

The Economic Burden of the Opioid Epidemic on States: The Case of Medicaid

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Overview

The opioid epidemic is a public health crisis that affects all levels of society. As the prevalence of opioid use disorder increases, the associated costs also rise. In this study, we focus on the costs to state Medicaid programs as they pertain to the opioid epidemic.

We used data from the Medicaid Analytical eXtract (MAX) files from 17 states that had complete data from 1999 to 2013 to examine the costs to state Medicaid programs associated with opioid use disorder (OUD). We included inpatient, outpatient, and prescription medication costs related to the treatment of OUD, as well as excess costs for other healthcare services (eg, general medical care) for individuals with OUD relative to a comparison group matched on age, gender, and state. We examined the changes that occurred over the study period in Medicaid enrollees with OUD and the total costs to Medicaid for these individuals. Finally, we extrapolated our results from the 17 states in the sample to the entire United States Medicaid population. All costs were adjusted for inflation and are reported in 2017 US dollars:

- Although several studies have examined healthcare costs that are attributable to OUD, few have explicitly taken the perspective of state Medicaid. Results from previous studies indicate that the total state Medicaid spending on substance use disorder services, the medications used to treat OUD, and the treatment of newborns with prenatal exposure to opioids is considerable.
- In our 17-state sample, the total Medicaid costs associated with OUD have more than tripled between 1999 and 2013, reaching more than \$3 billion in 2013. After extrapolating these results to all 50 states, state Medicaid costs associated with the opioid epidemic totaled more than \$8.4 billion in 2013.
- Although the cost of OUD treatment increased over time, most of the growth was driven by the rise in costs for other healthcare services. By 2013, costs for other healthcare services comprised 70.1% of total Medicaid costs associated with OUD, compared with 52.4% in 1999.
- Further research is needed to determine what factors have contributed to the increase in state health insurance costs that are attributed to OUD.

ABSTRACT

The societal burden of opioid use disorder (OUD) is considerable and contributes to increased healthcare costs and overdose deaths. However, the burden is not well understood. The purpose of this analysis is to estimate the state Medicaid programs' costs for treating OUD and how these costs have changed over time. We used data from the Medicaid Analytic eXtract files from 17 states between 1999 and 2013 to examine the healthcare costs associated with OUD. Inpatient, outpatient, and prescription medication costs related to the treatment of OUD were included, as were excess costs for other healthcare services (eg, general medical care) for individuals with OUD relative to a comparison group of individuals without OUD matched on age, sex, and state. We then extrapolated our results to the entire US Medicaid population using population-based sample weights. All costs were adjusted for inflation and are reported in 2017 US dollars. During our study period, the number of patients who were diagnosed with OUD increased 378%, from 39,109 (0.21% of total Medicaid enrollment) in 1999 to 186,979 (0.60% of total Medicaid enrollment) in 2013 in our 17-state sample. Even after adjusting for inflation, total Medicaid costs associated with OUD more than tripled during this time, reaching more than \$3 billion in 2013, from \$919 million in 1999. Most of this growth was due to excess non-OUD treatment costs for patients with OUD, which increased 363% over the period; the rate of growth is triple the expenditures for OUD treatment services. When the results were extrapolated to the entire United States, the Medicaid costs associated with OUD increased from more than \$2 billion in 1999 to more than \$8 billion in 2013. The total cumulative costs that were associated with OUD for this extrapolated 50-state sample over a 15-year time period amounts to more than \$72.4 billion. OUD imposes considerable financial burden on state Medicaid programs, and the burden is increasing over time.

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For author information and disclosures, see end of text.

