



Impact of Medication-Assisted Treatment for Opioid Addiction on Medicaid Expenditures and Health Services Utilization Rates in Vermont



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ABSTRACT

In the face of increasing rates of overdose deaths, escalating health care costs, and the tremendous social costs of opioid addiction, policy makers are asked to address the questions of whether and how to expand access to treatment services. In response to an upward trend in opioid abuse and adverse outcomes, Vermont is investing in statewide expansion of a medication-assisted therapy program delivered in a network of community practices and specialized treatment centers (Hub & Spoke Program). This study was conducted to test the rationale for these investments and to establish a pre-Hub & Spoke baseline for evaluating the additive impact of the program. Using a serial cross-sectional design from 2008 to 2013 to evaluate medical claims for Vermont Medicaid beneficiaries with opioid dependence or addiction (6158 in the intervention group, 2494 in the control group), this study assesses the treatment and medical service expenditures for those receiving medication-assisted treatment compared to those receiving substance abuse treatment without medication. Results suggest that medication-assisted therapy is associated with reduced general health care expenditures and utilization, such as inpatient hospital admissions and outpatient emergency department visits, for Medicaid beneficiaries with opioid addiction. For state Medicaid leaders facing similar decisions on approaches to opioid addiction, these results provide early support for expanding medication-assisted treatment services rather than relying only on psychosocial, abstinence, or detoxification interventions.

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1. Introduction

1.1. Opioid Epidemic

Opioid addiction continues to grow as a public health problem with significant impacts on morbidity and mortality, health care expenditures, crime, and health outcomes. In 2013, 1.9 million Americans were dependent on pain relievers, and 517,000 were dependent on heroin (Substance Abuse and Mental Health Services Administration (SAMHSA), 2014a). Kolodny et al. estimated that this figure was closer to 5 million when including individuals with active opioid prescriptions who may also have been addicted (Kolodny, Courtwright, Hwang, et al., 2015). While use of prescription opioids has held steady or declined since 2002, heroin use has increased (Substance Abuse and Mental Health Services Administration (SAMHSA), 2014a). The growth in heroin use has carried over to patterns in mortality, which is increasing nationally (Department of Health and Human Services, 2015). In 2010, 3036 deaths resulted from heroin overdoses and 16,651 deaths from

opioid pain reliever overdoses. In 2013, heroin overdose deaths more than doubled to 8257 while opioid pain reliever overdose deaths dropped slightly to 16,235 (National Institute on Drug Abuse, 2015). Furthermore evidence associates nonmedical use of pain relievers with subsequent heroin use (Muhuri, Gfroerer, & Davies, 2013), highlighting the link between licit and illicit drug use and the need to address both as a continuum of the same epidemic.

Vermont's experience mirrors the national trend. Nonmedical use of prescription pain relievers among Vermonters age 12 years and older declined between 2012 and 2013 (from 4.6% to 3.7%; p -value <0.01), (Substance Abuse and Mental Health Services Administration (SAMHSA), 2014b) even as opiate-attributed deaths (from 39 to 68 per year) and overdoses (from 1.4 to 2.2 discharges per 10,000 people) increased from 2010 to 2013 (Vermont Department of Health, 2014a). Between 2008 and 2012, the average number of infants exposed to opiates at birth more than doubled, increasing from 17.8 births per 1000 hospital deliveries to 39.8 (Vermont Department of Health, 2014b). One possible explanation for the increase in adverse opioid-related outcomes is an increase in heroin use. The addictions treatment system intake experience appears to support this conclusion. From 2011 to 2013, the number of Vermonters receiving treatment for prescription opiates and heroin increased from 2864 (654 for heroin and 2210 for

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prescription opiates) to 3971 (1375 for heroin and 2596 for prescription opiates) — a 38.6% overall increase, with a 110.2% increase for heroin and a 17.5% increase for prescription opiates (Vermont Department of Health, 2014b).

The combination of increasing overdose deaths, opiate-exposed newborns, and demand for treatment services constituted a public health emergency, and Vermont policymakers determined that a systemic response was needed. However, in a small, rural state, policymakers must consider the cost of expanding access to treatment for opioid addiction and the impact on overall health care and medical service expenditures.

