

## ORIGINAL RESEARCH

# Utilization, Spending, and Price of Opioid Medications in the US Medicaid Programs Between 1991 and 2019

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**BACKGROUND:** The opioid epidemic and drug abuse are critical public health challenges in the United States. The number of deaths from exceeding the recommended opioid dose is increasing.

**OBJECTIVE:** To describe the recent trends in utilization, spending, and cost of opioid medications in the US Medicaid population between 1991 and 2019.

**METHODS:** This retrospective, descriptive study was designed to evaluate the utilization of, spending on, and cost of opioids from 1991 to 2019 in the Medicaid population. We extracted data from the Centers for Medicare & Medicaid Services national Medicaid pharmacy files. The opioids received included fentanyl, meperidine, morphine, hydromorphone, oxycodone, hydrocodone, hydrocodone plus acetaminophen, oxycodone plus acetaminophen, tapentadol, and tramadol. The number of prescriptions and reimbursement spending were calculated for each medication per quarter year. The average per-prescription reimbursement as a proxy of drug price was calculated as the reimbursement amount divided by the number of prescriptions per quarter year. The market shares by spending and utilization were also calculated for each opioid medication.

**RESULTS:** The number of all opioid prescriptions in Medicaid increased from approximately 2.1 million in 1991 to approximately 41.6 million in 2015, and then reduced to approximately 19.1 million in 2019. During this 29-year study period, the opioid medications that were used as monotherapy were hydrocodone (246.8 million prescriptions), oxycodone (111.9 million prescriptions), and tramadol (75.2 million prescriptions). The total spending in the Medicaid population on opioids was \$19.4 billion, including approximately \$7.3 billion spending on oxycodone, approximately \$3.7 billion on fentanyl, and approximately \$3.3 billion on hydrocodone. The majority of opioid prices increased over time, and the highest average costs per opioid prescription in 2019 were \$1188 for oxycodone, \$641 for tapentadol, and \$198 for fentanyl.

**CONCLUSIONS:** The utilization of and spending on opioid medications in Medicaid increased over time, peaked in 2015, and then declined with the initiation of nationwide programs to combat the opioid epidemic. Effective cost-containment strategies and programs to combat the abuse of opioids are warranted in Medicaid programs.

**KEY WORDS:** drug price, fentanyl, hydrocodone, Medicaid, opioids, opioids spending, opioids utilization, oxycodone, oxycodone, reimbursement, tapentadol

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In the US population, the number of deaths that result from exceeding the recommended opioid dose is increasing.<sup>1</sup> Death resulting from overdoses of prescribed and nonprescribed opioid medications increased 4-fold from 1999 to 2019, and the overdose of opioid medications led to a daily average of 136 deaths in the US population.<sup>2</sup> From 2000 to 2010, opioid prescription utilization rose to almost 90 million.<sup>3</sup> In 2013, the combination of opioid overdose and the inappropriate use of opioids cost the United States approximately \$78.5 billion.<sup>4</sup> Furthermore, medical expenses increased as a result of the inappropriate use of opioids by individuals who had more than 1 disease (ie, multiple comorbidities).<sup>5</sup>

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**Table 1** Frequently Prescribed Opioids in US Medicaid Programs

Generic drug name	Brand names
Fentanyl	Abstral, Actiq, Duragesic, Fentanyl, Subsys
Meperidine	Demerol, Meperidine
Morphine	Kadian, Morphine, MS Contin, Infumorph, Depodur, Avinza, Astramorph
Hydromorphone	Dilaudid, Hydromorphone, Exalgo
Oxymorphone	Opana, Oxymorphone
Hydrocodone	Hysingla, Zohydro ER, Hydrocodone
Oxycodone	Oxycontin, Roxicodone, Oxycodone
Tapentadol	Nucynta
Hydrocodone + acetaminophen	Xodol, Vicodin, Co-Gesic
Tramadol	Ryzolt, Ultram, Tramadol, Conzip
Oxycodone + acetaminophen	Tylox, Roxicet, Primlev, Percocet, Endocet, Magnacet

The number of adults and children receiving opioid therapy has significantly increased in the emergency department setting in the United States.<sup>6,7</sup> Patients with conditions that are not related to cancer are more likely to receive a weaker opioid than a potent opioid.<sup>8</sup> Opioid therapy has been prescribed in the primary care setting for individuals who have a chronic noncancer illness, especially those with low-back pain.<sup>9</sup> Furthermore, opioid medications are prescribed more often to women with endometriosis than to women without endometriosis.<sup>10</sup>

Opioid medications are not endorsed in the Centers for Disease Control and Prevention guideline as a primary treatment option for chronic pain in individuals without cancer, because of the medications' harmful effects.<sup>11</sup> In clinical practice, however, there is a distinction between various healthcare specialties when prescribing opioids in the United States, and primary care physicians prescribe the largest number of opioid drugs.<sup>12</sup>

A study by Xie and colleagues has shown that the total healthcare costs were dramatically higher in patients who were consistently receiving opioid medications than in patients who did not receive them, for the 12 months after receiving the first opioid prescription at the emergency department or at hospital admission (\$49,766 vs \$19,875, respectively;  $P < .0001$ ).<sup>13</sup>