Summary Of Background Prevalence and Economic Impact of Opioid Use Disorder

OUD affects 2.5 million Americans¹ and is prevalent across all age groups and backgrounds. It has contributed to increasing injection drug use as well as the spread of infectious diseases, such as HIV and hepatitis C.²⁻⁴ The growth of OUD has resulted in increases of healthcare costs and of opioid overdose deaths.⁵ Estimates of overall societal costs (ie, healthcare, criminal justice, and workplace costs) associated with OUD have risen from \$11.8 billion in 2001,⁶ to \$55.7 billion in 2007,⁷ and \$78.5 billion in 2016.⁸

Individuals with OUD are more likely than those without OUD to use medical services, such as physician outpatient visits, emergency department (ED) services, and inpatient hospital stays.⁹ They also have a higher prevalence of comorbid conditions, such as other substance use disorders, psychiatric disorders, and pain-related diagnoses.¹⁰ Hospitalization rates for patients with OUD have more than doubled, from 117 admissions per 100,000 in 1993 to 296 admissions per 100,000 in 2012.¹¹ The Agency for Healthcare Research and Quality estimates that OUD-related ED visits have grown at a rate of 8% per year since 2005,¹² while the rate of overdose deaths involving opioids increased 200% between 2000 and 2014.¹³ Undiagnosed OUD is also expensive, with estimated costs equal to 80% of the costs of diagnosed OUD.¹⁴

Medicaid beneficiaries are at a greater risk for substance use disorders, including OUD,¹⁰ with approximately 12% of beneficiaries aged between 18 and 64 years diagnosed.¹⁵ Medicaid beneficiaries also have 50% to 100% higher rates of mental and substance use disorders compared with the general population.¹⁶ These rates exceed those of other insurance groups.¹⁶ Results of a Kentucky study found that 60% of Medicaid recipients with chronic pain both used illicit drugs and misused prescription drugs.¹⁷ In addition, Medicaid pays an estimated mean cost of \$18,511 per OUD-related ED visit.¹⁸ Because Medicaid also pays for one-fourth to one-third of all OUD treatment episodes,^{19,20} costs are a critically important component of the current opioid crisis in the United States.

Cost of Medication-Assisted Treatment for Opioid Use Disorder

Treatment options for OUD include medication and counseling. Medication-assisted treatment, a combination of medications and counseling, is associated with fewer relapses than medication alone.^{21,22} Medications used to treat OUD include methadone, buprenorphine, and naltrexone (the long-acting injectable form of naltrexone, Vivitrol, is most common). Buprenorphine, an opioid agonist, is associated with a high cost and limited prescribing capacity.²³ Wen et al examined whether the Medicaid expansion of 2014 and the increased prescribing capacity affected buprenorphine use that is covered by Medicaid. The authors found that the

expansion was associated with a 70% increase in Medicaid-covered buprenorphine prescriptions and a 50% increase in buprenorphine spending.²³ Additionally, although the expansion greatly improved access to OUD medication therapy, it also increased Medicaid expenditures for OUD treatments.²³

Almost one-third of patients who receive treatments for substance use disorder are covered by Medicaid.²⁴ Medicaid expenditures related to substance use disorders rose from 9% of the total spending on substance use disorders in 1986 to 21% in 2009.²⁵ In 2009 alone, Medicaid accounted for 21% of the \$24 billion that health insurers spent treating substance use disorders,²⁵ although this amounted to slightly less than 1% of total Medicaid spending.²⁶ Between 2011 and 2016, Medicaid spending on buprenorphine, naltrexone, and naloxone (a medication that blocks the effects of opioids and is used in overdose situations) increased 136%, from \$394.2 million to \$929.9 million.²⁷ An estimated 14.6% of people with OUD received medication therapy in 2014.²⁸ With the annual excess healthcare costs for individuals with OUD ranging from \$5874 to \$15,183,⁹ the already high costs of treating individuals with OUD will likely continue to grow, and the burden on Medicaid will likely continue to increase.