1.2. Treatment for Opioid Abuse or Dependence

Medication-assisted treatment (MAT) is defined by the U.S. Department of Health and Human Services' Center for Substance Abuse Treatment as “the use of medications, in combination with counseling and behavioral therapies to provide a whole patient approach to the treatment of substance use disorders” (Substance Abuse and Mental Health Services Administration (SAMHSA), 2016). The approach involves long-term use of medications and is akin to insulin use among people with diabetes. Evidence has demonstrated that MAT, the combination of medication and counseling, is more effective at treatment retention and reduction of heroin and prescription opiate abuse than using time-limited medication (i.e., opioid detoxification or tapering) or psychosocial and abstinence interventions; the latter approaches are associated with higher rates of relapse (Fullerton, Kim, Thomas, et al., 2014; Thomas, Fullerton, Kim, et al., 2014). Furthermore, maintenance MAT is associated with improved birth outcomes when given to opioid-addicted pregnant women, although neonatal abstinence syndrome remains a concern (Fullerton et al., 2014; Thomas et al., 2014). Both Fullerton et al. and Thomas et al. found mixed results on whether MAT affected the use of other illicit drugs, criminal behavior, and risk factors for human immunodeficiency virus (HIV) or hepatitis C virus (HCV). Other studies, however, do indicate an association between MAT and reduced overall mortality and specifically while in prison, recidivism, and treatment engagement among those recently released from prison (Degenhardt, Larney, Kimber, et al., 2014; Farrell-MacDonald, MacSwain, Cheverie, Tiesmaki, & Fischer, 2014; Larney, Gisev, Farrell, et al., 2014; Zaller et al., 2013).

1.3. Cost of Medication-Assisted Treatment for Opioid Abuse or Dependence

While the effectiveness of maintenance MAT in reducing opioid use has been demonstrated, the treatment itself comes with higher direct costs than tapering, abstinence, or psychosocial interventions. In 2009, \$866 million was spent across all payers on substance abuse prescription medicine, 93% of which went towards buprenorphine, one of the drugs used to treat opioid addiction (Substance Abuse and Mental Health Services Administration (SAMHSA), 2013). While the costs of methadone are negligible, the daily dosing and other services provided in opioid treatment programs (OTPs) where methadone is dispensed are relatively high.

However, the question remains as to whether MAT costs can be offset by reductions in other health care expenditures. Relatively few studies have examined the total cost of health care services for opioid addicts. Two studies have looked at data from commercial health insurance claims on the overall health care costs and utilization rates for those using MAT compared to those treated without MAT (Baser, Chalk, Fiellin, & Gastfriend, 2011; McCarty et al., 2010). McCarty et al. found that over a five-year period, members on MAT had 50% lower total annual health plan costs than those who had two or more visits to an addiction treatment department and no methadone and 62% lower than those with zero or one visit for addiction treatment and no methadone (McCarty et al., 2010). Baser et al. found that after a six-month period, those with MAT had significantly lower overall annual

health plan costs compared to those with no medication (\$10,192 vs. \$14,353; p-value <0.0001) (Baser et al., 2011). The difference was driven largely by lower inpatient services and non-opioid-related outpatient services for the group receiving medication (Baser et al., 2011).

McAdam-Marx et al. reported in 2010 that Medicaid beneficiaries with opioid abuse, dependence, or poisoning had nearly triple the total medical costs adjusted for baseline sample characteristics compared to beneficiaries matched by age, gender, and state with no opioid abuse diagnosis (\$23,556 vs. \$8436; p-value <0.001). The opioid dependence/abuse group also had higher prevalence of comorbidities, such as psychiatric disorders, pain-related diagnoses, and other substance abuse conditions (McAdam-Marx, Roland, Cleveland, & Oderda, 2010). While this study considered overall cost, it did not address MAT costs in particular or any impact treatment may have had on overall cost.

