ESTIMATING COST REDUCTIONS ASSOCIATED WITH THE COMMUNITY SUPPORT PROGRAM FOR PEOPLE EXPERIENCING CHRONIC HOMELESSNESS

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Pine Street Inn
Ending Homelessness

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The Massachusetts Medicaid Policy Institute (MMPI)—a program of the Blue Cross Blue Shield of Massachusetts Foundation—is an independent and nonpartisan source of information and analysis about the Massachusetts Medicaid program, MassHealth. MMPI's mission is to promote the development of effective Medicaid policy solutions through research and policy analysis.

ABOUT THE PINE STREET INN

Pine Street Inn partners with homeless individuals to help them move from the streets and shelter to a home and assists formerly homeless individuals in retaining housing. The nonprofit organization provides street outreach, emergency services, supportive housing, job training and connections to employment. Pine Street Inn tirelessly advocates for collaborative solutions to end homelessness.

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EXECUTIVE SUMMARY

OVERVIEW AND STUDY AIMS

This report presents the results of a study analyzing the impact of the Community Support Program for People Experiencing Chronic Homelessness (CSPECH) on the utilization and cost of health care services administered by the Massachusetts Behavioral Health Partnership (MBHP), which serves as MassHealth's behavioral health contractor for its Primary Care Clinician (PCC) Plan. The PCC Plan is a managed care program run by MassHealth (the Massachusetts Medicaid program) that serves about 410,000 members. CSPECH is an innovative program through which MBHP provides reimbursement for community-based support services for chronically homeless individuals. CSPECH services are provided alongside separately financed and administered subsidized housing in an approach known as permanent supportive housing (PSH). As an integral part of the PSH model, CSPECH services are crucial for helping sustain recipients' tenancy in housing and meeting their health care needs. The motivation for this study lies in prior research demonstrating that PSH can lead to lower physical and behavioral health costs, and acute care costs in particular. Thus the study sought to address the following questions:

1. Is receipt of CSPECH services associated with reductions in physical and behavioral health costs?
2. To what extent do physical and behavioral health care cost reductions associated with CSPECH offset the cost of the program itself?

DATA AND ANALYTIC APPROACH

The study was based on data provided by MassHealth for a group of 1,301 individuals who entered the CSPECH program at some point between state fiscal year (SFY) 2007 and SFY2013. MassHealth provided data on the costs of reimbursed physical and behavioral health services used by this population over this time period. These data allowed us to capture physical and behavioral health costs both before and after initiation of CSPECH services. We used two different analytic approaches to estimate whether there were statistically meaningful reductions in costs associated with CSPECH entry and to compare cost reductions with the cost of CSPECH services, thus allowing us to calculate the net cost of CSPECH. The gold standard for evaluating the impact of an intervention of interest like CSPECH involves randomly assigning individuals either to a group that receives the intervention or to a control group that does not. This approach was not possible with the current study, and we therefore used two less rigorous but widely employed alternative methods. Our application of the two analytic approaches (and additional testing of modifications to each approach) was intended to assess whether findings were directionally similar regardless of the method used to analyze the available data.

RESULTS

Key findings from the report are summarized below:

- Health care costs (including both physical and behavioral health costs) decreased by an average of $226 per person in the month immediately following initiation of CSPECH services. The cost decline persisted such that per-person monthly costs were $765 lower in the 24th month following CSPECH entry than they had been in the month prior to CSPECH entry.

- Initiation of CSPECH services was associated with a $6,072 or an $11,914 annual reduction in average per-person health care costs; the amount depended on the analytic approach employed. Significant reductions in inpatient and outpatient behavioral health costs as well as inpatient and outpatient medical costs contributed to this overall cost reduction. The difference in the magnitude of cost reductions resulting from the two approaches may be due to several factors, including differences in the subgroups of CSPECH participants included in each analysis and reliance on within-person changes in costs in one approach and on between-person changes in cost in the second. However, it is also important to note that the confidence intervals around each of these estimates are large and the ranges of values they include overlap significantly. In both cases the lower bound of the confidence interval provides an estimate of cost reductions that are greater than CSPECH service costs. Moreover, the consistency between the two approaches with respect to their overall result of significant cost reductions provides greater confidence in study findings with respect to the relationship between CSPECH service receipt and costs.
- Reductions in non-CSPECH health care costs more than fully offset the cost of CSPECH services, resulting in annual per-person net savings of $2,291 or $7,013, depending on the analysis employed. This translates into a return of between $1.61 and $2.43 for each dollar spent on CSPECH.

IMPLICATIONS

Findings from this report are consistent with prior studies that have shown that coupling an array of supportive services of the type provided by CSPECH with permanent housing can lead to substantial improvements in housing stability and significant reductions in the utilization of acute health care and other public services among persons experiencing chronic homelessness. These findings are important in the context of a highly dynamic environment around the use of Medicaid funds (both nationally and in Massachusetts specifically) to help address social determinants of health, like housing stability. Amid increasing calls to use health care dollars to promote housing stability, the results from this report suggest that such use of funds is likely to be a wise investment. All the same, any cost savings that result from a Medicaid-funded service program like CSPECH that is provided in concert with separately financed and administered permanent housing should be seen as a desirable collateral effect rather than the ultimate goal. Such an approach is more importantly a logical and humane response to a social ill that exacts a significant human toll.

INTRODUCTION

This report presents the results of a study analyzing the impact of the Community Support Program for People Experiencing Chronic Homelessness (CSPECH) on the utilization and cost of health care services administered by the Massachusetts Behavioral Health Partnership (MBHP), which serves as MassHealth's behavioral health contractor for its Primary Care Clinician Plan (the managed care plan run directly by MassHealth and serving about 410,000 members, roughly a third of MassHealth managed care eligible members). CSPECH is an innovative program through which MBHP provides reimbursement for community-based support services provided to chronically homeless individuals. Implemented in 2006, CSPECH was developed as a MBHP performance incentive initiated in collaboration with the Massachusetts Housing and Shelter Alliance (MHSA).

The study was motivated by two related strands of research. The first consists of evidence that demonstrates the importance of housing stability as a key social determinant of health. Indeed, prior studies show an association between homelessness and a wide range of adverse health outcomes,[1,2] including an increased risk of mortality.[3,4] Persons experiencing housing instability also face a number of barriers to accessing primary or preventive care, such as a lack of health insurance coverage,[5] transportation,[6] and challenges in meeting basic life necessities—a priority that competes with accessing preventive care.[7] Both these factors contribute to patterns of physical and behavioral health service use among persons experiencing homelessness that are characterized by increased use of more expensive forms of acute care such as inpatient and emergency department services.[8–12] This ultimately translates into added costs for health care systems.[13]

Equally important is the body of research establishing permanent supportive housing (PSH) as an effective intervention for persons experiencing chronic homelessness. The PSH model combines ongoing subsidized housing matched with flexible health, behavioral health, social, and other support services.[14] These supportive services are the component of PSH provided through CSPECH (with housing delivered and funded separately) and they are viewed as crucial to the PSH model for maintaining housing stability and promoting improved health in the high-need, hard-to-serve population of persons experiencing chronic homelessness. Many PSH programs are operated under the "Housing First" model, which prioritizes supporting people experiencing homelessness to enter low-threshold housing as quickly as possible, and then providing necessary supportive services while embracing consumer choice as a key principle.[15] A number of rigorously designed experimental studies have shown this model to be effective at helping individuals remain stably housed.[16,17] Moreover, evidence also shows that PSH is associated with improved health and clinical outcomes[18,19] and can lead to lower physical and behavioral health costs,[20] resulting mainly from reductions in costly acute health care services. When combined with reductions in costs for shelter, criminal justice, and other public services, the net cost of PSH can be marginal. In some cases, there can be net savings.

These prior studies suggest that providing CSPECH as the supportive service component of a PSH approach (in which housing is provided separately) is likely to be associated with decreases in health care costs and indeed, reductions in the use of avoidable high cost health services was one of the goals of the program at the time of its creation. However, there has been no formal attempt to date to estimate the potential health care cost reductions associated with CSPECH and to assess how any health care cost reductions compare with the cost of CSPECH itself. More broadly, no prior study has attempted to assess the potential health care cost offsets associated with a Medicaid-funded supportive services program that, like CSPECH, functions as the supportive services component of a PSH program. Thus an evaluation of the relationship between CSPECH service receipt and non-CSPECH

health care costs has implications both for Massachusetts specifically and for state Medicaid programs elsewhere. With this in mind, the present study sought to address the following questions:

1. Is receipt of CSPECH services associated with reductions in physical and behavioral health costs?
2. To what extent do physical and behavioral health care cost reductions associated with CSPECH offset the cost of the program itself?

The remainder of this report provides an overview of the CSPECH program, describes the methods used to address the study questions, and summarizes the results. The report concludes with a discussion of the potential implications of findings from this study.

THE CSPECH PROGRAM

Conceptualized and designed through a collaboration between MBHP and MHSA, the CSPECH program is motivated by three goals: 1) to help stabilize the health and basic needs of a high-risk, high-cost population; 2) to reduce the utilization of costly acute health services such as emergency departments and inpatient hospitalization; and 3) to reduce homelessness overall. CSPECH was explicitly developed as a specific type of Community Support Program (CSP), an existing MassHealth-covered service. Since 2006, CSPECH services have been available to MBHP members who meet the medical necessity criteria for the program. In 2015, these services were inserted into the MassHealth Managed Care Organization/Care Plus contract for Pay for Success participants, but these data were not part of the analysis presented in this study, which focuses solely on CSPECH services provided to MBHP members. This was done contemporaneously with the Commonwealth's Chronic Individual Homelessness Pay for Success Initiative, a social innovation financing project intended to use private dollars to fund the creation of new PSH units for persons experiencing chronic homelessness. Additionally in 2016, these CSP services for chronically homeless individuals (regardless of Pay for Success participation) were included in the MassHealth Managed Care Organization/CarePlus contract, and in January 2017 within the Senior Care Options contract.

In concept, CSPECH is perhaps best understood as a mechanism to pay for the supportive services component of PSH. Although permanent housing is a critical complement to CSPECH services, housing costs are not reimbursable through Medicaid. Thus, CSPECH functions as the vital bridge to obtaining housing stability and a crucial support in maintaining housing stability once participants obtain housing. CSPECH services also enhance health by addressing unmet health needs for this uniquely hard-to-reach, high-need population. Housing costs are typically paid for through separate funding streams, such as the U.S. Department of Housing and Urban Development's Continuum of Care program. In practice, CSPECH is implemented through a network of organizations that provide services. There are two types of models for the provision of CSPECH. In one, behavioral health service providers can partner with separate housing organizations to provide CSPECH services to participants in the housing provider's permanent housing programs. Only the supportive services are reimbursable Medicaid expenses. Alternatively, a single organization with an existing portfolio of supportive housing units provides both permanent housing and CSPECH services to participants.

To be eligible for CSPECH services, an individual must meet the U.S. Department of Housing and Urban Development's definition of chronic homelessness.[21] That is, they must both have a disability (at least one of the following: substance use disorder, serious mental illness, developmental disability, post-traumatic stress

disorder, cognitive impairments from brain injury, chronic physical illness or disability) and meet criteria for duration of homelessness (either continuously homeless for one year or more, or having four or more episodes of homelessness cumulatively totaling one year or more over a three-year period). Additionally, to receive CSPECH services, an MBHP member must meet MBHP's medical necessity requirement, demonstrating clinical diagnosis with risk for inpatient admission, and be reasonably expected to respond to intervention.[22] CSPECH services are provided by community support workers who work with eligible individuals who meet these requirements to help them prepare for and transition to an available housing unit and to coordinate access to needed health and other services. Transitioning to housing is the main priority, and CSPECH services are reimbursable for up to 90 days prior to when a CSPECH participant is housed. Once participants are housed, community support workers focus on coordinating their access to physical health, behavioral health, and other needed services geared towards helping sustain tenancy and meet their health needs. Such services can include assistance with improving daily living skills or obtaining other benefits.

As CSPECH services are intended to be flexible and provided on an as-needed basis, the CSPECH billing structure is an important feature of the program. Indeed, CSPECH services are billed on a daily, rather than service unit, basis. Providers are reimbursed a flat daily rate during a participant's enrollment in the program, which reduces the administrative burden of CSPECH providers and aligns with the intended concept and structure of the service delivery model.

METHODOLOGY OVERVIEW

DATA

This study was based on data provided by MassHealth for all 1,301 individuals who initiated CSPECH services at any point from the beginning of state fiscal year (SFY) 2007 (July 1, 2006) through the end of SFY2013 (June 30, 2013). MassHealth provided all fee-for-service and managed care encounter claims for all 1,301 members of the study cohort for the period from the beginning of SFY2006 (July 1, 2005) through the end of SFY2013 (June 30, 2013). The fee-for-service and managed care encounter claims data included information on the age and sex of the CSPECH participant as well as dates of service, claim type, provider code and total amount paid for all claims. The data also included an indicator as to whether a given claim was for CSPECH services. As shown in Table 1, members of the study cohort were predominantly male, and two-thirds were between the ages of 40 and 59 at the time of initiation of CSPECH services, with roughly 40 percent aged 50 and above.

We constructed a measure of total health care costs based on both fee-for-service claims paid by MassHealth and claims reported in the encounter data. Accordingly, we calculated total health care costs for each member of the study cohort for each month before and after the initiation of their CSPECH services. To do so, we used the first date on which each member of the study cohort had a

TABLE 1. CHARACTERISTICS OF STUDY COHORT

	VARIABLE	N (%)
	Male	943 (72.5)
Age Group	18–29	136 (10.5)
	30–39	211 (16.2)
	40–49	443 (34.1)
	50–59	425 (32.7)
	60–65	86 (6.6)
Fiscal Year of CSPECH Entry	2007	218 (16.8)
	2008	158 (12.1)
	2009	109 (8.4)
	2010	122 (9.4)
	2011	155 (11.9)
	2012	266 (20.4)
	2013	273 (21.0)

CSPECH claim as an index date to classify claims as occurring either before or after CSPECH entry. All claims with a start date occurring prior to this index date were credited to the pre-CSPECH period and all claims with a start date after this index date were assigned to the post-CSPECH period. We calculated total cost based on the amount paid reported in the claims data, and we converted all costs to 2015 dollars using the U.S. Bureau of Economic Analysis Personal Consumption Expenditures index.[23] In addition to creating a total health care cost measure, we used claim type and provider type codes to stratify health care costs into the following categories (see Appendix C for additional details):

1. Inpatient behavioral health
2. Inpatient medical
3. Outpatient behavioral health
4. Outpatient medical
5. Long-term services and supports (LTSS)
6. Pharmacy
7. Other

As the goal of the analysis was to assess the relationship between CSPECH service receipt and the cost of non-CSPECH health care services, and because such costs would be incurred only in the post-CSPECH period, we excluded claims for CSPECH services from our analysis.

ANALYTIC APPROACH

A study using an experimental design in which individuals are randomly assigned either to a group that receives an intervention or to a control group that does not is the gold standard for evaluating the intervention's impact on an outcome of interest. Such an approach was not possible with the current study, which was based on observational data in the form of the claims data described above. We therefore used two less rigorous but widely employed quasi-experimental approaches to assess the extent to which CSPECH is linked with decreases in health care costs. We summarize each of these approaches below (additional methodological details are available in Appendix A).