Pregnancy, Delivery, Maternal, and Child Outcomes Related to Opioid Use

Prenatal exposure to opioids also poses physiological risks and complications for newborns, such as cleft lip and palate, low birth weight, preterm labor, placental abruption, and neurological problems.^{29,30} Infants exposed to opioids prenatally have a 50% to 80% chance of developing neonatal withdrawal,³¹⁻³³ known as neonatal abstinence syndrome (NAS). The opioid epidemic has caused NAS to become a public health challenge, with a 5-fold increase in the incidence of NAS between 2000 and 2012.³⁴⁻³⁷ This increase in incidence accounts for an estimated \$1.5 billion in annual hospital expenditures across the United States.^{34,37} Although state Medicaid programs provide 78% of medical coverage for pregnant women³⁴⁻³⁶ and 77.6% of NAS costs are attributed to state Medicaid programs,³⁸ we do not examine these costs in this paper, but instead leave them for other companion articles in this special issue (see pages S264 and S270).^{39,40}

Based on this literature, it is clear that state Medicaid programs bear a particularly large economic burden of the opioid epidemic. In 2015, Medicaid covered 3 of 10 people with OUD.⁵ With a higher rate of mental and substance use disorders, the Medicaid population is more vulnerable to OUD. The magnitude of this burden and how it has changed over time, however, has not been well documented. The objective of this study was to use data from the Medicaid programs in multiple states over several years to document the economic burden of OUD on state Medicaid programs nationally.

Conceptual Framework

Based on the literature and the various components that make up OUD expenditures, we developed the following framework to describe how OUD could drive up state Medicaid expenditures. Although some states may have other programs that provide treatment for OUD, the current study focuses only on state Medicaid programs. As illustrated in **Figure 1**, patients with pain conditions may begin using prescribed opioid medications. As patients continue using their medications, they may become addicted and switch to heroin as access to additional opioid pain medications becomes more difficult; their medications may be intentionally or unintentionally diverted to other people. All of these paths end with a diagnosis of OUD. Often, treatment for individuals with OUD is initiated in the ED and leads to further healthcare service use that is reimbursed by health insurance. In the conceptual model, insurance-covered treatments for OUD consist of inpatient services (eg, hospitalizations and residential rehabilitation services), outpatient services (eg, counseling services), and prescription medications (ie, methadone, buprenorphine, and naltrexone). Because the perspective of the cost analysis is that of the state, we include only state expenditures and do not include patient out-of-pocket payments.

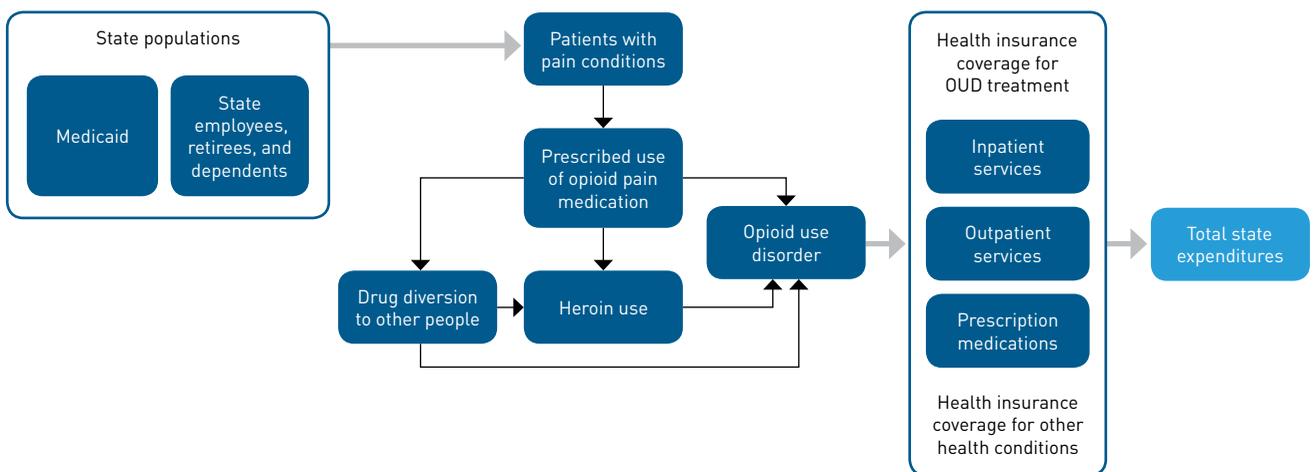
Below, we estimate the costs to state Medicaid programs, which provide the bulk of care for OUD, that are attributable to the opioid epidemic. Expenditures associated with OUD have 2 components. First, we identify all inpatient, outpatient, and prescription medication services that have an associated diagnosis code or Food and Drug Administration indication corresponding to OUD. Then, we add the Medicaid expenditures for these services to derive the total cost of OUD treatment to the state Medicaid program. Because