Focusing specifically on a Medicaid population is important for two reasons. First, Medicaid beneficiaries as a population remain at greater risk for substance abuse, including opioid addiction and overdose. Approximately 12% of Medicaid beneficiaries between ages 18 and 64 years has a substance use disorder (Mann, Frieden, Hyde, Volkow, & Koob, 2014). In Washington State, the U.S. Centers for Disease Control and Prevention (CDC) found that between 2004 and 2007, 45.5% of fatal prescription opioid painkiller overdoses involved people enrolled in Medicaid (Coolen, Best, Lima, Sabel, & Paulozzi, 2009). Second, Medicaid's share of all substance abuse expenditures has increased from 9% to 21% between 1986 and 2009 (Substance Abuse and Mental Health Services Administration (SAMHSA), 2013). This equates to Medicaid spending approximately \$5 billion in 2009 on substance abuse treatment, an amount that includes federal, state, and local funds. This dollar amount and the findings by McAdam-Marx et al. (2010) indicate that state Medicaid programs have an interest in understanding the potential impact of expanding MAT services on total expenditures and utilization of medical services.

This study examines Vermont's Medicaid expenditures for opioid addiction treatment and other medical and non-medical services, including special Medicaid services (SMS), which are services uniquely reimbursed by Medicaid that target social, economic, and rehabilitative needs (e.g., transportation, home and community-based services, case management, dental, residential treatment, day treatment, mental health facilities, and school-based services). More explicitly, it compares the health care expenditures between two groups with opioid addiction: those receiving MAT (“MAT group”), specifically methadone or buprenorphine, and those receiving non-medication treatment approaches, such as behavioral therapies alone (“non-MAT group”), with the goal of assessing the cost effectiveness of MAT and establishing baseline data against which expanded and enhanced treatment access can be evaluated.

2. Material and Methods

2.1. Data Source and Sample Population

This study reviewed annual medical expenditures and utilization rates (per person) for Vermont Medicaid enrollees from 2008 to 2013 who were identified as having an opioid addiction or dependency. The data source for this study was Vermont's all-payer claims database, the Vermont Health Care Uniform Reporting and Evaluation System (VHCURES). Due to limitations arising from the statutorily-mandated de-identified status of VHCURES, this study could not use a cohort design, but instead relied on annual cross-sectional data for each year in the study period.

The study population included members with Medicaid coverage, ages 18–64 years, who had claims in VHCURES indicating treatment for opioid addiction between the calendar years 2008 and 2013. Within each year, members participating in MAT were compared to members with opioid addiction receiving non-MAT therapies. Expenditures and

Table 1

Summary health & demographics for the study population, unique count of Medicaid patients for the years 2008 to 2013.

Demographic/Health characteristic	MAT		Non-MAT		χ^2 P-value
	Member count	%	Member count	%	
N	6158	71.2%	2494	28.8%	
Age (in years), females*					
18–34, female	2450	79.0%	711	64.3%	<0.001
35–44, female	634	20.4%	222	20.1%	
45–64, female	294	9.5%	205	18.6%	
Age (in years), males*					
18–34, male	2259	73.8%	898	64.6%	<0.001
35–44, male	724	23.7%	271	19.5%	
45–64, male	330	10.8%	256	18.4%	
3 M™ Clinical Risk Group (CRG)*					
Opioid-addicted only (CRG category 1)†	644	10.5%	494	19.8%	<0.001
Acute illness or minor chronic disease (CRGs 2–4)	275	4.5%	334	13.4%	
Single dominant or moderate chronic disease (CRG 5)	5350	86.9%	1522	61.0%	
Significant chronic disease, multi-organ system (CRG 6)	1637	26.6%	605	24.3%	
Cancer/Catastrophic condition (CRGs 7–9)	56	0.9%	45	1.8%	
Women with pre- and perinatal care (denominator is females)	962	31.0%	142	12.9%	<0.001
Hepatitis C virus (HCV) diagnosis	1267	20.6%	249	10.0%	<0.001
Medicaid in the prior year	5473	88.9%	2035	81.6%	<0.001
Serious mental health disorder	1328	21.6%	509	20.4%	0.234
Chronic disease					
Asthma	1384	22.5%	448	18.0%	<0.001
Attention deficit hyperactivity disorder (ADHD)	803	13.0%	203	8.1%	<0.001
Coronary heart disease	33	0.5%	19	0.8%	0.218
Chronic obstructive pulmonary disorder (COPD)	137	2.2%	69	2.8%	0.134
Depression	3125	50.7%	1072	43.0%	<0.001
Hypertension	425	6.9%	215	8.6%	0.006
Diabetes	161	2.6%	92	3.7%	0.007

* Since individuals can be in multiple age and clinical risk groups over the span of the study period, the sum of the percentages exceeds 100%.