Analytic Approach 1

The first analytic approach we employed capitalized on the availability of monthly claims data for CSPECH participants both before and after their entry into CSPECH. We applied a statistical modeling technique known as fixed effects regression to these data. This technique allowed us to compare each individual CSPECH participant's health care costs before the initiation of CSPECH services and after initiation. In other words, in this analysis, each CSPECH participant functioned as his or her own comparison group, and the analysis relies on within-person changes in health care costs between the pre- and post-CSPECH periods to estimate the change in health care costs associated with CSPECH entry. An advantage of the fixed effects approach is that it controls for all person-level characteristics (e.g., sex, race/ethnicity, education level, veteran status) that may be associated with health care costs and that do not change over time. Controlling for these type of between-person characteristics is important as they are otherwise likely to bias estimates of the relationship between CSPECH and other health care costs.

We employed two separate modeling approaches in the fixed effects analysis. The first focused on examining changes in health care costs immediately following CSPECH entry. An advantage of this approach is that it also allowed us to assess whether any cost reductions persisted, grew, or were attenuated over time. In concept, this model is analogous to what is known as an "event study" design (a variant of a regression discontinuity design) in which one tries to identify whether there is a sharp change in an outcome immediately following an event of interest, in this case initiation of CSPECH services. The second fixed effects model that we used sought simply to model average within-person differences in health care costs between the entire two-year pre-CSPECH and entire two-year post-CSPECH observation period. We used this estimate to develop an annualized estimate of changes in health care costs following CSPECH entry.

Analytic Approach 2

The second analytic approach we employed is known as a difference-in-difference design, and we used this approach, too, to calculate an annualized estimate of changes in health care costs associated with CSPECH entry. Under this approach, we calculated the difference in costs between the one-year periods before and after CSPECH entry for a group of participants, and similarly calculated the difference in costs experienced over the same time periods for a comparison group who did not enter CSPECH. A comparison of these two differences—known as a difference-in-difference estimate—thus provides an estimate of the relationship between CSPECH entry and health care costs.

As we had access to MassHealth claims data only for individuals who received CSPECH services (and not for a group of chronically homeless persons who did not), we capitalized on staggered dates of initiation of CSPECH services to identify a comparison group for the difference-in-difference analysis. Specifically, we assigned members of the study cohort to the CSPECH intervention and comparison groups on the basis of the fiscal year in which they initiated CSPECH services, and then assessed changes in health care costs experienced by persons in each group over a standard two-year period (in calendar time) that straddled the CSPECH entry date for persons in the CSPECH intervention group (i.e., health costs one year before and one year after entry into CSPECH), and that directly preceded the CSPECH entry date for persons in the comparison group (i.e., health costs in the two years prior to the initiation of CSPECH services). Such an approach is similar in concept to what is known as a wait list control design, which has been employed in prior research of the impact of PSH on health care costs.[24]

Importantly, this approach assumes that persons in the comparison group were homeless during the two-year observation period. This assumption is not possible to verify, but it is reasonable given that chronic homelessness is a criterion of eligibility for CSPECH. Thus, individuals are likely to have been homeless for the majority of the time in the run-up to their entry into CSPECH. To further control for potential differences between the CSPECH intervention and comparison groups, we used a statistical technique known as propensity score matching to account for baseline differences in terms of age, sex, and prior health service utilization costs. This technique aims to balance the CSPECH intervention and comparison group with respect to these characteristics, thereby facilitating more of an "apples to apples" comparison between the two groups. The requirements for executing this analytic approach meant that data for only a relatively small subset (415) of the total cohort of 1,301 CSPECH participants were used.

Net Cost of CSPECH

We compared the annualized estimates of the changes in health care costs associated with CSPECH entry that resulted from both analytic approaches with the annualized estimates of the total cost of CSPECH services for

persons included in each analysis. This allowed us to calculate the net cost of CSPECH, more specifically, to assess whether the cost reductions associated with CSPECH entry were greater than the cost of the program itself.

For each of the analytic approaches described above, we conducted several additional sets of analyses to test whether findings from our main analysis differed substantively when we made changes to the analytic approach (e.g., examining only a subset of members of the study cohort, and modeling the natural logarithm of cost). This approach provided a check on the robustness of findings from our main analysis, and consistency between the main and supplemental analysis engendered greater confidence in study findings with respect to the relationship between CSPECH and health care costs. The results section of this report focuses on the main set of analysis, although we provide additional information about the supplemental analyses we conducted in Appendix B.

Limitations to Methodology

Several limitations to the methodology employed in this study bear mentioning. First, as the study was based on observational data, our findings can speak to the relationship between CSPECH entry and health care costs, but they cannot fully establish that this relationship is causal in nature. This is due in part to the fact that CSPECH services are intended to be paired with subsidized housing in a PSH model, and it is thus not possible to parse out the extent to which CSPECH services and the receipt of subsidized housing were separately responsible for the observed reductions in health care costs. In this respect, the present study is no different from prior studies of PSH, which have yet to fully identify the independent impact of housing and services. As a separate issue, our inability to identify causality also stems from the fact that, despite our attempts to control for sources of bias when assessing the relationship between CSPECH and health care costs, other factors might explain our results. Most notable in this regard is a statistical phenomenon known as regression to the mean. In the present context, the concern with regression to the mean is that individuals initiating CSPECH services may have done so after a period of abnormally high health care utilization, and their health care costs may simply return to a level that is more typical for them after initiating CSPECH. Thus, observed changes in costs from before CSPECH entry to after CSPECH entry may be due to regression to the mean, rather than to the impact of CSPECH itself. This would be especially problematic if individuals were selected for CSPECH services on the basis of having high health care costs. However, CSPECH eligibility is determined by chronic homelessness status, and thus persons are not systematically selected for CSPECH services on the basis of their level of health care utilization.

Second, the study uses the first date on which an individual had a paid CSPECH claim to index the pre- and post-CSPECH periods. Due to the way in which such services are billed, this may be an imprecise measure of the initiation of CSPECH services, and this in turn may impact our study findings, particularly those about the immediate change in health care costs. A final limitation of the study is that the data we used did not include information about MassHealth eligibility. Thus we make assumptions that individuals are consistently enrolled based on the first and last dates on which they had claims. We tested the extent to which this assumption might affect our results by conducting a supplemental analysis (results shown in Appendix B) that includes only individuals with non-zero costs in any given month.

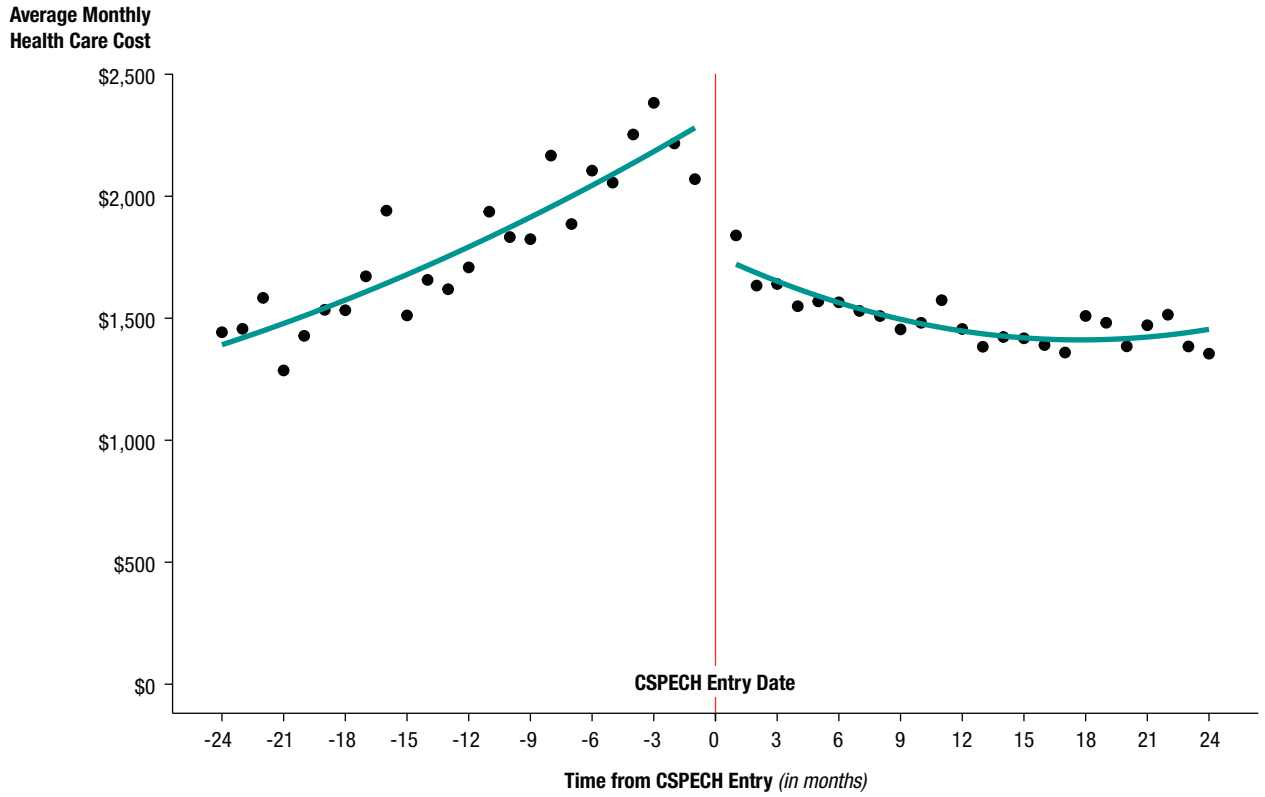
RESULTS

ANALYTIC APPROACH 1

Immediate and Persistent Changes in Health Care Costs Following CSPECH Entry

This section summarizes the results of the analysis that was used to examine changes in health care costs immediately following initiation of CSPECH services, and the persistence of these changes over time. Figure 1 plots the unadjusted average total health care costs per person for each month before and after CSPECH entry over a two-year period. Monthly per-person costs amounted to an average of $1,832, ($21,984 annually) in the two-year period prior to CSPECH entry, and an average of $1,510 ($18,120 annually) in the two-year period following CSPECH entry.†

FIGURE 1. AVERAGE MONTHLY PER-PERSON HEALTH CARE COSTS, PRE-/POST-CSPECH ENTRY



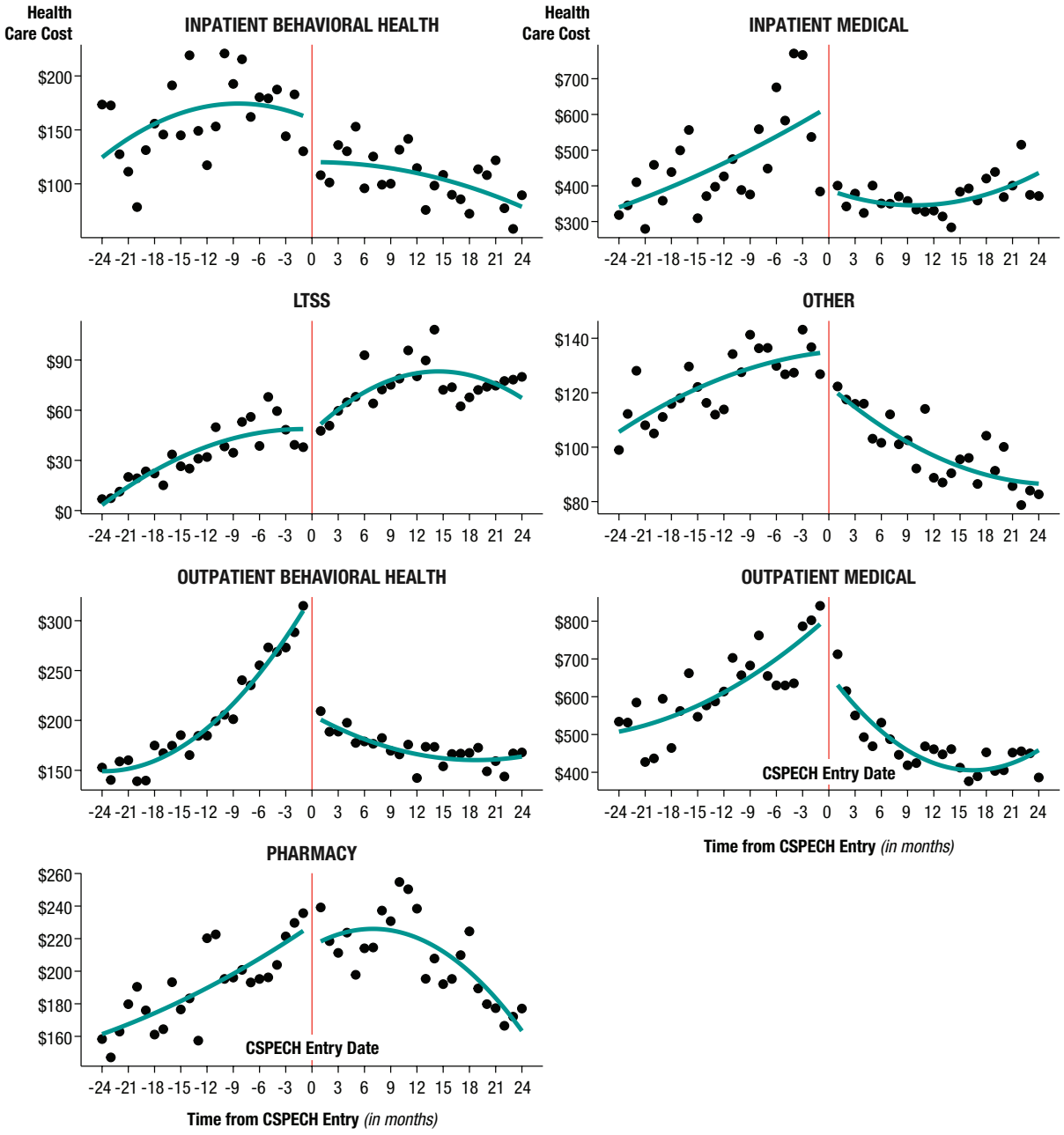
Note: The figure plots average per-person health care costs.
The lines represent quadratic regression models fit on either side of the pre-/post-CSPECH entry period.

The graph also shows a clear change in the trend of costs following CSPECH entry. Because month-to-month costs fluctuate substantially, the figure includes a line that models the overall trend in the pre- and post-CSPECH periods. The figure shows that health care costs were increasing in the months leading up to the initiation of

† The figures are based on raw (non-transformed) cost measures. We created a parallel set of figures using log-transformed costs. The trends in these figures did not differ substantively from those produced with the raw cost measures, and we therefore provide the former set of figures here. Figures showing the log-transformed cost are provided in Appendix B.

CSPECH services and were above $2,000 per person per month in the period immediately preceding CSPECH entry. However, there appears to be a sharp break from this trend immediately following CSPECH entry, with per-person per-month costs declining sharply and remaining consistently lower than in the run-up to CSPECH entry. Figure 2 shows that a similar pattern was evident when considering costs for inpatient and outpatient medical costs, outpatient behavioral health costs, and, to a lesser extent, inpatient behavioral health and other costs.