individuals with OUD may be more likely to have other health problems, such as infections, injuries/accidents, and poor control of chronic conditions (eg, diabetes or hypertension), we also compare the total Medicaid healthcare expenditures for individuals with OUD with an age-, sex-, and state-matched comparison group of patients who do not have a diagnosis of OUD. This approach allows us to capture both the expenditures directly related to OUD treatment and the expenditures associated with other poor health outcomes that may be related to OUD.

Gross Cost Estimates

For this analysis, we used data from MAX files, which is a set of person-level data files with information on Medicaid eligibility, service utilization, and payments that was developed by Centers for Medicare and Medicaid Services (CMS) to support research and policy analysis about Medicaid populations. The claims data contain both fee-for-service and Medicaid managed care claims. Managed care contracts have become increasingly common in Medicaid, and managed care encounter claims have been shown to be complete and of comparable quality with fee-for-service claims.⁴¹ Until recently, information about treatments for substance use disorders was not available from Medicaid databases after the redaction of such claims under federal law.⁴² When this rule was changed in 2017, it allowed CMS to include substance use disorder claims in MAX data for every year.^{43,44} MAX data are available through the Pennsylvania State University Virtual Research Data Center. Seventeen states (California, Georgia, Idaho, Iowa, Louisiana, Michigan, Minnesota, Mississippi, Missouri, New Jersey, Pennsylvania, South Dakota, Tennessee, Utah, Vermont, West Virginia, and Wyoming) had complete MAX data from 1999 to 2013 that were available for the analysis.

FIGURE 1. Conceptual Framework for Paths That Lead to OUD Expenditures



OUD indicates opioid use disorder.

The analytic sample included individuals with a diagnosis of OUD. Following previous studies,⁴⁵ we used a broad definition of OUD that included any inpatient or outpatient visit with a diagnosis of opioid (prescription pain medications or heroin) abuse, dependence, poisoning, or adverse effects (*International Classification of Diseases, Ninth Revision* codes 304.0, 304.7, 305.5, 965.0, E850.0-E850.2, E935.0-E935.2) but excluded self-inflicted poisoning (E950.0-E950.5) and assault by poisoning (E962.0). We also identified a comparison group of individuals without a diagnosis of OUD, matched 1-to-1 with the OUD sample by state, age, and sex.

For both the OUD and comparison cohorts, Medicaid expenditures were computed per individual per year by adding the “Medicaid payment amount” variable across all claims (inpatient, long-term care, outpatient, and prescription drug) during the year. The “Medicaid payment amount” indicates the total amount of money paid by Medicaid for the service. Medicaid expenditures for OUD treatment were computed by adding 1) the Medicaid payment amount across all claims (inpatient, long-term care, and outpatient) that had an associated diagnosis code of OUD, and 2) prescription drug claims for medications used to treat OUD (methadone, buprenorphine, and long-acting injectable naltrexone). Some managed care claims for OUD rehabilitation services were set to zero because Medicaid managed care plans are paid a capitated amount per enrollee rather than per service provided, as in a fee-for-service plan. We replaced

