was also used as a reference group. We used robust standard errors to address heteroscedasticity. The intervention group was Medicaid beneficiaries ages 21–64 who had received services for a psychiatric EMC from an ED, general hospital, or participating IMD at any time during the four-year evaluation period, and who lived within the MEPD catchment area. The comparison group was beneficiaries meeting the same criteria but who lived outside of the MEPD catchment area.

*p<0.10, **p<0.05, ***p<0.01

Exhibit III.37. Adjusted total mental health spending in West Virginia: pre-post analyses alternative model results

	Alternative model 1		Alternative model 2		Alternative model 3	
	Marginal effect	Standard error	Marginal effect	Standard error	Marginal effect	Standard error
Demonstration period	-	-	-	-	-5.47	33.43
Quarter Since Demo Began:						
1	56.39	34.91	-	-	-	-
2	97.15***	32.73	-	-	-	-
3	71.04***	27.09	-	-	-	-
4	73.72***	23.96	-	-	-	-
5	162.33***	37.39	-	-	-	-
6	151.67***	28.42	-	-	-	-
Quarter Since Demo Began (continuous)	-	-	26.78***	5.57	-	-
Quarter (continuous)	-	-	-	-	15.16**	6.83
Demonstration period * Quarter (continuous)	-	-	-	-	4.99	9.12
Sample size	104,271		104,271		104,271	

Source: Mathematica analysis of Medicaid and Medicare data obtained from CMS for West Virginia (2010-2013), which had 1.5 years of demonstration data.

Note: Exhibit presents average marginal effects of MEPD on total mental health costs and total federal mental health costs per beneficiary per month using a two part model. The first part of the model is a logistic regression analysis predicting the likelihood of any costs in that person quarter. The second part of the model is a general linear model of non-zero costs using the gamma scale family and a log link function (Buntin and Zaslavsky 2004) since costs are not normally distributed. N's reflect person quarters. Control variables included age, race, gender, dual Medicare-Medicaid enrollment status, and quarter. We used robust standard errors to address heteroscedasticity. Alternative model 1 allows for the effect of MEPD to change each quarter in a nonlinear way. Alternative model 2 allows for linear effects during the demonstration period. Alternative model 3 allows for different linear effects before and during MEPD. All models include interactions to assess for differential effects of MEPD. The intervention group was Medicaid beneficiaries ages 21–64 who had received services for a psychiatric EMC from an ED, general hospital, or participating IMD at any time during the four-year evaluation period, and who lived within the MEPD catchment area.

*p<0.10, **p<0.05, ***p<0.01

Exhibit III.38. Adjusted total federal mental health spending in West Virginia: pre-post analyses alternative model results

	Alternative model 1		Alternative model 2		Alternative model 3	
	Marginal effect	Standard error	Marginal effect	Standard error	Marginal effect	Standard error
Demonstration period	-	-	-	-	-3.90	24.15
Quarter Since Demo Began:						
1	34.07	24.54	-	-	-	-
2	67.68***	23.99	-	-	-	-
3	46.75**	19.94	-	-	-	-
4	50.56***	18.48	-	-	-	-
5	110.38***	26.54	-	-	-	-
6	103.20***	21.15	-	-	-	-
Quarter Since Demo Began (continuous)	-	-	18.13***	2.89	-	-
Quarter (continuous)	-	-	-	-	10.07***	3.60
Demonstration period * Quarter (continuous)	-	-	-	-	4.12	5.50
Sample size	104,271		104,271		104,271	

Source: Mathematica analysis of Medicaid and Medicare data obtained from CMS for West Virginia (2010-2013), which had 1.5 years of demonstration data.

Note: Exhibit presents average marginal effects of MEPD on total mental health costs and total federal mental health costs per beneficiary per month using a two part model. The first part of the model is a logistic regression analysis predicting the likelihood of any costs in that person quarter. The second part of the model is a general linear model of non-zero costs using the gamma scale family and a log link function (Buntin and Zaslavsky 2004) since costs are not normally distributed. N's reflect person quarters. Control variables included age, race, gender, dual Medicare-Medicaid enrollment status, and quarter. We used robust standard errors to address heteroscedasticity. Alternative model 1 allows for the effect of MEPD to change each quarter in a nonlinear way. Alternative model 2 allows for linear effects during the demonstration period. Alternative model 3 allows for different linear effects before and during MEPD. All models include interactions to assess for differential effects of MEPD. The intervention group was Medicaid beneficiaries ages 21–64 who had received services for a psychiatric EMC from an ED, general hospital, or participating IMD at any time during the four-year evaluation period, and who lived within the MEPD catchment area.

*p<0.10, **p<0.05, ***p<0.01

Exhibit III.39. Change in proportion of MEPD-eligible IMD patients: primary and alternative model regression results

	Primary Regression Specification	Alternative Model 1	Alternative Model 2	Alternative Model 3
Post	-0.0100 (0.0133)	-0.0099 (0.0132)	-0.0050 (0.0135)	0.0003 (0.0182)
Quarter	0.0001 (0.0015)	0.0000 (0.0016)	-0.0003 (0.0018)	0.0001 (0.0015)
Quarter Since Demo	0.0082** (0.0034)	0.0083** (0.0033)	0.0082** (0.0036)	0.0046 (0.0037)
Constant	0.3292*** (0.0168)	0.3284*** (0.0178)	0.3330*** (0.0200)	0.3291*** (0.0140)
R-squared	**0.0718**	**0.0713**	**0.0685**	**0.0282**
Sample size	**274**	**272**	**240**	**240**

Source: Mathematica analysis of IMD data from 2010-2014. The primary regression specification, Alternative Model 1, and Alternative Model 3 includes 17 IMDs across 12 states. Alternative Model 2 includes 15 IMDs across 10 states.

Notes: Exhibit presents regression results from interrupted time-series models. Standard errors, robust for clustering at the facility level, are in parentheses. All models are identical, but use a different sample definition. The models include an indicator for MEPD period, a linear quarterly time trend during the observed period, and an additional time trend beginning at MEPD implementation that allows the slope of the estimated time trend line to vary before and during MEPD. The models all also includes IMD-level fixed effects. The alternative models differ in the sample definition. Alternative Model 1 excludes the first quarters of data from two IMDs that had low sample sizes relative to the remaining quarters during the observation period. Alternative Model 2 excludes two IMDs from states that implemented MEPD approximately one quarter following other states. Alternative Model 3 excludes the final two quarters of data from all IMDs participating in MEPD.

*p < 0.1, **p < 0.05, ***p<0.01.

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