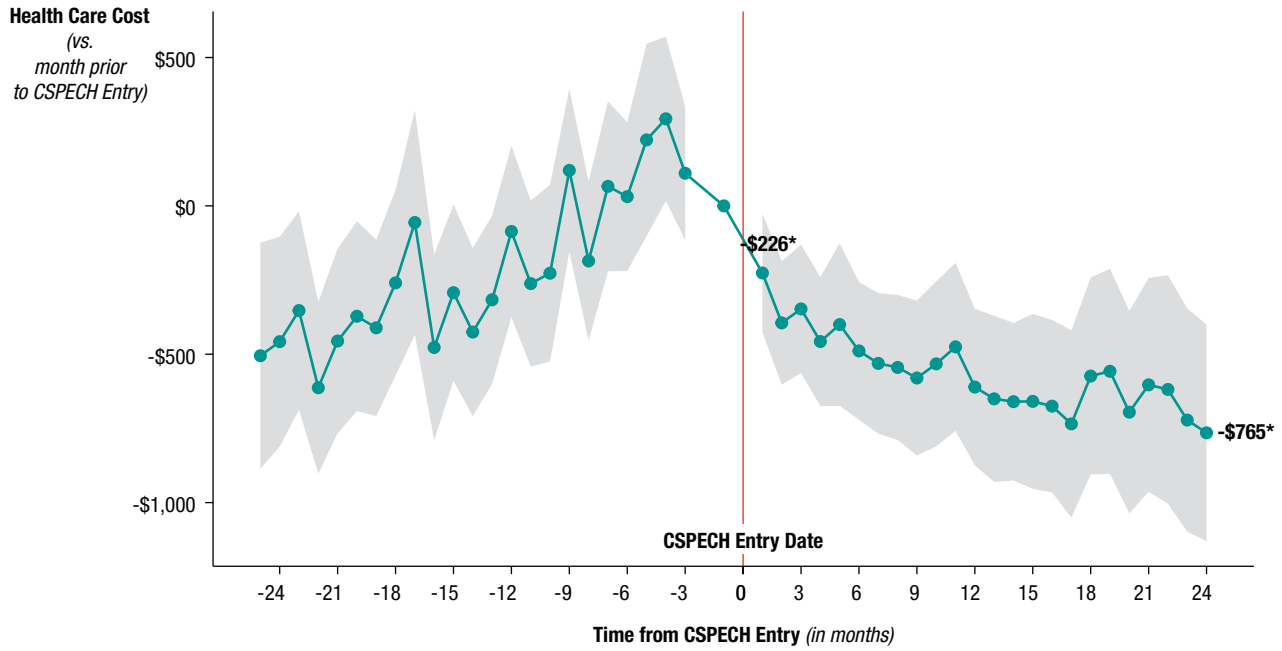
FIGURE 2. AVERAGE MONTHLY PER-PERSON HEALTH CARE COSTS, PRE-/POST-CSPECH ENTRY (BY SERVICE TYPE)



Note: The figure plots average per-person health care costs.
The lines represent quadratic regression models fit on either side of the pre-/post-CSPECH entry period.
LTSS = Long-Term Services and Supports.

As described above, we used a fixed effects regression model, in which measures of the month relative to CSPECH entry were the key variables of interest. They were used to assess whether the observed change in health care costs between the month immediately before and immediately after CSPECH entry was statistically significant. The results of this model also allowed us to assess whether such reductions were sustained, amplified, or attenuated over subsequent months. Figure 3 graphs the results of this analysis.‡ The figure plots changes in total costs relative to the month immediately prior to the initiation of CSPECH services. As the figure shows, relative to the month immediately preceding CSPECH entry, total costs declined by $226 in the month following CSPECH entry. Moreover, the decline in total costs persisted and even grew larger, such that in the 24th month following CSPECH entry, total per-person costs were $765 lower than they had been in the month preceding CSPECH entry. Figure 4 graphs the results of models that were estimated for specific types of health care costs. The figure shows that much of the total decline in per-person costs in the month immediately following CSPECH entry was due to outpatient behavioral health and outpatient medical costs. Moreover, both of these per-person costs continued to decline in subsequent months following CSPECH entry relative to their values in the month immediately preceding CSPECH entry, as did inpatient behavioral health costs.

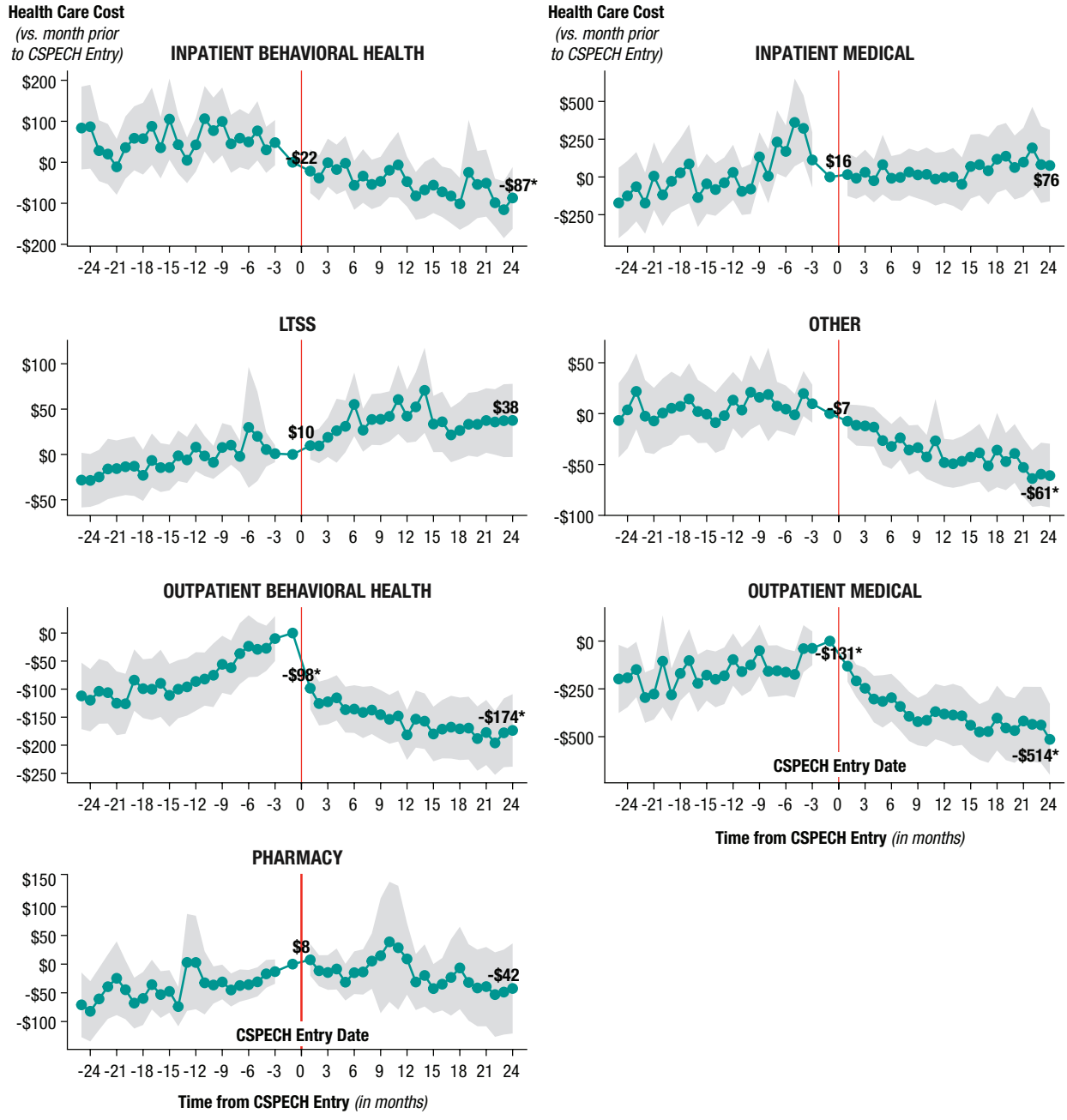
FIGURE 3. ESTIMATED MONTH-BY-MONTH CHANGES IN AVERAGE PER-PERSON HEALTH CARE COSTS FOLLOWING CSPECH ENTRY



Note: The figure plots the coefficients of dummies for time from CSPECH entry, obtained from an OLS regression with individual fixed effects.
*Statistically significant at $p < .05$ level.
The shaded gray area represents 95% confidence intervals for these coefficients.

‡ The models presented in the main text are based on raw (non-transformed) cost measures. We estimated a parallel set of models using log-transformed costs. The results of these models did not differ substantively from the models estimated with the raw cost measures, and we therefore report the result of the raw cost models here. Results of the log-transformed models are provided in Appendix B.

FIGURE 4. ESTIMATED MONTH-BY-MONTH CHANGES IN AVERAGE PER-PERSON HEALTH CARE COSTS FOLLOWING CSPECH ENTRY (BY SERVICE TYPE)



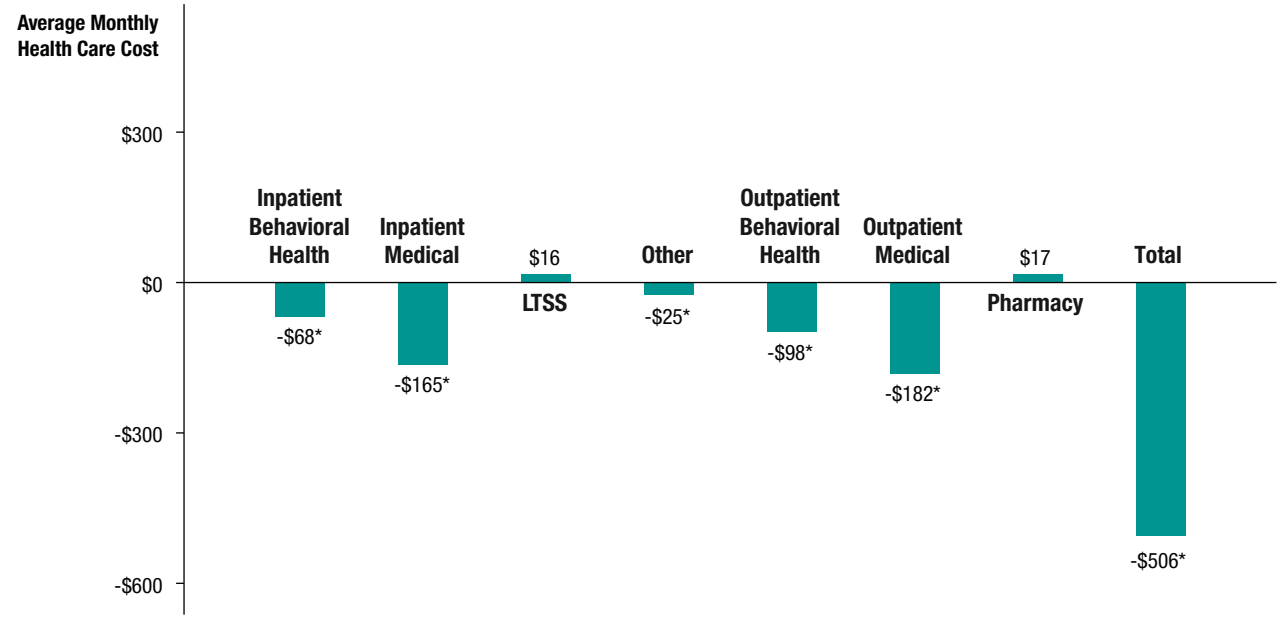
Note: The figure plots the coefficients of dummies for time from CSPECH entry, obtained from an OLS regression with individual fixed effects.
*Statistically significant at $p < .05$ level.
The shaded gray area represents 95% confidence intervals for these coefficients.
LTSS = Long-Term Services and Supports.

Average Changes in Health Care Costs Following CSPECH Entry

We estimated an additional set of models to assess whether monthly per-person costs were significantly lower on average across the entire two-year period following CSPECH entry relative to the two-year period prior to CSPECH entry. The results of these models are summarized in Figure 5. The figure shows that total health care costs decreased by an average of $506 per person per month following CSPECH entry. This translates to an annualized reduction in per-person costs of $6,072.

The figure shows that reductions in total costs were driven primarily by inpatient and outpatient medical services, although there were significant declines in inpatient and outpatient behavioral health and other services. There was a slight but not statistically significant increase in per-person monthly LTSS and pharmacy costs.

FIGURE 5. ESTIMATED CHANGE IN AVERAGE MONTHLY PER-PERSON HEALTH CARE COSTS FOLLOWING CSPECH ENTRY



*Statistically significant at p <.05 level.
LTSS = Long-Term Services and Supports.
Estimates based on fixed effects regression model.

ANALYTIC APPROACH 2

Table 2 presents the results of the difference-in-difference analysis used to develop annual estimates of changes in health care costs associated with CSPECH entry. The table shows that among CSPECH participants included in the analysis, total annual per-person costs declined from $21,761 to $18,807 between the one-year period before CSPECH entry and the one-year period after CSPECH entry, a difference of $2,954. In contrast, total costs among those in the comparison group increased from $18,991 to $27,950 over the same period, a difference of $8,959. The resulting difference-in-difference estimate indicates that entry into CSPECH was associated with an $11,914 decrease in total annual per-person health care costs.

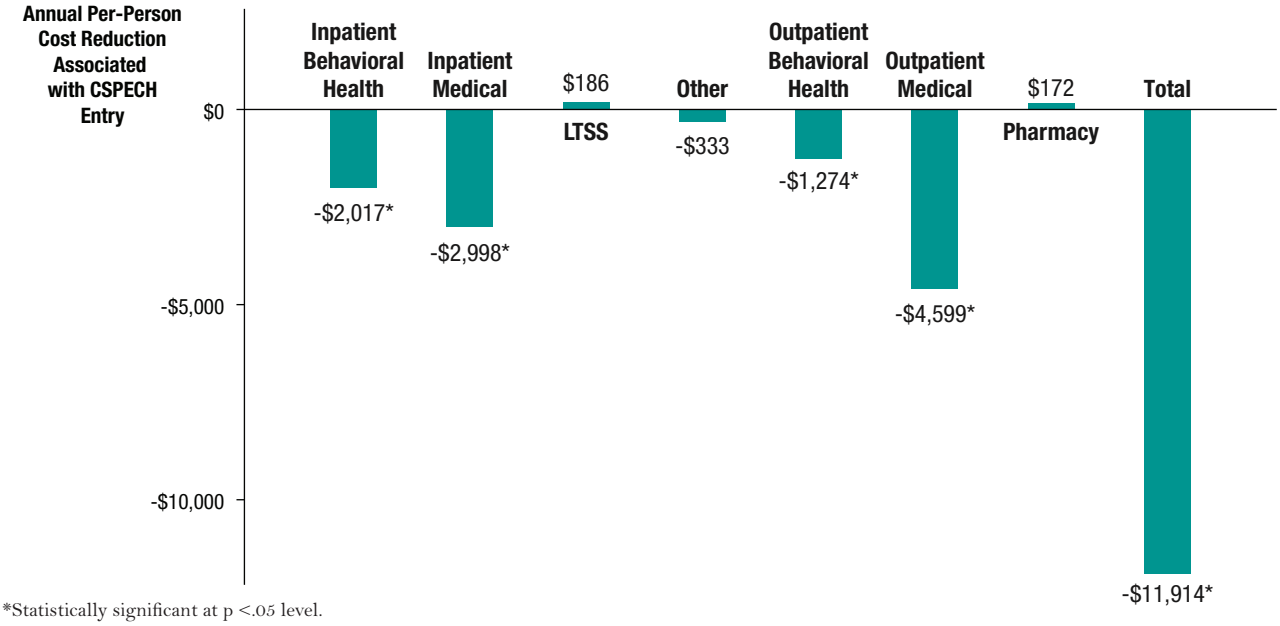
Figure 6 displays the corresponding estimates of the annual changes in health care costs associated with CSPECH entry, stratified by service type.

TABLE 2. RESULTS OF DIFFERENCE-IN-DIFFERENCE ANALYSIS

	CSPECH			COMPARISON			DIFFERENCE-IN-DIFFERENCE
CLAIM TYPE	PRE	POST	DIFFERENCE	PRE	POST	DIFFERENCE	
Inpatient behavioral health	$1,577	$1,561	-$16	$1,433	$3,434	$2,001	-$2,017*
Inpatient medical	$5,817	$4,476	-$1,341	$5,145	$6,802	$1,657	-$2,998*
Outpatient behavioral health	$2,339	$2,040	-$299	$1,952	$2,928	$976	-$1,274*
Outpatient medical	$8,444	$5,824	-$2,620	$6,584	$8,563	$1,979	-$4,599*
LTSS	$512	$854	$342	$41	$197	$156	$186
Pharmacy	$2,146	$2,822	$676	$2,610	$3,115	$504	$172
Other	$1,204	$1,088	-$116	$1,884	$2,101	$217	-$333
Total	**$21,761**	**$18,807**	**-$2,954**	**$18,991**	**$27,950**	**$8,959**	**-$11,914***

Note: * indicates statistical significance at the p < .05 level. P values calculated using nonparametric bootstrap and percentile method.
LTSS = Long-Term Services and Supports.
Standardized cost estimates based on two-part regression models that adjusted for age, sex and baseline health care costs.
Due to covariate adjustment, sum of adjusted cost estimates by type do not equal total adjusted cost estimate.