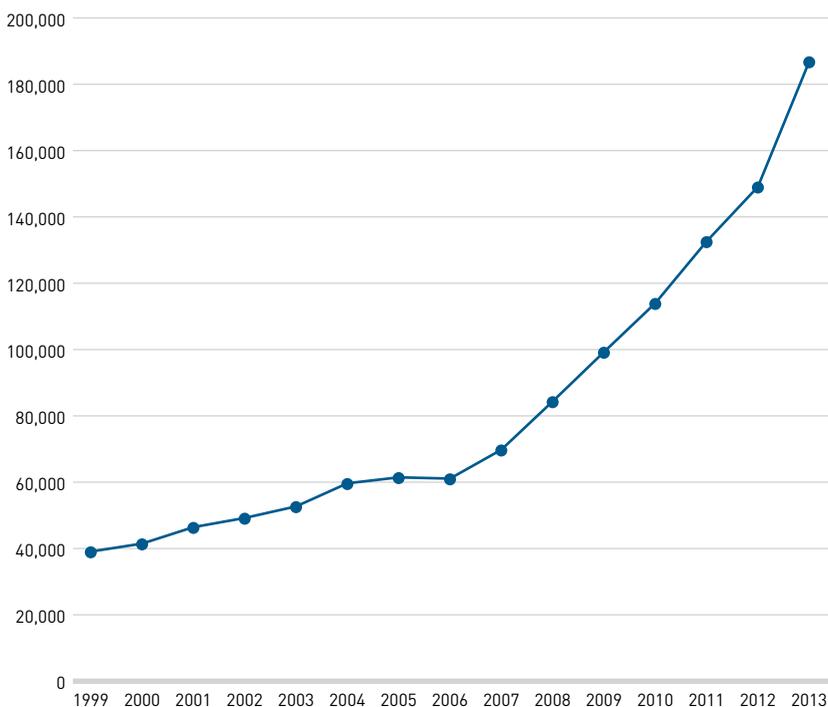
the zero cost of these claims with the average payments among the fee-for-service claims. Because patients with OUD may also have higher healthcare costs for other conditions (eg, infections or poor adherence to treatment for chronic conditions), we also computed Medicaid expenditures for non-OUD services for both the OUD and comparison cohorts. Total OUD-related Medicaid expenditures were then defined as the sum of the OUD treatment costs and the excess non-OUD costs (non-OUD costs in the OUD group minus the non-OUD costs in the comparison group). Expenditures were then Winsorized at the first and 99th percentiles to reduce the influence of outliers.⁴⁶ All expenditures were adjusted for inflation using the Medical Care component of the Consumer Price Index and are reported in 2017 US dollars.

As shown in **Figure 2**, the number of patients with OUD increased substantially over time in our 17-state sample, from 39,109 in 1999 to 186,979 in 2013; this is an increase of 378%. Average annual Medicaid expenditures per patient for patients with OUD and the matched comparison group of patients without OUD are presented in the **Table**, and total Medicaid expenditures are presented in **Figure 3**. The total OUD-related Medicaid expenditures (the sum of OUD treatment costs and excess non-OUD costs) had an increase of 246%, from \$919 million in 1999 to \$3.18 billion in 2013. OUD treatment expenditures increased 118%, from \$438 million in 1999 to \$952 million in 2013. Excess non-OUD costs increased more (363%) from

\$482 million in 1999 to \$2.23 billion in 2013. In 1999, OUD treatment expenditures represented 47.6% of total OUD-related Medicaid expenditures, but by 2013, this percentage had fallen to 29.9%, indicating that the burden of non-OUD expenditures for patients with OUD grew over time.

We used the results from our sample states to extrapolate to national estimates. For each of the 17 states in our sample, we created a sampling weight equal to the inverse of the ratio of the number of Medicaid enrollees in the state to the total US Medicaid enrollment. Based on these weights, we estimate that nationally, the number of individuals with OUD who were treated in state Medicaid programs increased 440%, from approximately 91,613 in 1999 to 494,569 in 2013. Total OUD-related Medicaid expenditures for these patients nearly quadrupled, from \$2.15 billion in 1999 to \$8.42 billion (or 3.2% of total Medicaid spending) in 2013.