† Members without additional comorbidities or complicating diagnoses.

selected utilization measures were evaluated for the MAT and non-MAT groups over the six-year period.

The inclusion criteria for the MAT group were based on claims data for the two primary drugs used in MAT: methadone and buprenorphine. Methadone is dispensed only at designated treatment facilities (Opioid Treatment Programs or OTPs). Prior to 2013 in Vermont, buprenorphine was prescribed only in general medical offices by authorized physicians (Office Based Opioid Treatment or OBOT). Members receiving methadone treatment were selected using the Healthcare Common Procedure Coding System (HCPCS) program code H0020 in the claims data. Members receiving buprenorphine treatment were selected using a list of National Drug Codes (NDCs), with the exclusion of any form of buprenorphine when prescribed specifically for pain management. In addition, patients under any treatment for chronic pain were excluded.

The non-MAT comparison group was also identified using claims data. These included members who never received MAT and had at least two opioid addiction diagnoses (i.e., ICD-9 codes 304.00, 304.01, 304.02, 304.70, 304.71, 304.72) on different dates of service, suggesting ongoing addiction. The opioid addiction treatment for the non-MAT population included individual and group outpatient services, intensive outpatient programs, partial hospitalization, detoxification, and residential treatment services identified from the claims data using HCPCS and revenue codes.¹ As in the MAT group, patients under any treatment for chronic pain were excluded.

For each calendar year, MAT and non-MAT members were evaluated using demographics and health status (Table 1). Demographic measures included age, gender, and county of residence. Health status indicators included major mental health disorders (i.e., schizophrenia,

major depression, bipolar and other psychoses), selected chronic disease diagnoses (i.e., asthma, attention deficit hyperactivity disorder (ADHD), chronic obstructive pulmonary disorder (COPD), congestive heart failure, coronary heart disease, depression, diabetes, and hypertension), and 3 M™ Clinical Risk Group (CRG) categories, which were used to identify differences in health status for other conditions (e.g., cancer) among the MAT and non-MAT populations. For purposes of ensuring a large enough subsample, the CRG categories were grouped into five categories: opioid-addicted only (which included those addicted or dependent on opioids with no comorbidities or complicating diagnoses); having a history of significant acute disease, a single minor chronic disease, or minor chronic disease in multiple organ systems; having a single dominant or moderate chronic disease; having significant chronic disease in multiple organ systems; and having dominant chronic disease in three or more organ systems, metastatic and complicated malignancies, or catastrophic conditions. Members with claims indicating pre- and perinatal care or HCV positivity were also identified. A measure of continuity of enrollment in Medicaid (“Medicaid in the Prior Year”) was assigned for a member who was enrolled in Medicaid during both the study period year and the prior year.

2.2. Statistical Analysis

To reduce the effect of extreme outlier cases, total expenditures were capped at the 99th percentile for each group (Centers for Medicare and Medicaid Services, 2014).

Demographic data for each group was compared with a χ^2 goodness of fit test with the significance level set at 0.05 (Table 1). Multivariable linear regression models were used to evaluate the expenditure and utilization dependent variables that were derived from claims data. Expenditure and utilization measures included those listed in Table 2.