FIGURE 6. SUMMARY OF ANNUAL PER-PERSON REDUCTIONS IN HEALTH CARE COSTS ASSOCIATED WITH CSPECH ENTRY



*Statistically significant at p <.05 level.
LTSS = Long-Term Services and Supports.
Standardized cost estimates based on two-part regression models that adjusted for age, sex and baseline health care costs.
Due to covariate adjustment, sum of adjusted cost estimates by type do not equal total adjusted cost estimate.

UNDERSTANDING DIFFERENCES IN THE RESULTS OF ANALYTIC APPROACH 1 AND ANALYTIC APPROACH 2

The difference in the magnitude of estimated cost reductions resulting from analytic approach 1 and analytic approach 2 may be due to several factors related to the different ways in which the two sought to evaluate the relationship between CSPECH and other health care costs. First, analytic approach 1 included all 1,301 members of the study cohort, whereas analytic approach 2 only included a subset of these individuals. Second, analytic approach 1 relied on within-person changes in costs (comparing CSPECH recipients with themselves before and after CSPECH entry) to estimate the relationship between CSPECH service receipt and health care costs, while analytic approach 2 relied on between-person costs (comparing CSPECH participants with a comparison group consisting of future CSPECH participants). More specifically, in the case of analytic approach 2, the estimate of cost reductions associated with receiving CSPECH services was influenced heavily by the increase in health care costs experienced by those members of the study cohort serving as the comparison group for the analysis. In other words, the results are premised on the assumption that among CSPECH participants, health care costs would have continued to increase by the same amount as those in the comparison group in the absence of CSPECH services. This assumption is not possible to verify and runs contrary to the findings of some prior studies that have used similar approaches. However, inspection of the pre-CSPECH costs of both groups identified similar and parallel upward trends, thus lending some validity to this assumption.

It is also important to note that there is a degree of uncertainty around each of these estimates. The standard way to express this uncertainty is through the use of confidence intervals, which provide a range of values around each point estimate within which we can be reasonably confident that the true reduction in CSPECH costs lies. The confidence intervals around the estimates of cost reductions from analytic approach 1 and analytic approach 2 are quite large, and the ranges of values they include overlap significantly. More specifically, the 95 percent confidence interval around the $6,072 estimate of the annual decrease in health care costs from analytic approach 1 ranges between $4,152 and $7,968, whereas the 95 percent confidence interval for the $11,914 estimated annual decrease from analytic approach 2 ranges between $6,564 and $17,668. Thus, while there appears to be a large difference in the results from analytic approach 1 and analytic approach 2, the ranges of the estimated reduction in health care costs within which we can be reasonably confident that the true reduction in costs lies are not entirely dissimilar.

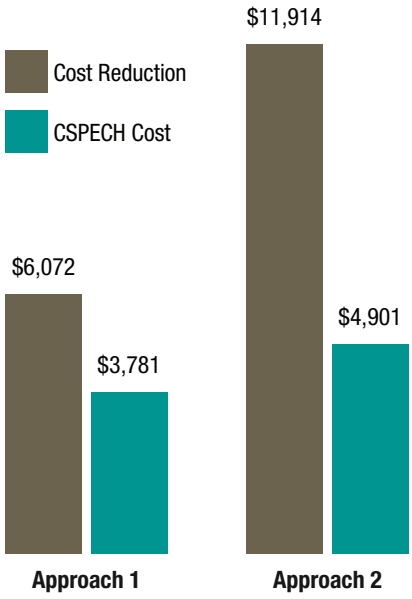
Moreover, perhaps the key takeaway point in comparing the two sets of analyses is that there is consistency between the two approaches with respect to their overall findings of significant health care cost reductions associated with CSPECH services. This provides greater confidence about the nature of the relationship between CSPECH service receipt and health care costs.

NET CSPECH COST

Figure 7 compares the estimated annual reduction in health care costs associated with CSPECH entry with the average annual cost of CSPECH services from both analytic approach 1 and analytic approach 2. Differences in CSPECH costs occur in part because different groups of individuals were used in the two approaches. Thus the actual amount of billed CSPECH services that the individuals analyzed in analytic approach 2 used in the first year following CSPECH entry was different from the corresponding amount calculated in analytic approach 1.

As the figure shows, the results from either analytic approach show meaningful savings associated with CSPECH services. More specifically, in analytic approach 1, the average annual per-person reduction in health care costs of $6,072 outstrips the $3,781 average annual per-person cost of providing CSPECH services, leading to a net cost savings of $2,291. In analytic approach 2, the average annual per-person reduction in health care costs is even greater, amounting to $11,914. While average annual per-person CSPECH costs are slightly higher at $4,901, the net cost savings associated with CSPECH amounts to $7,013. In other words, every $1 spent on CSPECH services is associated with between $1.61 and $2.43 in savings due to reductions in other reimbursed services. As noted above, there is uncertainty around the estimated reductions in health care costs associated with CSPECH. However, in both cases the lower bound values of the 95 percent confidence intervals are greater than the estimated costs of CSPECH services.

FIGURE 7. COMPARISON OF CSPECH PROGRAM COSTS WITH ESTIMATED HEALTH CARE COST REDUCTIONS



DISCUSSION AND IMPLICATIONS

Findings from this report that receipt of CSPECH services is associated with reductions in health care costs, and net cost savings, are consistent with prior studies that have shown that providing permanent housing coupled with ongoing supportive services of the type available through CSPECH to persons experiencing chronic homelessness can lead to significant reductions in the utilization of acute health care and other public services. Our findings point to cost reductions in both inpatient and outpatient behavioral health services following CSPECH initiation. We also found significant reductions in inpatient medical costs, and especially large reductions in outpatient medical costs. Although it could not definitively be determined from the available data, this category of services likely includes emergency department care, so this finding may be driven by reductions in emergency department services use. If so, this result would be consistent with prior research. These findings are important in the context of a highly dynamic environment around the use of Medicaid funds (both nationally and in Massachusetts specifically) in a manner that acknowledges social determinants of health like housing status. Indeed, some health care providers have explicitly called for the use of Medicaid dollars to directly pay for housing costs.[25] However, in a June 2015 Informational Bulletin, the Center for Medicare and Medicaid Services issued guidance clarifying that it does not

provide federal dollars for room and board and outlining the "circumstances under which Medicaid reimburses for certain housing-related activities" and services.[26]

Massachusetts has recently received approval for a Medicaid Section 1115 waiver that includes the implementation of accountable care organizations (ACOs) into MassHealth's managed care program. As these ACOs will be explicitly tasked with addressing social determinants of health, including housing, findings from this study are particularly timely. Indeed, reform to MassHealth will include an infusion of new funds that can be used by ACOs to pay for "flexible services" intended to address social determinants of health. Findings from this study suggest that to the extent that such funds are used to address housing stability, they may yield cost reductions in potentially expensive forms of health care. In short, there is significant and growing interest both in Massachusetts and nationally in the use of health care dollars to address social factors, and our findings suggest that housing-related investments are likely to pay off. There are also likely to be other societal benefits to approaches like CSPECH that use health care dollars to provide innovative services for chronically homeless individuals. Indeed, our study did not evaluate reductions in emergency shelter use, criminal justice system costs, and increases in employment and earnings that prior studies suggest also result from permanent supportive housing models for persons experiencing homelessness.

In taking stock of the findings from this report and their implications, a note of caution is warranted. Specifically, while our findings of health care cost reductions are consistent with prior studies that have used more rigorous designs, methodological limitations mean that we cannot conclusively state from our data that there is a causal relationship between CSPECH service receipt and reductions in non-CSPECH health care costs. Indeed, as noted above, we cannot isolate the independent impact of CSPECH services and moreover, to the extent that entry into CSPECH coincides with (or is determined by) a period of abnormally high health care use, regression to the mean may explain a large part of the reductions in costs we observed and would be a plausible interpretation of the trends in costs that we observed in the pre- and post-CSPECH period.

Finally, it is important to note that none of the foregoing should be taken to imply that the value in a program like CSPECH lies solely in its potential to deliver cost savings to the health care system and elsewhere. To the contrary, cost savings resulting from PSH should be seen as a desirable collateral effect of a logical and humane response to homelessness. In other words, savings should not be seen as a necessary condition for addressing homelessness. Similar arguments have been offered elsewhere,[27] but the idea bears repeating here. Regardless of the health care costs at play, homelessness and other forms of housing instability exact a substantial human toll, and we as a society thus have an obligation to address them with comprehensive, evidence-based policy responses.

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APPENDIX A

This appendix provides additional details on the methodology that was employed in this study. It describes the data and study cohort and the outcome measures and analysis strategy that were employed to assess the impact of CSPECH on physical and behavioral health services costs.

DATA AND STUDY COHORT

Data for the study were provided by the Massachusetts Office of Medicaid (MassHealth). MassHealth used billing codes specific to CSPECH claims to identify all 1,301 MassHealth members who had at least one claim indicating receipt of CSPECH services at any point between July 1, 2006 (the beginning of SFY2007), and June 30, 2013 (the end of SFY2013). MassHealth provided all fee-for-service and managed care encounter claims for all persons who met this criterion for the period from July 1, 2005 (the beginning of SFY2006), through June 30, 2013 (the end of SFY2013). Claims data were provided at the service encounter level and include service start and end dates, claim type, procedure code, diagnosis code, and amount paid by. Claims data also included member sex and year of birth.

We used the first date on which each member of the study cohort had a CSPECH claim as an index date to classify service claims as occurring either before or after CSPECH entry. All claims with a start date prior to this index date were credited to the pre-CSPECH period, and all claims with a start date after this index date were assigned to the post-CSPECH period.

OUTCOME MEASURES

The primary outcome measure of interest was the total physical and behavioral health care expenditures for each member of the study cohort. We calculated this total cost measure on a monthly basis for each month before and after a member's date of entry into CSPECH. Our data did not include information on dates of MassHealth enrollment for members of the study cohort. Therefore, we approximated MassHealth enrollment for each member based on the dates of their first and last service in the available MassHealth claims data. Members were considered enrolled in each month from the date of their first service encounter until the date of their last service encounter. The timing of first and last service encounters relative to the CSPECH entry date differed for each member of the study cohort, resulting in a pre-CSPECH observation period that ranged from eight years to one month and a post-CSPECH observation period that ranged from seven years to one month. This approach for approximating MassHealth enrollment assumes that study cohort members remained continuously enrolled between the dates of their first and last service encounters in the data. This assumption is unlikely to hold true in all cases, and we therefore conducted supplemental analyses in which we only counted persons as enrolled in months in which they had a reimbursed claim. The results of these analyses are presented in Appendix B.

In addition to the total cost measure, we created separate cost measures for each of the following service types:

1. Inpatient behavioral health
2. Inpatient medical
3. Outpatient behavioral health

4. Outpatient medical
5. Long-term services and supports (LTSS)
6. Pharmacy
7. Other

To create these measures, we assigned each claim to one of these categories based on the claim type and provider type codes. Appendix C provides a summary of the unique combinations of claim type and provider type that were present in the claims data and the service type category to which they were assigned.

All costs were converted to 2015 dollars using the U.S. Bureau of Economic Analysis Personal Consumption Expenditures index. Costs of CSPECH claims were excluded to allow for an examination of the relationship between CSPECH services and non-CSPECH costs.

ANALYSIS

Fixed Effects Models

We used a series of fixed-effects ordinary least squares regression models to assess whether per-person health care costs declined in the period immediately following CSPECH entry and to assess whether such cost decreases persisted over time. To do so, we estimated models of the following form:

$$Cost_{it} = \beta_0 + \beta_t\, Month_{it} + \beta_1\, Age_{it} + \alpha_i + \epsilon_{it}$$

where $Cost_{it}$ is the total cost for individual i in month t, $Month \in$ {-n, ..., -1, 1, ... n} is the number of months before or after CSPECH entry, and thus $Month$ is a series of dummy variable for month t relative to the month prior to CSPECH entry for individual i, Age is a measure of the age of individual i in month t, α is a fixed effect for cohort member i, and ϵ_{it} is an error term for individual i in month t. In the model, the month prior to CSPECH entry is set to 0, and thus the β_t are the coefficients of interest in the model, which represents the average change in costs relative to the month prior to CSPECH entry. This model specification is analogous to that used in an "event study" design (which is a variant on the regression discontinuity design), wherein the aim is to assess whether there is a sharp change in an outcome of interest immediately following a (presumably exogenous) event or intervention. In this case, the event of interest is the initiation of CSPECH services.

We then used a second set of fixed effects models to estimate the overall change in monthly per-person costs following CSPECH entry. To do so, we estimated models of the following form:

$$Cost_{it} = \beta_0 + \beta_1\, POSTCSPECH_{it} + \beta_2\, Age_{it} + \alpha_i + \epsilon_{it}$$

where $POSTCSPECH$ is equal to 1 for individual i in all months t following CSPECH entry and 0 otherwise, and as above, Age is a measure of the age of individual i in month t, α is a fixed effect for individual i, and ϵ_{it} is an error term for individual i in month t. The coefficient of interest in this model is β_1, which provides a single estimate of the mean monthly changes in cost from the pre- to the post-CSPECH period. (We also ran models that included year-month fixed effects to control for time trends. Findings from these models did not differ substantively from those resulting from the specification described above).

We estimated separate models for total health care costs and for each of the seven subtypes of health care costs described above. Because the distribution of health care costs is generally right-skewed, using raw health care

costs as an outcome can potentially lead to biased results. We therefore estimated an additional set of models that used the natural logarithm of health care costs as the outcome variable. The results of these additional models are summarized in Appendix B. In all models, standard errors were clustered at the individual level. All models were estimated using the lfe package in the R environment for statistical computing.

Our main fixed-effects models included all 1,301 members of the study cohort and included monthly costs for each cohort member for up to 24 months before and after CSPECH entry. As not all members of the study cohort had a reimbursed claim at least 24 months before and 24 months after their CSPECH entry date, this resulted in an unbalanced panel. We therefore weighted each person-month observation by the inverse of the number of observations that each person contributed to the dataset. To test the robustness of results from this main analysis, we conducted several additional analyses using different sample selection criteria and time windows for analysis. The analyses and their corresponding results are summarized in Appendix B.

Difference-in-Difference Analysis

A difference-in-difference approach estimates the effect of an intervention of interest (in this case CSPECH) by comparing changes in an outcome of interest (in this case physical and behavioral health costs) across the pre-/post-intervention time periods between a group that receives an intervention (the intervention group) and a group that does not (the comparison group). The key assumption of the difference-in-difference design is that the change in the outcome experienced by the comparison group serves as an appropriate counterfactual for the intervention group. In other words, it represents the change that the intervention group would have experienced had its members not received the intervention of interest. This assumption is known as the "parallel trends" assumption. A visual inspection of the trend in costs prior to CSPECH entry for both the CSPECH intervention and comparison groups used in the analysis indicated that this assumption was met to a reasonable degree, with both groups having increasing costs in the pre-intervention period.