FIGURE 2. Number of Medicaid Enrollees Diagnosed With OUD



OUD indicates opioid use disorder.

Limitations

Our analysis shows that costs to state Medicaid programs pertaining to the opioid epidemic

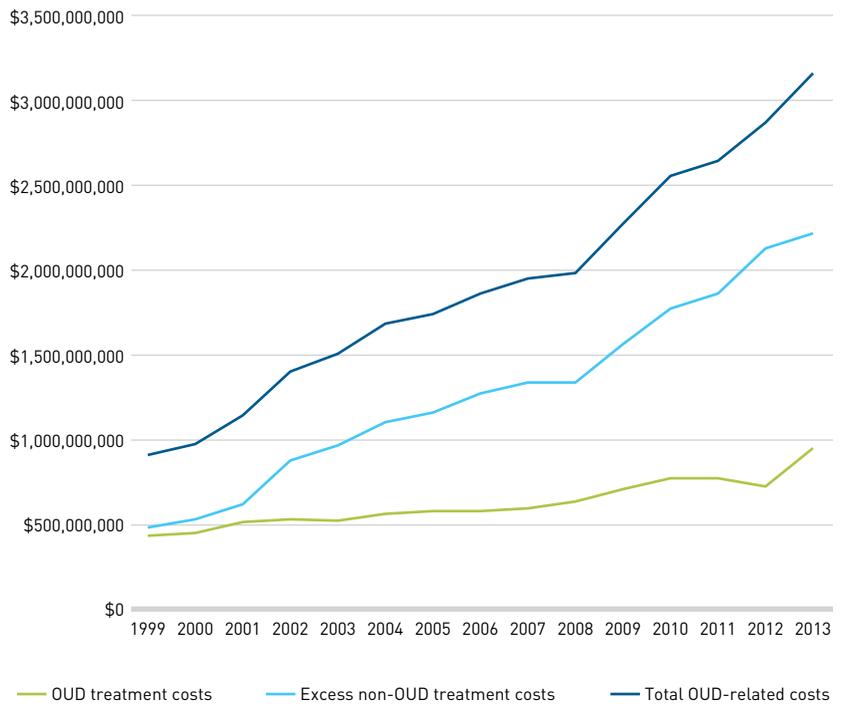
TABLE. Average Annual Medicaid Expenditures per Patient for Patients With OUD and a Matched Comparison Group of Patients Without OUD (2017 US dollars)

Year	Inpatient				Outpatient				Prescription Drug				Total			
	OUD		No OUD		OUD		No OUD		OUD		No OUD		OUD		No OUD	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1999	3024	9853	563	4837	5123	6736	2145	5942	1718	5320	666	3415	9865	15,250	3374	9337
2000	3121	10,314	520	3961	5333	7401	2217	6336	1999	5931	745	2850	10,452	16,159	3482	8907
2001	3311	10,970	543	4526	5624	7341	2365	6634	2193	5632	836	3216	11,128	16,722	3745	9570
2002	3791	13,404	581	4842	6210	8224	2519	6975	2373	5416	927	2809	12,375	19,382	4027	10,049
2003	4034	13,941	624	4764	6332	7951	2687	7481	2844	6418	1153	3325	13,210	20,313	4464	10,686
2004	4081	14,932	598	4567	6634	8419	2783	7756	3270	7221	1285	3553	13,984	21,764	4666	11,003
2005	4188	15,374	637	5116	6865	24,685	2896	8262	3183	6494	1301	3698	14,236	32,547	4834	11,716
2006	4673	16,725	695	6624	7124	26,127	2943	8580	2403	7818	652	2605	14,200	38,472	4290	12,298
2007	4403	17,558	721	6451	7339	9468	3264	9278	2353	6327	677	2759	14,096	24,441	4663	12,739
2008	3687	15,794	725	5968	7521	9099	3480	9907	2260	5851	672	3100	13,468	22,570	4877	13,194
2009	3452	15,524	676	6030	7869	9467	3716	10,091	2315	6471	638	3530	13,635	22,636	5029	13,346
2010	3489	19,374	631	5913	8058	11,741	3881	10,702	2362	15,915	618	3472	13,909	31,066	5131	13,712
2011	3150	15,996	617	6070	7745	9213	3854	10,822	2087	7045	573	3635	12,981	22,867	5044	13,885
2012	2561	14,766	534	5511	8522	48,944	4309	14,434	1799	62,935	482	3122	12,882	99,666	5326	16,494
2013	1912	14,076	503	5528	8803	26,116	4481	13,627	1175	4086	420	3638	11,889	33,200	5404	15,898