The “Total Expenditures” model included the costs of all medical services and the costs associated with opioid addiction treatments for both the MAT group and the non-MAT group, as described above. The “Total Expenditures without Treatment” model excluded all opioid addiction treatment costs to determine the impact of MAT on medical

¹ HCPCS and Revenue Codes: G0176, G0177, H0001, H0002, H0004, H0005, H0006, H0014, H0016, H0020, H0022, H0028, H0031, H0032, H0036, H0037, H0046, H0047, H2017, H2018, H2019, H2020, H2027, H2033, H2035, H2036, S9475, T1006, T1007, T1011, T1012, 0907, 90,801, 90,802, 90,804, 90,805, 90,806, 90,807, 90,808, 90,809, 90,810, 90,811, 90,812, 90,813, 90,814, 90,815, 90,845, 90,846, 90,847, 90,849, 90,853, 90,857, 90,862, 90,875, 90,876, 90,880, H0015, S9480, T1008, 0905, 0906, H0010, H0011, H0012, H0013, H0018, H0019, T2048, 1002, 90,816, 90,817, 90,818, 90,819, 90,821, 90,822, 90,823, 90,834, 90,826, 90,827, 90,828, 90,829, H0017, H2013, H0008, H0009, H0035, S0201, H2034, 1004

Table 2
Adjusted average annual expenditures and utilization rates[†].

	MAT group	Non-MAT	Difference [‡]	P-value
Expenditures				
Total expenditures	\$14,468	\$14,880	−\$412	0.07
Total expenditures without treatment	\$ 8794	\$11,203	−\$2409	<0.01
Buprenorphine expenditures	\$2708	−\$47	\$2755	<0.01
Total prescription expenditures	\$4461	\$2166	\$2295	<0.01
Inpatient expenditures	\$2132	\$3757	−\$1625	<0.01
Outpatient expenditures	\$345	\$604	−\$259	<0.01
Professional expenditures	\$674	\$981	−\$307	<0.01
SMS expenditures [*]	\$2872	\$4160	−\$1288	<0.01
Utilization (rate/person)				
Inpatient days	1.54	3.00	−1.46	<0.01
Inpatient discharges	0.30	0.52	−0.22	<0.01
ED visits	1.44	2.48	−1.04	<0.01
Primary care physician visits	15.27	9.81	5.46	<0.01
Advanced imaging	0.29	0.54	−0.25	<0.01
Standard imaging	0.76	1.43	−0.67	<0.01
Colonoscopy	0.01	0.02	−0.01	<0.01
Echography	0.46	0.53	−0.07	0.002
Medical specialist visits	0.49	0.82	−0.33	<0.01
Surgical specialist visits	3.04	1.89	1.15	<0.01

* SMS refers to special Medicaid services and include transportation, home and community-based services, case management, dental, residential treatment, day treatment, mental health facilities, and school-based services.

[†] Multivariable regression analysis, adjusted for gender, age, calendar year, clinical risk groups, Medicaid in the prior year, hepatitis C virus (HCV) status, and pre- and perinatal care.

[‡] Difference = MAT – non-MAT.

expenditures alone. All expenditure outcomes and utilization rates listed in Table 2 were adjusted for partial enrollment within the calendar year and the independent variables included MAT status, gender, age group, pre- and perinatal status, HCV status, “Medicaid in prior year” status, and health status as measured by CRGs. Chronic diseases and mental health disorders were excluded from the regression because they were encompassed by the CRGs. The independent variable of MAT v. non-MAT was created as a binary (0/1) variable, as were “Women with pre- and perinatal care”, HCV, and “Medicaid in the prior year”. The remaining were multi-level indicator variables - the model adjusted for age and gender groups using males 18–34 as the reference group, and health status based on CRG groups using “opioid-addicted only” as the reference group.

All statistical analysis was done with SAS version 9.3.

3. Results

3.1. Sample Population and Demographics

Over the period from 2008 to 2013, we identified 6158 unique Medicaid beneficiaries with a diagnosis for opioid misuse and health care claims for MAT, and 2494 unique Medicaid patients with a diagnosis of opioid misuse but no claims for MAT. Table 1 compares the health status and demographics for Medicaid members who received MAT and non-MAT treatment between 2008 and 2013. The MAT group was slightly younger with higher proportion of 18–34 year olds in both genders (79.0% vs. 64.3% for females and 73.8% vs. 64.6% for males). Overall the MAT group was more likely to be female (50.3% vs. 44.3%; p-value <0.001). In line with this trend, MAT members had a higher rate of pre- and perinatal care compared to non-MAT (16% vs 6%). MAT members also had a higher prevalence of known positive tests for HCV (21% vs 10%) and were more likely than non-MAT to have continuity of coverage in Medicaid as indicated by having Medicaid in the prior year (88.9% vs. 81.6%). The prevalence of members with serious mental health disorders (e.g., schizophrenia, major depression, bipolar and other psychoses) in MAT was slightly higher than non-

MAT (22% vs. 20%), but the difference was not statistically significant (p-value = 0.23).