As noted above, the data provided by MassHealth included only claims for individuals who had a record of CSPECH service receipt at some point over the period from July 1, 2006, to June 30, 2013. Thus the approach we used in our difference-in-difference analysis for assigning persons to the CSPECH intervention or comparison group was similar in concept to a wait list control design. This approach essentially entailed selecting CSPECH intervention and comparison groups based on the date range in which their initial CSPECH services occurred, and then assessing changes in health care costs experienced by persons in each group over a standard time period (in calendar time) that straddled the CSPECH entry date for persons in the CSPECH intervention group (i.e., it captured health care costs both before and after entry into CSPECH) and directly preceded the CSPECH entry date for persons in the comparison group (i.e., it only captured health costs prior to their CSPECH initiation date). The assumption implicit in this approach is that the persons who make up the comparison group "looked" similar to those in the intervention group in the pre-CSPECH time period, at least insofar as their eligibility for CSPECH was concerned. This primarily means that they met the criteria for chronic homelessness. This assumption is not possible to test with the available data, but given that the criteria for chronic homelessness require individuals to have been homeless for an extended period of time, it is plausible to assume that persons in the comparison group were, at a minimum, experiencing homelessness in the time period prior to their entry into CSPECH. This is arguably more plausible when considering one-year pre-/post-CSPECH observation periods, and we thus consider this as our main analysis.

We conducted two parallel sets of analyses using a difference-in-difference approach. The main analysis examined physical and behavioral health costs for the one-year periods before and after the date of CSPECH entry, while the secondary analysis utilized a two-year observation period on either side of CSPECH entry. In both cases,

we conducted analysis using different intervention and comparison groups, which are described in more detail below. This approach resulted in a total of four estimates of the relationship between CSPECH service receipt and health care costs: two estimates using the one-year pre-/post-CSPECH observation periods and two using the two-year pre-/post-CSPECH observation periods.

To apply the difference-in-difference approach described above in practice, we assigned members of the study cohort to the intervention and comparison groups on the basis of the fiscal year in which their first CSPECH service occurred. For the main analysis (one year pre-/post-CSPECH) persons whose first CSPECH service took place in fiscal year 2007, 2008, or 2011 made up the pool of potential subjects for the CSPECH intervention group, while those who entered CSPECH in 2009, 2010, or 2013 served as the pool of potential subjects for the comparison group. Under this setup, those who entered CSPECH in 2009, 2010, and 2013 were intended to serve as the comparison for those who entered in 2007, 2008, and 2011, respectively. To ensure standard one-year pre-/post-CSPECH observation periods, we excluded members of the CSPECH group who did not have any claims that were at least one year before and one year after their initial CSPECH service date. To ensure similar one-year observation periods for those in the comparison group, we dropped persons from the comparison group who did not have claims in both the fiscal year prior and the fiscal year subsequent to the fiscal year of CSPECH entry for which they were intended to serve as a comparison group. For example, among those who entered CSPECH in fiscal year 2009 and who were the intended comparison group for fiscal year 2007 CSPECH entrants, we excluded persons who did not have a claim in both fiscal year 2006 and fiscal year 2008. These procedures reduced the size of the CSPECH and comparison groups to 269 and 146, respectively.

We then used propensity scores to match persons in the CSPECH intervention group with persons in the comparison group. In the present study, we used propensity scores to create two separate matched groups of CSPECH participants and comparison subjects. For the first group, we estimated propensity scores (using logistic regression) based on sex, year of birth, and CSPECH entry year. For comparison subjects, CSPECH entry year was set equal to the entry year for the CSPECH cohort to whom they were intended to be compared (e.g., entry year for those who entered in 2009 was set equal to 2007). For the second group, we estimated propensity scores based on sex, year of birth, CSPECH entry year, and total health care costs in the year prior to the beginning of the pre-CSPECH observation period (i.e., two years prior to CSPECH entry). CSPECH entry year for the comparison group was defined in the same way as described above. The inclusion of total cost as an additional matching variable helped create CSPECH intervention and comparison groups that had similar baseline levels of health care utilization. However, as the available claims data stretched back only to the beginning of fiscal year 2006, it was not possible to measure total cost two years prior to entry into CSPECH for those who entered CSPECH in fiscal year 2007. As such, those who entered CSPECH in 2007 were excluded from the CSPECH intervention group for this analysis, and those who entered in fiscal year 2009 (their intended comparison group) were likewise excluded from the pool of potential comparison subjects. In both cases, we used propensity scores to identify matches in the comparison group based on nearest neighbor matching using the MatchIt package in the R environment for statistical computing. Members of the comparison group were matched with replacements.

We used the same approach for the secondary analysis that utilized a two-year observation period on either side of CSPECH entry. However, the use of a two-year observation window required that the selection of potential subjects for the CSPECH intervention and comparison groups be based on different fiscal years of entry into CSPECH. More specifically, those whose first CSPECH service took place in fiscal year 2008, 2009, or 2010 made up the pool of potential subjects for the CSPECH intervention group, while those who entered CSPECH in 2011, 2012, or 2013 served as the pool of potential subjects for the comparison group. Under this setup, those who entered CSPECH in 2008, 2009, and 2010 were intended to serve as the comparison for those who entered in 2011,

2012, and 2013, respectively. Much as in the one-year pre-/post-CSPECH analysis, when including total health care costs in the year prior to the pre-CSPECH observation period (i.e., three years prior to CSPECH entry), we were forced to exclude from the intervention group persons who entered CSPECH in 2008, and to exclude their intended comparison cohort of persons who entered CSPECH in 2011, as it was not possible from the available data to measure their service use three years prior to their entry into CSPECH.

Table 3 below summarizes the four CSPECH intervention and comparison groups that resulted from the sample selection procedures described above. The results from the analysis conducted with these four groups provided a way to assess whether the estimates of the impact of CSPECH on physical and behavioral health services use was consistent across different compositions of the intervention and comparison groups and different observation time periods.

TABLE 3. SUMMARY OF SAMPLE SIZES FOR DIFFERENCE-IN-DIFFERENCE ANALYSIS

MATCHING APPROACH	TIME PERIOD	CSPECH INTERVENTION GROUP (N)	COMPARISON GROUP (N)
Age and Sex	1 Year Pre/Post	443	207
Age and Sex	2 Year Pre/Post	252	168
Age, Sex, and Cost	1 Year Pre/Post	269	146
Age, Sex, and Cost	2 Year Pre/Post	153	150

After conducting propensity score matching, we aggregated health care costs for the one- and two-year time periods before and after the initial date of CSPECH entry for both the CSPECH intervention and comparison groups. For those in the comparison group, the CSPECH entry date was set equal to the date of entry for the member of the CSPECH intervention with whom they were matched by propensity score. We aggregated all costs into a total cost measure, and also created separate aggregated cost measures for each of the seven service types described above.

We then conducted the difference-in-difference analysis using a series of two-part regression models, to account for the skewed nature of the cost data. In the first part of the model, we used logistic regression to estimate the probability of any health care cost. In the second part of the model, we used a gamma regression model with a log-link function to estimate costs conditional on having any cost. Both models were estimated using the standard specification for a difference-in-difference model with two time periods, the general form of which is:

$$f(Cost_{it}) = \beta_0 + \beta_1\, postCSPECH_t + \beta_2\, CSPECH_i + \beta_3\, (postCSPECH_t * CSPECH_i) + x\beta$$

where $Cost_{it}$ is the total cost for cohort member i in time period t, f represents the link function (i.e., logit or log), $postCSPECH_t$ is a dummy variable set to 1 if the observation is from the post-CSPECH entry period and 0 otherwise, $CSPECH_i$ is a dummy variable set to 1 if individual i is in the CSPECH intervention group and 0 otherwise, and x is a vector of predictor variables including sex, year of birth, CSPECH entry year and, where applicable, the natural log of the total cost of health care services use in the year prior to the beginning of the pre-CSPECH observation period. The predictor of interest in this model is β_3, which represents the difference-in-difference estimate.

We used predicted values across both parts of the two-part models to estimate the regression-adjusted estimate of the effect of CSPECH entry on total costs. These estimates were standardized to the underlying characteristics to the sample population as a whole. We used the non-parametric bootstrap to estimate 95 percent confidence intervals around these estimates based on 1,000 replicates and using the percentile method. All models were estimated using the glm function in the R environment for statistical computing.

APPENDIX B

This section presents results from supplemental analyses that were conducted in addition to the main analysis presented in the body of the report. These analyses are geared toward testing the robustness of the main study findings to variations in the analytic approach.

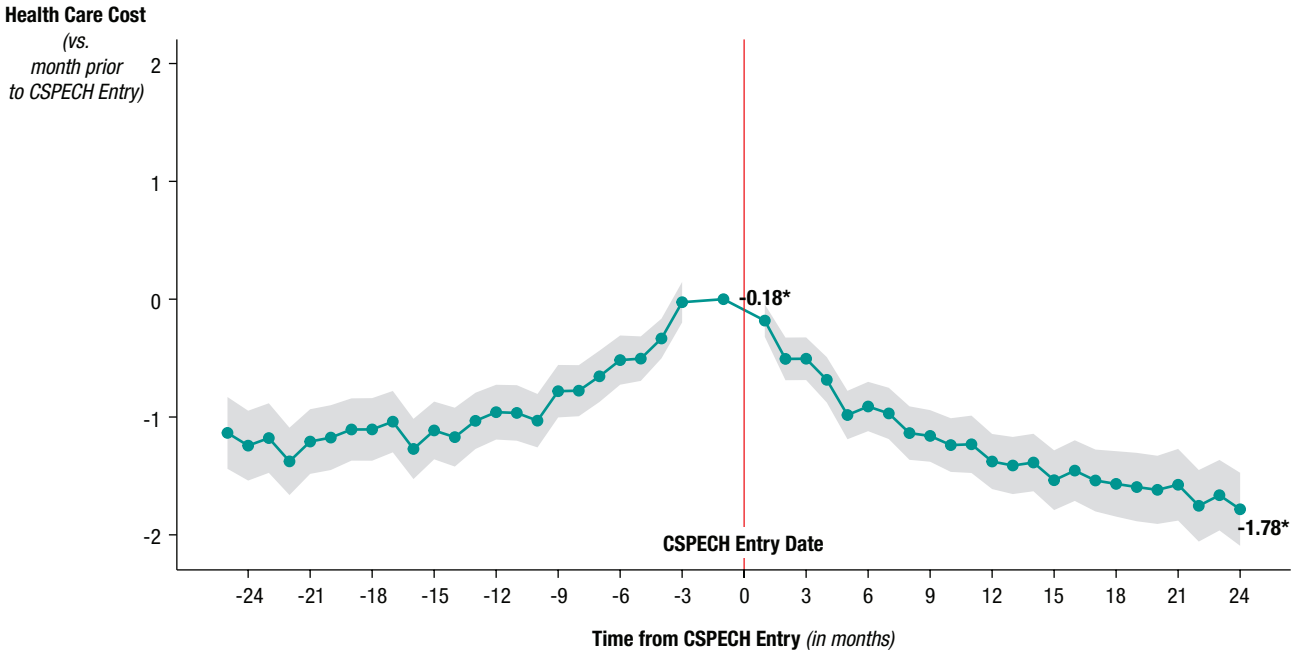
For the fixed-effects models, we replicated the main analysis using the natural logarithm of cost as the outcome variable. We also conducted the analysis using the following subsamples of the study cohort, using both raw and log cost as the outcome variable:

- **Sample B:** Replicated the main analysis but included observations for individuals only in months where they had non-zero costs.
- **Sample C:** Used all observations from up to 36 months before and after CSPECH entry.
- **Sample D:** Same as sample C but included observations for individuals only in months where they had non-zero costs.
- **Sample E:** Included all individuals who had at least 24 months of observation time before and after CSPECH entry, resulting in a group of persons with a uniform observation period before/after CSPECH entry.
- **Sample F:** Same as sample E but included observations for individuals only in months where they had non-zero costs.

For the difference-in-difference analysis, as noted above, we replicated the analysis matching based solely on age and sex and using two-year pre-/post-observation periods. The results of these supplemental analyses are provided below. The findings were overall highly consistent with the findings presented in the main body of the report.

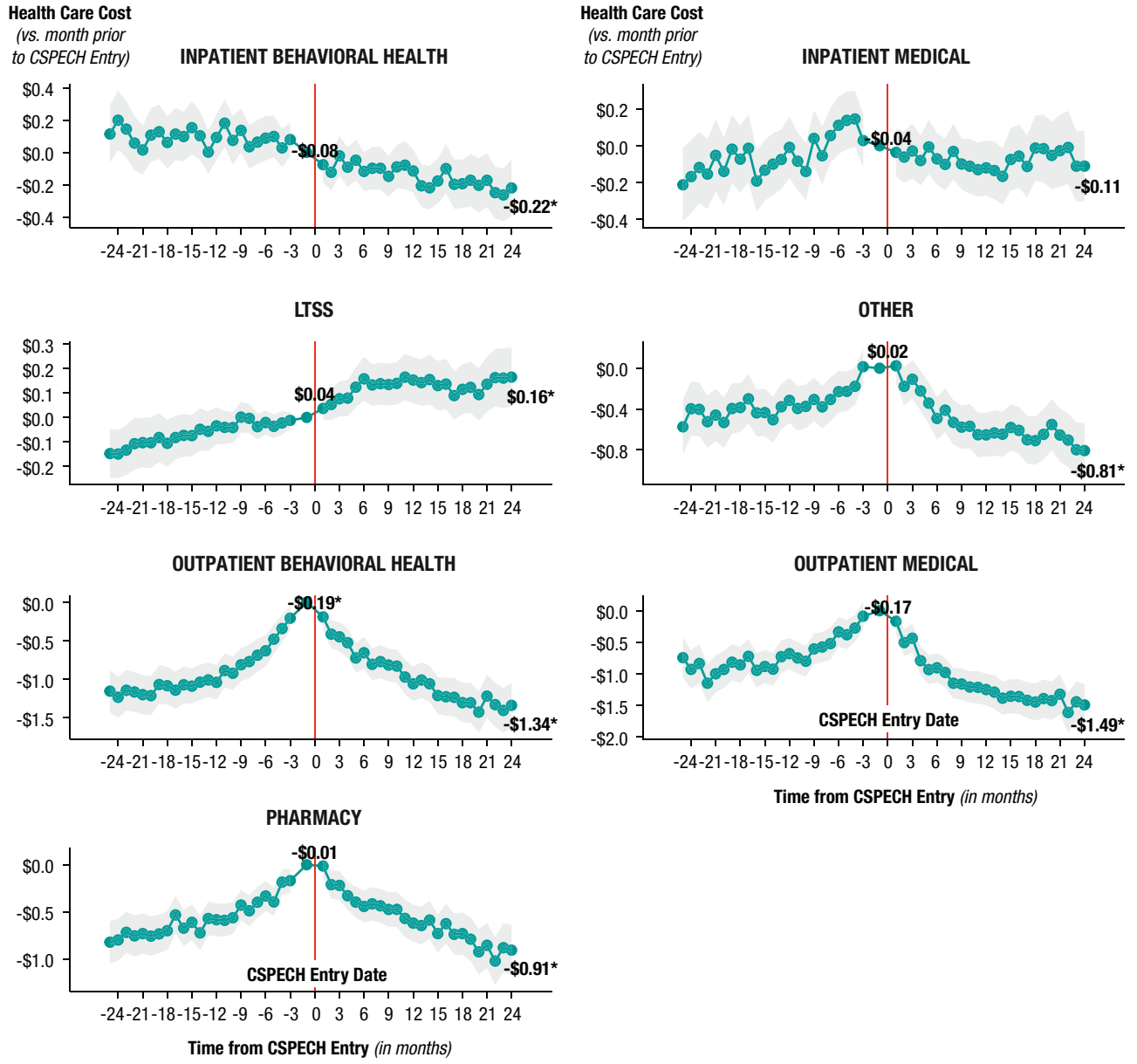
REPLICATION OF MAIN FIXED-EFFECTS MODELS WITH LOG-TRANSFORMED COST VARIABLE

FIGURE 8. ESTIMATED MONTH-BY-MONTH CHANGES IN AVERAGE PER-PERSON HEALTH CARE COSTS FOLLOWING CSPECH ENTRY (USING LOG [COST] AS OUTCOME)



Note: The figure plots the coefficients of dummies for time from CSPECH entry, obtained from an OLS regression with individual fixed effects.
*Statistically significant at $p < .05$ level.
The shaded gray area represents 95% confidence intervals for these coefficients..