OUD indicates opioid use disorder; SD, standard deviation.

have increased considerably over the past 15 years and reached \$8.42 billion in 2013, the most recent year of data available at the time of the study. However, the results must be considered in the context of the study's limitations. The most significant limitation is that complete MAX data were available for only 17 states and were limited to the period from 1999 to 2013. If Medicaid data were obtained directly from the states (or a selection of states) instead of from CMS, more recent cost estimates could be computed and patterns of treatment and costs over a long period of time could be examined. In addition, there may also be other costs to the state Medicaid programs that are attributable to OUD that we are not able to observe. For example, children of parents with an OUD may be more likely to become undernourished, suffer from chronic conditions, or become victims of accidents and injuries. Because we are not able to link family members in the MAX database, we cannot identify the children of parents with OUD and are not able to include these costs in the analysis.

FIGURE 3. Health Insurance Costs for Medicaid Enrollees Diagnosed With OUD



OUD indicates opioid use disorder.

Finally, the study is limited to Medicaid expenditures. States also incur costs related to the opioid epidemic among their employees and retirees. Although we are not aware of studies that specifically focus on state employees and retirees, there are studies of privately insured individuals. OUD greatly affects the working-age population, and studies report the highest rates of nonmedical use of opioids and overdose deaths in the group of adults aged 18 to 49 years.^{13,47} Rice et al estimated the incremental annual healthcare cost of OUD to an employer to be \$10,627 per patient. In addition, an employee with OUD had \$1244 excess annual work-loss costs.⁴⁸

Future Directions

The analyses presented provide a general overview of the cost of the opioid epidemic to state Medicaid plans. A more robust analysis would involve developing cost models that control for state-level and patient characteristics. In addition, future studies should explore factors that may be related to the increase in OUD costs. For example, data on promotional activities by pharmaceutical firms, both direct-to-consumer and provider-targeted, could be included,^{49,50} which would allow for the estimation of the potential effects of industry behavior on Medicaid expenditures for the opioid epidemic.

In addition to the enhancements of the Medicaid analysis, future studies could examine insurance costs for state employees and retirees. The analyses described here could be applied to private health insurance claims data to estimate the cost to private insurers of the opioid epidemic and determine an annual cost per enrollee. As state employees are likely to yield results similar to those of other privately insured individuals, the estimates could be used to derive the cost associated with OUD to the states among state employees, to develop cost models and to estimate the effects of industry behaviors, as in the Medicaid analyses.

As the current analysis shows, the states' economic burden from the opioid epidemic is considerable. However, the results likely underestimate this burden. Future studies could further refine our estimates to include non-Medicaid expenditures, and they could estimate the burden on infants, children, and adolescents associated with having parents with an OUD. Understanding these costs is important for developing targeted prevention and treatment programs and policies to help mitigate this public health crisis. ■

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important intellectual content (EA, GL); statistical analysis (DB, DLL, GL, XX); administrative, technical, or logistic support (EA, XX); supervision (DLL).

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