Table 1 also compares risks groups and prevalence of select conditions between the two groups. Based on the χ^2 goodness of fit test, there was significant difference in the distribution of the risk groups among the MAT and non-MAT groups. The non-MAT group had higher proportions categorized as opioid-addicted only (i.e., those with opioid addiction or dependency but without comorbidities or complicating diagnoses) or as having acute illness or a minor chronic disease. The MAT group had higher proportions with a single dominant or moderate chronic disease or a significant chronic disease in multiple organ systems. Both groups had low rates of cancer and catastrophic conditions. Of the selected chronic conditions with significant differences between the two groups, MAT had higher prevalence of ADHD, depression, and asthma and a lower prevalence of hypertension and diabetes.

3.2. Multivariable Regression Results

Table 2 shows the adjusted expenditure and utilization rates per person for the MAT and the non-MAT groups and the differences between the two study populations. In all categories of expenditures except prescriptions, members of the MAT group had lower costs. For total medical expenditures, including treatment costs, the MAT group's annual expenditures were \$412 less than the non-MAT group's expenditures, although this difference was not significant (p-value: 0.07). When opioid addiction treatment costs for both groups were excluded, the difference in annual expenditures of the MAT group relative to the non-MAT group grew to −\$2409 (p-value: <0.01). In each of the four expenditure subcategories (inpatient, outpatient, professional services, and special Medicaid services expenditures) the MAT group's medical expenditures were significantly lower, with the largest difference seen in inpatient expenditures (−\$1625). For the utilization categories (Table 2), the MAT group has significantly lower utilization rates per person across all categories except for primary care physician visits and surgical specialist visits.

The expenditure models also found that, independent of MAT status, a positive diagnosis of HCV was associated with significantly higher costs for both models: \$3518 (p-value: <0.01) in the “Total Expenditures” model and \$2679 (p-value: <0.01) in the “Total Expenditures Without Treatment Costs” model. Conversely, being enrolled in Medicaid in the previous year was associated with lower costs: −\$1169 (p-value: <0.01) in the “Total Expenditures” model and −\$630 (p-value: 0.01) in the “Total Expenditures without Treatment Costs” model.

4. Discussion

4.1. Findings

The results indicated that the overall difference in annual average expenditures was lower for the MAT group, even with the cost of MAT, but not significantly lower. However, when opioid addiction treatment costs were removed, the MAT group had substantial and statistically significant lower health care costs overall compared to the non-MAT group. This was especially noteworthy given the MAT group's higher rates of pre- and perinatal care, HCV positivity, and more severe health status according to risk groupings (higher proportions of young females and higher rates of pre- and perinatal care were expected because pregnant women were prioritized for MAT treatment, especially in OTPs). Evaluation of the utilization rates suggests that reduction in cost was due, in part, to lower inpatient admissions and outpatient hospital emergency department visits. The higher rate of primary care visits for the MAT group was expected since buprenorphine is prescribed in general medical offices. It may also indicate that MAT may be successfully linking patients with preventive care services. The increased utilization of the surgical specialists and the decreased utilization of imaging services will require additional analysis to identify the reasons for

these trends. Overall, however, this study, in conjunction with the many studies supporting MAT treatment efficacy, suggests that expanding Vermont's MAT services for its Medicaid-enrolled population has the potential to produce better opioid addiction treatment results and lower overall health care costs compared to other approaches to opioid addiction treatment.

The findings also indicate that more continuous enrollment in Medicaid was associated with reduced expenditures independent of the MAT program. One interpretation of this result is that newly insured members tended to have higher initial health care utilization if they had been without it beforehand, and their continued enrollment led to a reduction in health care expenditures. Further study is needed to evaluate this conclusion and its implications on expanding MAT services.