FIGURE 9. ESTIMATED MONTH-BY-MONTH CHANGES IN AVERAGE PER-PERSON HEALTH CARE COSTS FOLLOWING CSPECH ENTRY (USING LOG [COST] AS OUTCOME), BY TYPE



Note: The figure plots the coefficients of dummies for time from CSPECH entry, obtained from an OLS regression with individual fixed effects.
*Statistically significant at $p < .05$ level.
The shaded gray area represents 95% confidence intervals for these coefficients..
LTSS = Long-Term Services and Supports.

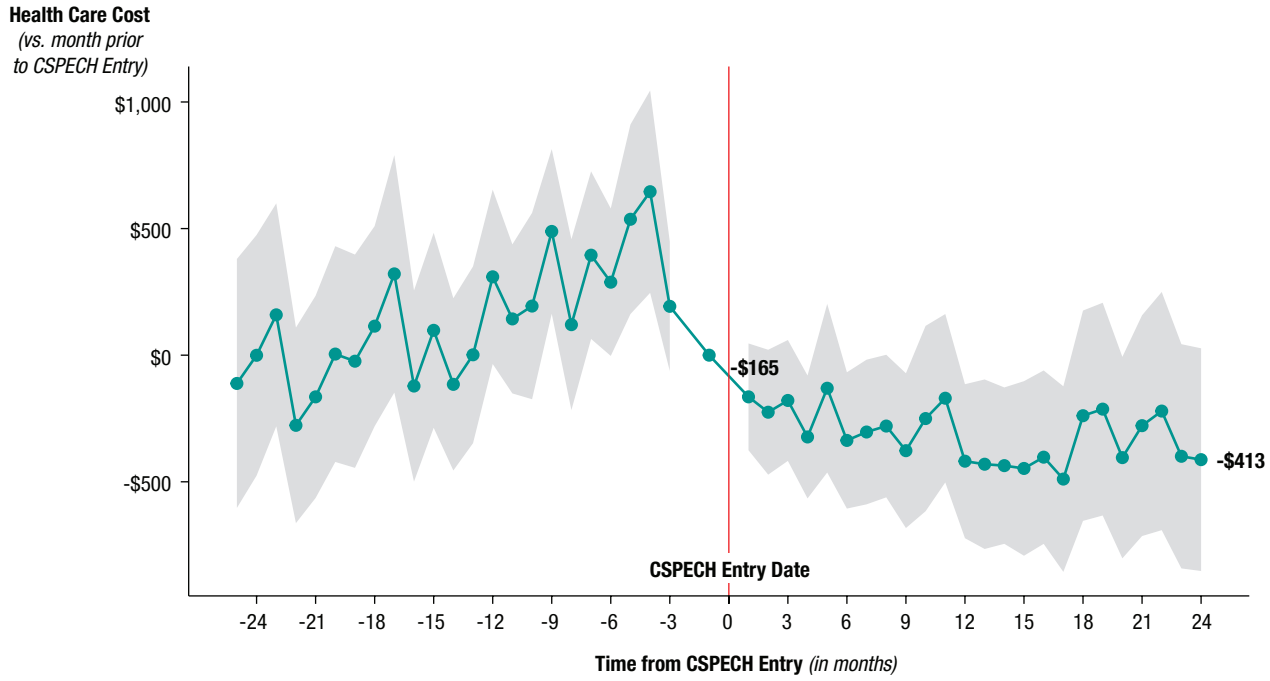
TABLE 4. FIXED EFFECTS MODELS OF ESTIMATED CHANGE IN AVERAGE MONTHLY PER-PERSON HEALTH CARE COSTS FOLLOWING CSPECH ENTRY (MAIN SAMPLE)

MODEL	IBH	IM	LTSS	O	OBH	OM	P	Total
Raw Cost (Main Analysis)	-68*	-165*	16	-25*	-98*	-182*	17	**-506***
Log(Cost)	-0.13*	-0.12*	0.09*	-0.08	-0.07	-0.36*	0.01	**-0.26***

Note: * indicates statistical significance at the $p < .05$ level.
Coefficient estimates based on OLS regression models with individual fixed effects. Standard errors clustered by individual.

SAMPLE B

FIGURE 10. ESTIMATED MONTH-BY-MONTH CHANGES IN AVERAGE PER-PERSON HEALTH CARE COSTS FOLLOWING CSPECH ENTRY (SAMPLE B)



Note: The figure plots the coefficients of dummies for time from CSPECH entry, obtained from an OLS regression with individual fixed effects.
*Statistically significant at p < .05 level.
The shaded gray area represents 95% confidence intervals for these coefficients..

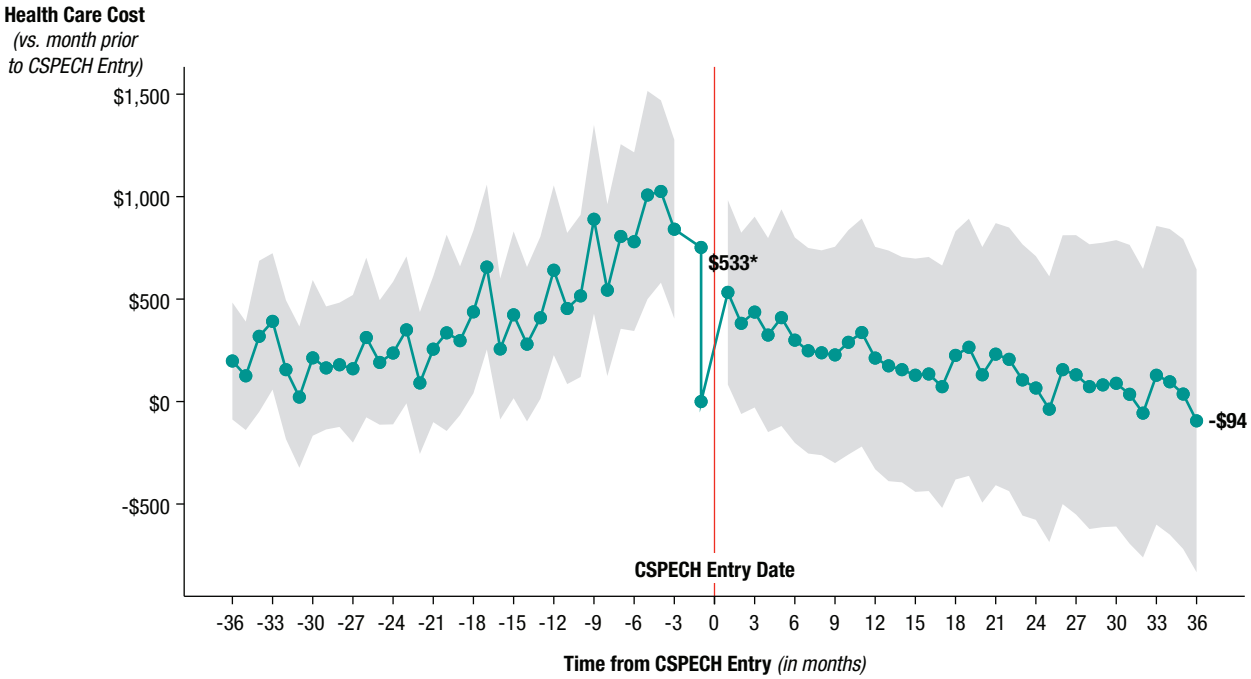
TABLE 5. FIXED EFFECTS MODELS OF ESTIMATED CHANGE IN AVERAGE MONTHLY PER-PERSON HEALTH CARE COSTS FOLLOWING CSPECH ENTRY (SAMPLE B)

MODEL	IBH	IM	LTSS	O	OBH	OM	P	Total
Raw Cost (Main Analysis)	-69*	-159*	13	-23*	-115*	-210*	13	**-550***
Log(Cost)	-0.13*	-0.13*	0.09*	-0.04	-0.09	-0.38*	0.02	**-0.21***
Observations	36,358							
Individuals	1,292							

Note: * indicates statistical significance at the p < .05 level.
Coefficient estimates based on OLS regression models with individual fixed effects. Standard errors clustered by individual.

SAMPLE C

FIGURE 11. ESTIMATED MONTH-BY-MONTH CHANGES IN AVERAGE PER-PERSON HEALTH CARE COSTS FOLLOWING CSPECH ENTRY (SAMPLE C)



Note: The figure plots the coefficients of dummies for time from CSPECH entry, obtained from an OLS regression with individual fixed effects.
*Statistically significant at p < .05 level.
The shaded gray area represents 95% confidence intervals for these coefficients..

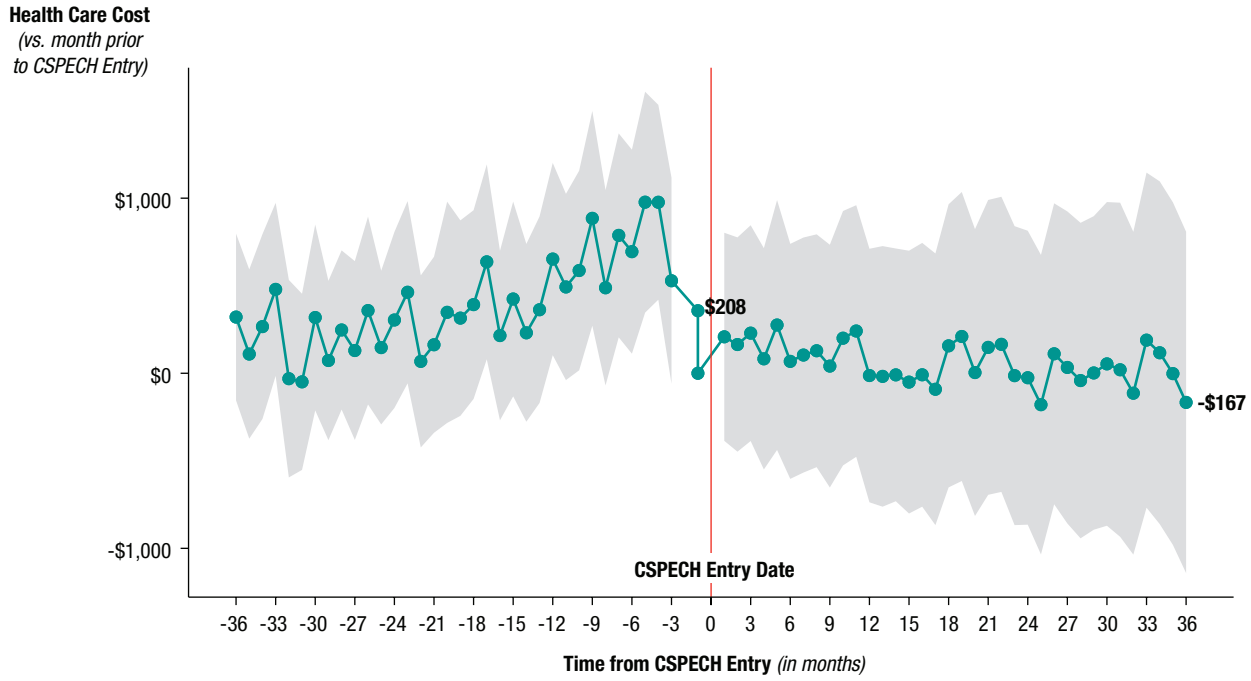
TABLE 6. FIXED EFFECTS MODELS OF ESTIMATED CHANGE IN AVERAGE MONTHLY PER-PERSON HEALTH CARE COSTS FOLLOWING CSPECH ENTRY (SAMPLE C)

MODEL	IBH	IM	LTSS	O	OBH	OM	P	Total
Raw Cost (Main Analysis)	-76*	-126*	17	-26*	-89*	-167*	17	**-450***
Log(Cost)	-0.15*	-0.1*	0.1*	-0.08	-0.02	-0.36*	0.06	**-0.21***
Observations	63,907							
Individuals	1,301							

Note: * indicates statistical significance at the p < .05 level.
Coefficient estimates based on OLS regression models with individual fixed effects. Standard errors clustered by individual.

SAMPLE D

FIGURE 12. ESTIMATED MONTH-BY-MONTH CHANGES IN AVERAGE PER-PERSON HEALTH CARE COSTS FOLLOWING CSPECH ENTRY (SAMPLE D)



Note: The figure plots the coefficients of dummies for time from CSPECH entry, obtained from an OLS regression with individual fixed effects.
*Statistically significant at p < .05 level.
The shaded gray area represents 95% confidence intervals for these coefficients..

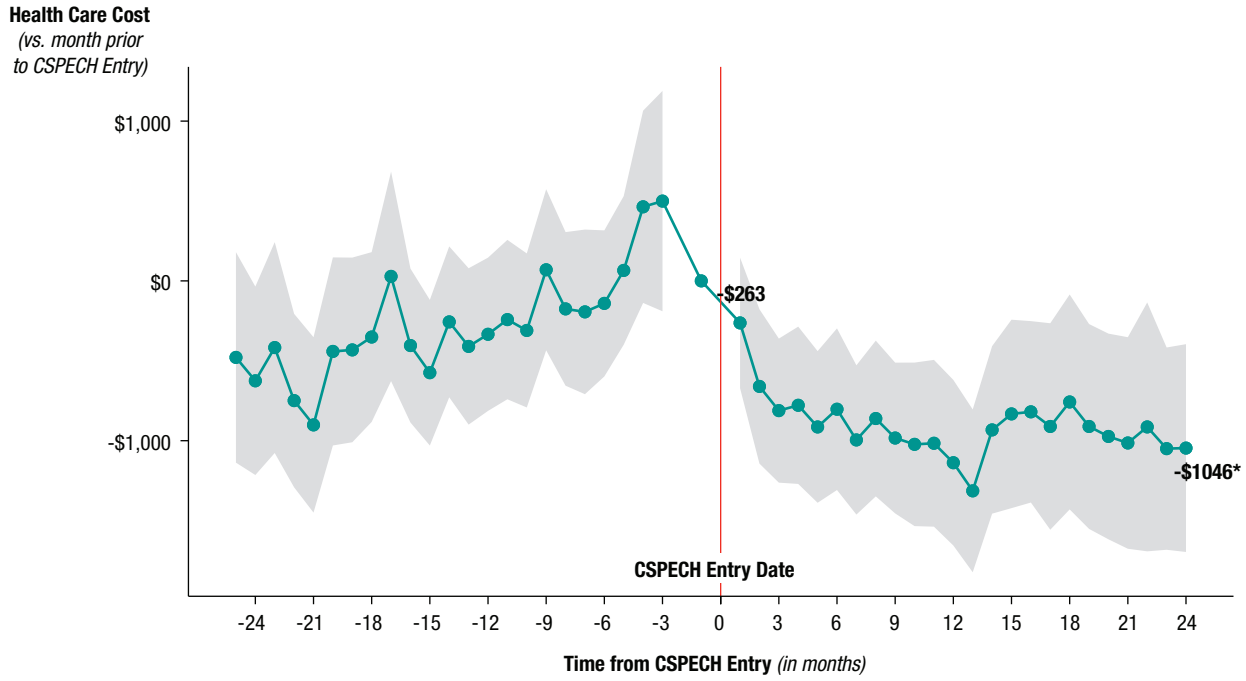
TABLE 7. FIXED EFFECTS MODELS OF ESTIMATED CHANGE IN AVERAGE MONTHLY PER-PERSON HEALTH CARE COSTS FOLLOWING CSPECH ENTRY (SAMPLE D)

MODEL	IBH	IM	LTSS	O	OBH	OM	P	Total
Raw Cost (Main Analysis)	-85*	-137*	16	-25*	-108*	-207*	15	**-532***
Log(Cost)	-0.17*	-0.12*	0.1*	-0.05	-0.05	-0.44*	0.07	**-0.21***
Observations	47,239							
Individuals	1,294							

Note: * indicates statistical significance at the p < .05 level.
Coefficient estimates based on OLS regression models with individual fixed effects. Standard errors clustered by individual.

SAMPLE E

FIGURE 13. ESTIMATED MONTH-BY-MONTH CHANGES IN AVERAGE PER-PERSON HEALTH CARE COSTS FOLLOWING CSPECH ENTRY (SAMPLE E)



Note: The figure plots the coefficients of dummies for time from CSPECH entry, obtained from an OLS regression with individual fixed effects.
*Statistically significant at p < .05 level.
The shaded gray area represents 95% confidence intervals for these coefficients..

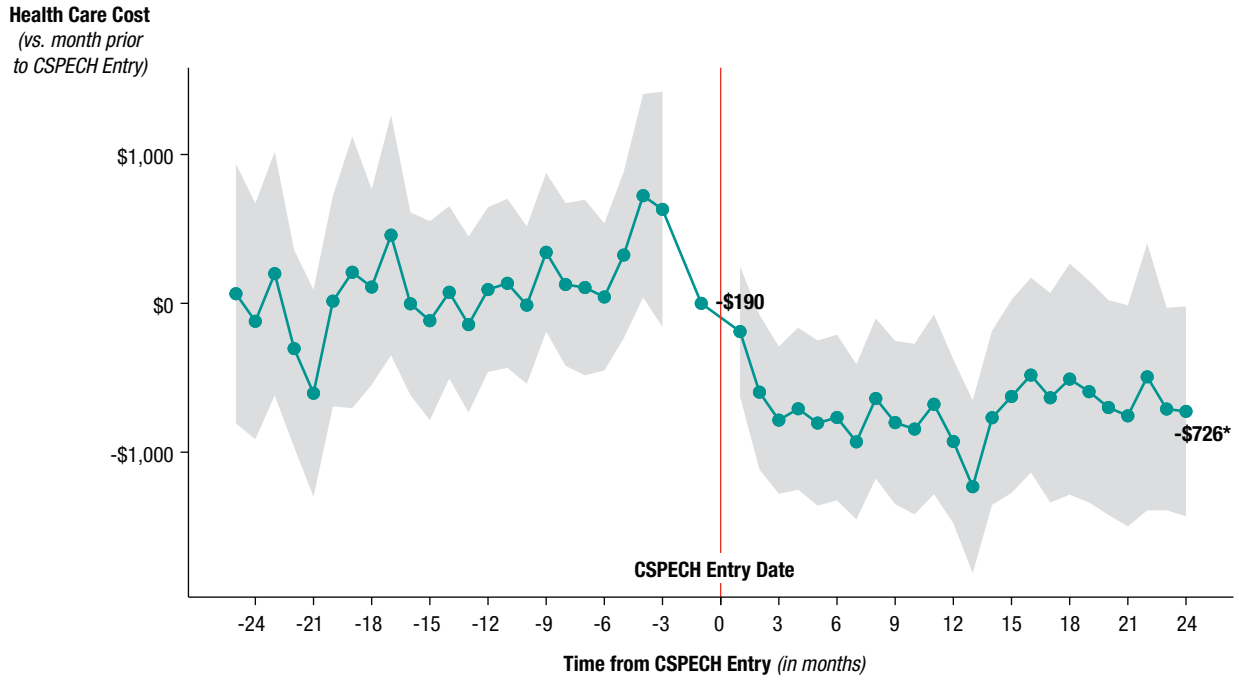
TABLE 8. FIXED EFFECTS MODELS OF ESTIMATED CHANGE IN AVERAGE MONTHLY PER-PERSON HEALTH CARE COSTS FOLLOWING CSPECH ENTRY (SAMPLE E)

MODEL	IBH	IM	LTSS	O	OBH	OM	P	Total
Raw Cost (Main Analysis)	-48	-123*	41*	-21	-15	-169*	30	**-305***
Log(Cost)	-0.11*	-0.11*	0.17*	0	0.37*	-0.01	0.3*	**0.28***
Observations	16,560							
Individuals	345							

Note: * indicates statistical significance at the p < .05 level.
Coefficient estimates based on OLS regression models with individual fixed effects. Standard errors clustered by individual.

SAMPLE F

FIGURE 14. ESTIMATED MONTH-BY-MONTH CHANGES IN AVERAGE PER-PERSON HEALTH CARE COSTS FOLLOWING CSPECH ENTRY (SAMPLE F)



Note: The figure plots the coefficients of dummies for time from CSPECH entry, obtained from an OLS regression with individual fixed effects.
*Statistically significant at p < .05 level.
The shaded gray area represents 95% confidence intervals for these coefficients..

TABLE 9. FIXED EFFECTS MODELS OF ESTIMATED CHANGE IN AVERAGE MONTHLY PER-PERSON HEALTH CARE COSTS FOLLOWING CSPECH ENTRY (SAMPLE F)

MODEL	IBH	IM	LTSS	O	OBH	OM	P	Total
Raw Cost (Main Analysis)	-83	-316*	-3	-29	-104*	-441*	-4	**-980***
Log(Cost)	-0.16*	-0.28*	0.02	-0.22*	-0.06	-0.55*	-0.13	**-0.35***
Observations	12,423							
Individuals	345							

Note: * indicates statistical significance at the p < .05 level.
Coefficient estimates based on OLS regression models with individual fixed effects. Standard errors clustered by individual.

DIFFERENCE-IN-DIFFERENCE MODELS

Age- and Sex-Matched Groups (1 Year Pre-/Post-CSPECH Entry)

TABLE 10. RESULTS OF DIFFERENCE-IN-DIFFERENCE ANALYSIS, MATCHED ON AGE AND SEX (1 YEAR PRE/POST)

	CSPECH			COMPARISON			DIFFERENCE-IN-DIFFERENCE
CLAIM TYPE	PRE	POST	DIFFERENCE	PRE	POST	DIFFERENCE	
Inpatient behavioral health	$1,865	$1,437	-$428	$1,722	$2,247	$525	-$953
Inpatient medical	$7,124	$4,904	-$2,220	$4,304	$6,346	$2,042	-$4,262*
Outpatient behavioral health	$2,998	$1,982	-$1,017	$1,976	$2,333	$357	-$1,373*
Outpatient medical	$8,729	$6,171	-$2,558	$5,873	$6,892	$1,019	-$3,576*
LTSS	$415	$874	$460	$158	$417	$259	$200
Pharmacy	$2,207	$2,620	$413	$2,025	$2,690	$665	-$252
Other	$1,445	$1,277	-$168	$1,375	$1,552	$177	-$346
Total	**$24,694**	**$18,983**	**-$5,711**	**$17,729**	**$22,751**	**$5,022**	**-$10,734***

Note: * indicates statistical significance at the p < .05 level. P values calculated using nonparametric bootstrap and percentile method.
Standardized cost estimates based on two-part regression models that adjusted for age and sex.
Due to covariate adjustment, sum of adjusted cost estimates by type do not equal total adjusted cost estimate.
LTSS = Long-Term Services and Supports.

Age-, Sex-, and Cost-Matched Groups (2 Years Pre-/Post-CSPECH Entry)

TABLE 11. RESULTS OF DIFFERENCE-IN-DIFFERENCE ANALYSIS, MATCHED ON AGE, SEX, AND COST (2 YEARS PRE/POST)

	CSPECH			COMPARISON			DIFFERENCE-IN-DIFFERENCE
CLAIM TYPE	PRE	POST	DIFFERENCE	PRE	POST	DIFFERENCE	
Inpatient behavioral health	$2,480	$1,134	-$1,346	$1,724	$2,108	$384	-$1,730*
Inpatient medical	$6,424	$4,376	-$2,049	$3,296	$4,574	$1,278	-$3,327*
Outpatient behavioral health	$2,406	$1,938	-$468	$1,291	$2,406	$1,115	-$1,583*
Outpatient medical	$7,967	$6,453	-$1,514	$5,111	$7,138	$2,027	-$3,540*
LTSS	$170	$846	$676	$255	$450	$195	$481
Pharmacy	$1,914	$2,970	$1,056	$2,266	$2,705	$439	$617*
Other	$1,520	$1,252	-$268	$1,340	$1,888	$548	-$816*
Total	**$22,672**	**$18,860**	**-$3,812**	**$14,802**	**$21,021**	**$6,219**	**-$10,030***

Note: * indicates statistical significance at the p < .05 level. P values calculated using nonparametric bootstrap and percentile method.
Standardized cost estimates based on two-part regression models that adjusted for age, sex and baseline health care costs.
Due to covariate adjustment, sum of adjusted cost estimates by type do not equal total adjusted cost estimate.
LTSS = Long-Term Services and Supports.

Age- and Sex-Matched Groups (2 Years Pre-/Post-CSPECH Entry)

TABLE 12. RESULTS OF DIFFERENCE-IN-DIFFERENCE ANALYSIS, MATCHED ON AGE AND SEX (2 YEARS PRE/POST)

	CSPECH			COMPARISON			DIFFERENCE-IN-DIFFERENCE
CLAIM TYPE	PRE	POST	DIFFERENCE	PRE	POST	DIFFERENCE	
Inpatient behavioral health	$2,292	$1,458	-$834	$936	$1,606	$670	-$1,504*
Inpatient medical	$6,818	$5,080	-$1,739	$5,147	$6,322	$1,175	-$2,914*
Outpatient behavioral health	$2,364	$2,178	-$186	$1,224	$1,711	$488	-$674*
Outpatient medical	$8,452	$6,428	-$2,024	$5,998	$7,700	$1,702	-$3,726*
LTSS	$188	$860	$672	$288	$463	$174	$498
Pharmacy	$2,336	$2,772	$436	$2,162	$2,360	$198	$239
Other	$1,568	$1,370	-$198	$1,611	$1,937	$326	-$524*
Total	**$24,012**	**$20,215**	**-$3,798**	**$17,336**	**$22,234**	**$4,898**	**-$8,696***

Note: * indicates statistical significance at the p < .05 level. P values calculated using nonparametric bootstrap and percentile method.
Standardized cost estimates based on two-part regression models that adjusted for age and sex.
Due to covariate adjustment, sum of adjusted cost estimates by type do not equal total adjusted cost estimate.
LTSS = Long-Term Services and Supports.

APPENDIX C

The table below lists all unique claim type and provider type combinations (shown in the two right-hand columns) that were present in the data provided by MassHealth for the study. The left-hand column of the table designates how each of the unique claim type-provider type combinations were categorized in the context of the present study into the seven discrete service type categories described in the main body of the report.

SERVICE TYPE CATEGORY (CATEGORIZED FOR STUDY)	CLAIM TYPE	PROVIDER TYPE
Inpatient—Behavioral Health	Inpatient Part A Crossover (UB)	73 – Psychiatric Inpatient Hospital (All Ages)
Inpatient—Behavioral Health	Professional Part B Crossover	73 – Psychiatric Inpatient Hospital (All Ages)
Inpatient—Behavioral Health	Outpatient Part B Crossover (UB)	73 – Psychiatric Inpatient Hospital (All Ages)
Inpatient—Behavioral Health	Hospital Inpatient	20 – Mental Health/Chemical Dep. (Nec)
Inpatient—Behavioral Health	Hospital Inpatient	21 – Mental Health Facilities
Inpatient—Behavioral Health	Hospital Inpatient	248 – Psychiatric Hospital-Inpatient
Inpatient—Behavioral Health	Hospital Inpatient	73 – Psychiatric Inpatient Hospital (All Ages)
Inpatient—Behavioral Health	Hospital Inpatient	22 – Chemical Dependency Treatment Ctr.
Inpatient—Behavioral Health	Hospital Inpatient	76 – Intensive Residential Treatment Program (Irtp)
Inpatient—Behavioral Health	Professional	35 – Residential Treatment Center
Inpatient—Behavioral Health	Hospital Outpatient	248 – Psychiatric Hospital-Inpatient
Inpatient—Medical	Unknown	1 – Acute Care Hospital
Inpatient—Medical	Inpatient Part A Crossover (UB)	70 – Acute Inpatient Hospital
Inpatient—Medical	Inpatient Part A Crossover (UB)	74 – Semi Acute Inpatient Hospital
Inpatient—Medical	Professional Part B Crossover	70 – Acute Inpatient Hospital
Inpatient—Medical	Professional Part B Crossover	71 – Chronic Inpatient Hospital
Inpatient—Medical	Outpatient Part B Crossover (UB)	70 – Acute Inpatient Hospital
Inpatient—Medical	Outpatient Part B Crossover (UB)	71 – Chronic Inpatient Hospital
Inpatient—Medical	Hospital Inpatient	1 – Acute Care Hospital
Inpatient—Medical	Hospital Inpatient	100 – Unknown Clinic
Inpatient—Medical	Hospital Inpatient	146 – Nursing Services
Inpatient—Medical	Hospital Inpatient	2 – Acute Care Hospital-Outpatient
Inpatient—Medical	Hospital Inpatient	250 – Community Health Center
Inpatient—Medical	Hospital Inpatient	301 – General Hospital
Inpatient—Medical	Hospital Inpatient	50 – Physician
Inpatient—Medical	Hospital Inpatient	58 – Family Practice
Inpatient—Medical	Hospital Inpatient	Unknown
Inpatient—Medical	Hospital Inpatient	35 – State Agency Services
Inpatient—Medical	Hospital Inpatient	70 – Acute Inpatient Hospital
Inpatient—Medical	Hospital Inpatient	71 – Chronic Inpatient Hospital
Inpatient—Medical	Hospital Inpatient	74 – Semi Acute Inpatient Hospital
Inpatient—Medical	Professional	246 – Rehab Hospital-Inpatient
Inpatient—Medical	Professional	70 – Acute Inpatient Hospital