Another point addressed in the results is the prevalence of HCV among the opioid-addicted population. As noted in Table 1, 20.6% of MAT members and 10.0% of non-MAT members were diagnosed with HCV between 2008 and 2013. By comparison, chronic HCV prevalence in the US is approximately 0.8% (Centers for Disease Control and Prevention (CDC), 2016). Further inquiry into the reasons behind this difference should be pursued, such as whether there is increased HCV screening for MAT patients, a possibility supported by another study (Larney, Grebely, Falster, et al., 2015), or greater referral among Medicaid beneficiaries with HCV to MAT services. Additionally, further analysis should evaluate the factors contributing to cost such as severity of HCV-associated disease and treatment-seeking patterns. HCV treatment is expensive, especially the combination therapies involving the relatively new sofosbuvir and ledipasvir approved after the time frame for this study; however, these drugs have significantly reduced side effects and treatment times (6–12 weeks vs. 24–48 weeks) and produce higher cure rates (85%–95% vs. 50%–80%) than the traditional pegylated-interferon with riboviron therapy (Centers for Disease Control and Prevention (CDC), 2016). Should MAT provide a means for improved HCV detection through increased screening, MAT may have the added benefit of reducing HCV transmission (Tsui, Evans, Lum, Hahn, & Page, 2014; White, Dore, Lloyd, Rawlinson, & Maher, 2014) and the medical complications that arise from chronic HCV infection.

4.2. Limitations

While VHCURES data have been validated as a reliable data source (Hoffer & Stein, 2014), they do have some limitations relevant to this study. First, as mentioned above, the de-identified status of VHCURES makes cohort studies difficult; therefore we used annual cross-sectional for each year in the study period.

Second, the dataset did not allow for the estimation of methadone costs in isolation. The HCPCS program code, which is used to identify MAT members receiving methadone and their treatment costs, combines medication and health home services. Furthermore, methadone is not present in pharmacy claims, limiting the ability to find treated members and isolate methadone medication costs.

Third, the data may include some bias due to the influence of outliers. While outliers were capped at the 99th percentile, they could still potentially influence the results given the small sample size. However, since the yearly dollar amounts were consistent (data not shown), this influence is likely minimal.

Finally, a few unmeasurable confounders could also have introduced bias to this study such as unaccounted differences in the severity of opioid addiction between the MAT and non-MAT groups and access to treatment. Additional studies on these factors would improve further evaluations of MAT.

5. Conclusion

Given that total health care expenditures did not differ significantly (p -value: 0.07) even with the higher costs of MAT services and medications, the outlook for a statewide program focused on providing

maintenance MAT is favorable. While the total addictions treatment costs were higher for the MAT group, these were offset by much lower health care utilization and expenditures, indicating an insignificant overall cost difference between the MAT and non-MAT groups. While causation cannot be determined in this study, the results, along with strong evidence that maintenance MAT is more effective at achieving treatment retention and reducing opioid use (Fullerton et al., 2014; Thomas et al., 2014), present a persuasive argument for expanding a MAT-centered opiate addiction treatment program throughout the state of Vermont.

Toward the end of this study's time frame (mid-2013), Vermont, through its health care delivery reform program, the Vermont Blueprint for Health, began to roll out a comprehensive services design built on MAT and the opportunity for Health Homes offered under the Affordable Care Act. The goal of this program, also known as Hub (OTPs) and Spoke (OBOT or buprenorphine-prescribing providers), was to expand access to methadone, enhance methadone treatment programs by linking Health Home Services with primary and community services, and providing clinical staff to support and complement primary care providers waived to prescribe buprenorphine.

The results of this study serve as a strong baseline by which to evaluate Vermont's Hub and Spoke program and to assess whether the reduction in medical costs have continued under the program's service enhancements. Additionally, the methodology employed in this study will be expanded to analyze the impact of MAT beyond health care, such as on incarceration rates, employment rates, and rates of child and family services. These subsequent studies will provide a fuller understanding of the societal costs and savings of opioid addiction and treatment.

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