continued

SERVICE TYPE CATEGORY (CATEGORIZED FOR STUDY)	CLAIM TYPE	PROVIDER TYPE
Long-Term Services and Supports	Inpatient Part A Crossover (UB)	09 – Nursing Facility
Long-Term Services and Supports	Inpatient Part A Crossover (UB)	71 – Chronic Inpatient Hospital
Long-Term Services and Supports	Outpatient Part B Crossover (UB)	09 – Nursing Facility
Long-Term Services and Supports	Home and Community Health	60 – Home Health Agency
Long-Term Services and Supports	Hospital Inpatient	30 – Long-Term Care (Nec)
Long-Term Services and Supports	Long-Term Care	100 – Unknown Clinic
Long-Term Services and Supports	Long-Term Care	146 – Nursing Services
Long-Term Services and Supports	Long-Term Care	20 – Mental Health/Chemical Dep. (Nec)
Long-Term Services and Supports	Long-Term Care	21 – Mental Health Facilities
Long-Term Services and Supports	Long-Term Care	215 – Home Health Organization
Long-Term Services and Supports	Long-Term Care	246 – Rehab Hospital-Inpatient
Long-Term Services and Supports	Long-Term Care	3 – Chronic Hospital-Inpatient
Long-Term Services and Supports	Long-Term Care	30 – Long-Term Care (Nec)
Long-Term Services and Supports	Long-Term Care	80 – Physical Medicine And Rehabilitation
Long-Term Services and Supports	Long-Term Care	09 – Nursing Facility
Long-Term Services and Supports	Long-Term Care	55 – Rest Home
Long-Term Services and Supports	Professional	58 – Fiscal Intermediary Services
Long-Term Services and Supports	Professional	59 – Personal Care Management Agency
Long-Term Services and Supports	Professional	62 – Adult Foster Care / Group Adult Foster Care
Long-Term Services and Supports	Professional	63 – Adult Day Health
Long-Term Services and Supports	Professional	64 – Day Habilitation
Long-Term Services and Supports	Professional	66 – Independent Living
Long-Term Services and Supports	Professional	68 – Home Care Corporation
Long-Term Services and Supports	Hospital Outpatient	69 – Hospice Care
Other	Unknown	200 – Transportation
Other	Unknown	235 – Supply Center
Other	Unknown	Unknown
Other	Unknown	301 – General Hospital
Other	Professional Part B Crossover	10 – Dentist
Other	Professional Part B Crossover	11 – Dental Clinic
Other	Professional Part B Crossover	41 – Durable Medical Equipment
Other	Professional Part B Crossover	42 – Oxygen And Respiratory Therapy Equip
Other	Professional Part B Crossover	43 – Prosthetics
Other	Professional Part B Crossover	45 – Independent Diagnostic Testing Facility (Idtf)
Other	Professional Part B Crossover	46 – Certified Independent Laboratory
Other	Professional Part B Crossover	49 – Transportation
Other	Dental	95 – Dentist
Other	Dental	10 – Dentist
Other	Dental	11 – Dental Clinic
Other	Dental	12 – Dental School Clinic Undergraduate
Other	Dental	13 – Dental School Clinic Graduate

continued

SERVICE TYPE CATEGORY (CATEGORIZED FOR STUDY)	CLAIM TYPE	PROVIDER TYPE
Other	Dental	14 – Public Health Dental Hygienist
Other	Dental	20 – Community Health Center (Chc)
Other	Dental	80 – Acute Outpatient Hospital
Other	Dental	81 – Hospital Licensed Health Center (Hlhc)
Other	Dental	97 – Group Practice Organization
Other	Professional	200 – Transportation
Other	Professional	311 – Durable Medical Equipment
Other	Professional	95 – Dentist
Other	Professional	96 – Dental Specialist
Other	Professional	Unknown
Other	Professional	11 – Dental Clinic
Other	Professional	31 – Volume Purchaser
Other	Professional	40 – Pharmacy
Other	Professional	41 – Durable Medical Equipment
Other	Professional	46 – Certified Independent Laboratory
Other	Professional	49 – Transportation
Other	Professional	89 – School-Based Medicaid
Other	Hospital Outpatient	100 – Unknown Clinic
Other	Hospital Outpatient	225 – Laboratory
Other	Hospital Outpatient	30 – Long-Term Care (Nec)
Other	Hospital Outpatient	83 – Psychiatry/Neurology
Other	Hospital Outpatient	Unknown
Outpatient—Behavioral Health	Unknown	20 – Mental Health/Chemical Dep. (Nec)
Outpatient—Behavioral Health	Professional Part B Crossover	05 – Psychologist
Outpatient—Behavioral Health	Professional Part B Crossover	07 – Therapist
Outpatient—Behavioral Health	Professional Part B Crossover	26 – Mental Health Center
Outpatient—Behavioral Health	Professional Part B Crossover	83 – Psychiatric Outpatient Hospital
Outpatient—Behavioral Health	Professional Part B Crossover	28 – Substance Abuse Program
Outpatient—Behavioral Health	Outpatient Part B Crossover (UB)	65 – Psychiatric Day Treatment
Outpatient—Behavioral Health	Professional	1 – Acute Care Hospital
Outpatient—Behavioral Health	Professional	170 – Therapists (Supportive)
Outpatient—Behavioral Health	Professional	171 – Psychologist
Outpatient—Behavioral Health	Professional	2 – Acute Care Hospital-Outpatient
Outpatient—Behavioral Health	Professional	21 – Mental Health Facilities
Outpatient—Behavioral Health	Professional	248 – Psychiatric Hospital-Inpatient
Outpatient—Behavioral Health	Professional	250 – Community Health Center
Outpatient—Behavioral Health	Professional	40 – Facility (Nec)
Outpatient—Behavioral Health	Professional	83 – Psychiatry/Neurology
Outpatient—Behavioral Health	Professional	05 – Psychologist
Outpatient—Behavioral Health	Professional	07 – Therapist
Outpatient—Behavioral Health	Professional	26 – Mental Health Center

continued

SERVICE TYPE CATEGORY (CATEGORIZED FOR STUDY)	CLAIM TYPE	PROVIDER TYPE
Outpatient—Behavioral Health	Professional	35 – State Agency Services
Outpatient—Behavioral Health	Professional	84 – Radiology
Outpatient—Behavioral Health	Professional	20 – Mental Health/Chemical Dep. (Nec)
Outpatient—Behavioral Health	Professional	22 – Chemical Dependency Treatment Ctr.
Outpatient—Behavioral Health	Professional	30 – Long-Term Care (Nec)
Outpatient—Behavioral Health	Professional	28 – Substance Abuse Program
Outpatient—Behavioral Health	Hospital Outpatient	20 – Mental Health/Chemical Dep. (Nec)
Outpatient—Behavioral Health	Hospital Outpatient	21 – Mental Health Facilities
Outpatient—Behavioral Health	Hospital Outpatient	83 – Psychiatric Outpatient Hospital
Outpatient—Behavioral Health	Hospital Outpatient	22 – Chemical Dependency Treatment Ctr.
Outpatient—Medical	Unknown	2 – Acute Care Hospital-Outpatient
Outpatient—Medical	Unknown	250 – Community Health Center
Outpatient—Medical	Unknown	4 – Chronic Hospital-Outpatient
Outpatient—Medical	Professional Part B Crossover	01 – Physician
Outpatient—Medical	Professional Part B Crossover	02 – Optometrist
Outpatient—Medical	Professional Part B Crossover	06 – Podiatrist
Outpatient—Medical	Professional Part B Crossover	16 – Chiropractor
Outpatient—Medical	Professional Part B Crossover	20 – Community Health Center (Chc)
Outpatient—Medical	Professional Part B Crossover	25 – Renal Dialysis Clinic
Outpatient—Medical	Professional Part B Crossover	47 – Orthotics
Outpatient—Medical	Professional Part B Crossover	75 – Semi Acute Outpatient Hospital
Outpatient—Medical	Professional Part B Crossover	80 – Acute Outpatient Hospital
Outpatient—Medical	Professional Part B Crossover	81 – Hospital Licensed Health Center (Hlhc)
Outpatient—Medical	Professional Part B Crossover	86 – Qmb Only Providers
Outpatient—Medical	Professional Part B Crossover	97 – Group Practice Organization
Outpatient—Medical	Outpatient Part B Crossover (UB)	20 – Community Health Center (Chc)
Outpatient—Medical	Outpatient Part B Crossover (UB)	24 – Rehabilitation Center
Outpatient—Medical	Outpatient Part B Crossover (UB)	25 – Renal Dialysis Clinic
Outpatient—Medical	Outpatient Part B Crossover (UB)	75 – Semi Acute Outpatient Hospital
Outpatient—Medical	Outpatient Part B Crossover (UB)	80 – Acute Outpatient Hospital
Outpatient—Medical	Outpatient Part B Crossover (UB)	81 – Hospital Licensed Health Center (Hlhc)
Outpatient—Medical	Outpatient Part B Crossover (UB)	82 – Chronic Outpatient Hospital
Outpatient—Medical	Outpatient Part B Crossover (UB)	83 – Psychiatric Outpatient Hospital
Outpatient—Medical	Professional	100 – Unknown Clinic
Outpatient—Medical	Professional	120 – Chiropractor
Outpatient—Medical	Professional	130 – Dietitian
Outpatient—Medical	Professional	135 – Medical Technologists
Outpatient—Medical	Professional	140 – Midwife
Outpatient—Medical	Professional	145 – Nurse Practitioner
Outpatient—Medical	Professional	146 – Nursing Services
Outpatient—Medical	Professional	150 – Optometrist

continued

SERVICE TYPE CATEGORY (CATEGORIZED FOR STUDY)	CLAIM TYPE	PROVIDER TYPE
Outpatient—Medical	Professional	160 – Physician's Assistant
Outpatient—Medical	Professional	165 – Therapy (Physical)
Outpatient—Medical	Professional	190 – Health Educator
Outpatient—Medical	Professional	215 – Home Health Organization
Outpatient—Medical	Professional	220 – Imaging Center
Outpatient—Medical	Professional	225 – Laboratory
Outpatient—Medical	Professional	230 – Pharmacy
Outpatient—Medical	Professional	235 – Supply Center
Outpatient—Medical	Professional	240 – Vision Center
Outpatient—Medical	Professional	301 – General Hospital
Outpatient—Medical	Professional	302 – Certified Clinical Nurse Specialist
Outpatient—Medical	Professional	4 – Chronic Hospital-Outpatient
Outpatient—Medical	Professional	5 – Ambulatory Surgery Centers
Outpatient—Medical	Professional	50 – Physician
Outpatient—Medical	Professional	51 – Medical Doctor Md
Outpatient—Medical	Professional	53 – Allergy & Immunology
Outpatient—Medical	Professional	54 – Anesthesiology
Outpatient—Medical	Professional	56 – Dermatology
Outpatient—Medical	Professional	57 – Emergency Medicine
Outpatient—Medical	Professional	58 – Family Practice
Outpatient—Medical	Professional	59 – Geriatric Medicine
Outpatient—Medical	Professional	60 – Internist (Nec)
Outpatient—Medical	Professional	61 – Cardiovascular Diseases
Outpatient—Medical	Professional	62 – Critical Care Medicine
Outpatient—Medical	Professional	63 – Endocrinology/Metabolism
Outpatient—Medical	Professional	64 – Gastroenterology
Outpatient—Medical	Professional	65 – Hematology
Outpatient—Medical	Professional	66 – Infectious Disease
Outpatient—Medical	Professional	67 – Medical Oncology
Outpatient—Medical	Professional	68 – Nephrology
Outpatient—Medical	Professional	69 – Pulmonary Disease
Outpatient—Medical	Professional	70 – Rheumatology
Outpatient—Medical	Professional	71 – Neurological Surgery
Outpatient—Medical	Professional	72 – Nuclear Medicine
Outpatient—Medical	Professional	73 – Obstetrics/Gynecology
Outpatient—Medical	Professional	74 – Ophthalmology
Outpatient—Medical	Professional	75 – Orthopedic Surgery
Outpatient—Medical	Professional	76 – Otolaryngology
Outpatient—Medical	Professional	77 – Pathology
Outpatient—Medical	Professional	78 – Pediatrician (Nec)
Outpatient—Medical	Professional	79 – Pediatric Specialist

continued

SERVICE TYPE CATEGORY (CATEGORIZED FOR STUDY)	CLAIM TYPE	PROVIDER TYPE
Outpatient—Medical	Professional	80 – Physical Medicine And Rehabilitation
Outpatient—Medical	Professional	81 – Plastic Surgery/Maxillofacial Surgery
Outpatient—Medical	Professional	85 – Surgeon
Outpatient—Medical	Professional	86 – Surgical Specialist
Outpatient—Medical	Professional	87 – Thoracic Surgery
Outpatient—Medical	Professional	88 – Urology
Outpatient—Medical	Professional	99 – Podiatry
Outpatient—Medical	Professional	01 – Physician
Outpatient—Medical	Professional	02 – Optometrist
Outpatient—Medical	Professional	03 – Optician
Outpatient—Medical	Professional	04 – Ocularist
Outpatient—Medical	Professional	06 – Podiatrist
Outpatient—Medical	Professional	16 – Chiropractor
Outpatient—Medical	Professional	17 – Nurse Practitioner
Outpatient—Medical	Professional	20 – Community Health Center (Chc)
Outpatient—Medical	Professional	21 – Family Planning Agency
Outpatient—Medical	Professional	22 – Abortion/Sterilization Clinic
Outpatient—Medical	Professional	24 – Rehabilitation Center
Outpatient—Medical	Professional	25 – Renal Dialysis Clinic
Outpatient—Medical	Professional	42 – Oxygen And Respiratory Therapy Equip
Outpatient—Medical	Professional	43 – Prosthetics
Outpatient—Medical	Professional	44 – Hearing Instrument Specialist
Outpatient—Medical	Professional	45 – Independent Diagnostic Testing Facility (Idtf)
Outpatient—Medical	Professional	47 – Orthotics
Outpatient—Medical	Professional	50 – Audiologist
Outpatient—Medical	Professional	65 – Psychiatric Day Treatment
Outpatient—Medical	Professional	80 – Acute Outpatient Hospital
Outpatient—Medical	Professional	81 – Hospital Licensed Health Center (Hlhc)
Outpatient—Medical	Professional	84 – Ambulatory Surgery Center
Outpatient—Medical	Professional	97 – Group Practice Organization
Outpatient—Medical	Hospital Outpatient	1 – Acute Care Hospital
Outpatient—Medical	Hospital Outpatient	2 – Acute Care Hospital-Outpatient
Outpatient—Medical	Hospital Outpatient	215 – Home Health Organization
Outpatient—Medical	Hospital Outpatient	25 – Rehabilitation Facilities
Outpatient—Medical	Hospital Outpatient	250 – Community Health Center
Outpatient—Medical	Hospital Outpatient	301 – General Hospital
Outpatient—Medical	Hospital Outpatient	5 – Ambulatory Surgery Centers
Outpatient—Medical	Hospital Outpatient	50 – Physician
Outpatient—Medical	Hospital Outpatient	57 – Emergency Medicine
Outpatient—Medical	Hospital Outpatient	58 – Family Practice
Outpatient—Medical	Hospital Outpatient	60 – Internist (Nec)

continued

SERVICE TYPE CATEGORY (CATEGORIZED FOR STUDY)	CLAIM TYPE	PROVIDER TYPE
Outpatient—Medical	Hospital Outpatient	66 – Infectious Disease
Outpatient—Medical	Hospital Outpatient	73 – Obstetrics/Gynecology
Outpatient—Medical	Hospital Outpatient	79 – Pediatric Specialist
Outpatient—Medical	Hospital Outpatient	80 – Physical Medicine And Rehabilitation
Outpatient—Medical	Hospital Outpatient	75 – Semi Acute Outpatient Hospital
Outpatient—Medical	Hospital Outpatient	80 – Acute Outpatient Hospital
Outpatient—Medical	Hospital Outpatient	81 – Hospital Licensed Health Center (Hlhc)
Outpatient—Medical	Hospital Outpatient	82 – Chronic Outpatient Hospital
Outpatient—Medical	Unknown	20 – Community Health Center (Chc)
Pharmacy	Professional Part B Crossover	40 – Pharmacy
Pharmacy	Pharmacy	100 – Unknown Clinic
Pharmacy	Pharmacy	20 – Mental Health/Chemical Dep. (Nec)
Pharmacy	Pharmacy	230 – Pharmacy
Pharmacy	Pharmacy	301 – General Hospital
Pharmacy	Pharmacy	311 – Durable Medical Equipment
Pharmacy	Pharmacy	Unknown
Pharmacy	Pharmacy	20 – Community Health Center (Chc)
Pharmacy	Pharmacy	40 – Pharmacy
Pharmacy	Pharmacy	80 – Acute Outpatient Hospital
Pharmacy	Pharmacy	81 – Hospital Licensed Health Center (Hlhc)
Pharmacy	Unknown	40 – Pharmacy

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