Bonakdar and colleagues examined the mean daily use of opioid therapy in the US Medicaid population for 10 years, from 2005 to 2014.<sup>14</sup> The researchers found that hydrocodone was the most frequently prescribed, and oxycodone had the largest percentage increase of days supplied.<sup>14</sup> Jiang and colleagues reviewed the prevalence of opioid medication use from 2010 to 2011 among patients who were going to have surgery in a large academ-

ic center.<sup>15</sup> The results showed that the rates of opioid use in orthopedics, neurosurgery, and gastrointestinal surgeries were 23.8%, 18.7%, and 14.4%, respectively.<sup>15</sup>

With these considerations in mind, our study's objective was to describe and examine the trends in utilization, spending, and cost of opioid medications in the Medicaid population. There are limited studies that evaluate the use and cost of opioid medications in this large population.<sup>14</sup>

## Methods

This retrospective study was designed to estimate the utilization of and spending on opioid medications for Medicaid patients from the first quarter of 1991 to the fourth quarter of 2019. We extracted data from the national Medicaid pharmacy claims drug data that are collected by the Centers for Medicare & Medicaid Services.<sup>16</sup> These data are available publicly, and drug claims from all states within the United States, as well as the District of Columbia, were included in our analysis. These data include the National Drug Code (NDC) of opioid medications, drug names, years, and quarters, as well as total pharmacy reimbursement amount, including the drug costs and administrative charges. Drug prescriptions were limited in this analysis to the outpatient setting.

In the 4 quarters of 2006 and in quarter 3 of 2007, the data included documentation errors (eg, extra zero in reimbursement amounts or in the number of prescription for many NDC-specific drugs).<sup>17,18</sup> Thus, to provide a valuable estimation for this data set, we calculated the average for medication utilization and spending of the quarters before and after the quarters with errors. The database includes generic and brand names of the opioid medications.

The medications included in our study include fentanyl, meperidine, morphine, hydromorphone, oxymorphone, hydrocodone, hydrocodone plus acetaminophen, oxycodone, oxycodone plus acetaminophen, tapentadol, and tramadol (Table 1).

We calculated the number of prescriptions and amount of spending (ie, the reimbursement amount) separately, by summing every quarter for each opioid medication across the individual NDCs. The data for each category of all drugs were aggregated, and the average cost (ie, the price) per paid claim was calculated as the spending amount, divided by the number of prescriptions.

The cost of opioid drugs is estimated in our study, because the data do not provide the cost. The cost could be less than what we present, because any rebates from the drug companies were not available in the database. We calculated the market shares for opioid medications using the percentage of the number of prescriptions and the percentage of spending. Several previously published

studies used the same procedure and method as used in our study.<sup>19-22</sup>

We used SAS version 9.4 (SAS Institute Inc; Cary, NC) and Microsoft Excel 2016 (Microsoft; Redmond, WA) to analyze the data.

## Results

The total number of all opioid prescriptions in Medicaid increased from approximately 2.1 million in 1991 to a peak of approximately 41.6 million in 2015, and then reduced to approximately 19.1 million in 2019 (Table 2). The total utilization of hydrocodone from quarter 1 of 1991 to quarter 4 of 2019 was estimated to be 246.8 million prescriptions, which is the highest utilization of all the opioids (Figure 1, and Appendix Table 1 available at [www.AHDBonline.com](http://www.AHDBonline.com)).

By contrast, oxycodone was ranked the second-most-used opioid therapy in Medicaid, with an estimated 111.9 million prescriptions (Appendix Table 1). The use of hydrocodone in 2012 rose to the peak of approximately 16 million prescriptions, then decreased to approximately 7.4 million prescriptions in 2019. Oxycodone reached the peak of approximately 10.4 million prescriptions in 2016 and decreased dramatically to approximately 5.9 million in 2019. In the 1990s, the use of morphine was negligible compared with the use of hydrocodone; however, the number of morphine prescriptions peaked, at approximately 3 million, in 2015 (Appendix Table 1).

The frequently prescribed opioids during the study period were hydrocodone (a total of approximately 246.8 million prescriptions), oxycodone (approximately 111.9 million prescriptions), oxycodone plus acetaminophen (approximately 29.6 million prescriptions), morphine (approximately 33.7 million prescriptions), and tramadol (approximately 75.2 million prescriptions; Appendix Table 1).

Approximately \$19.4 billion was spent on opioid medications in the US Medicaid programs over the 29 years of this study (Figure 2, and Appendix Table 2 available at [www.AHDBonline.com](http://www.AHDBonline.com)). Of this total, approximately \$7.3 billion was for oxycodone, representing the highest spending compared with the other opioid drugs, followed by \$3.7 billion for fentanyl and \$3.3 billion for hydrocodone. For example, the reimbursement for oxycodone increased continuously and significantly from approximately \$3.6 million in 1991 to approximately \$76 million in 1999, peaked at approximately \$550 million in 2015, and then decreased to approximately \$199.2 million in 2019. By contrast, the annual spending on fentanyl from 1991 to 2000 did not exceed \$100 million. Spending on fentanyl peaked in 2004 at approximately \$421 million, and then decreased to approximately \$151.5 million in 2019.

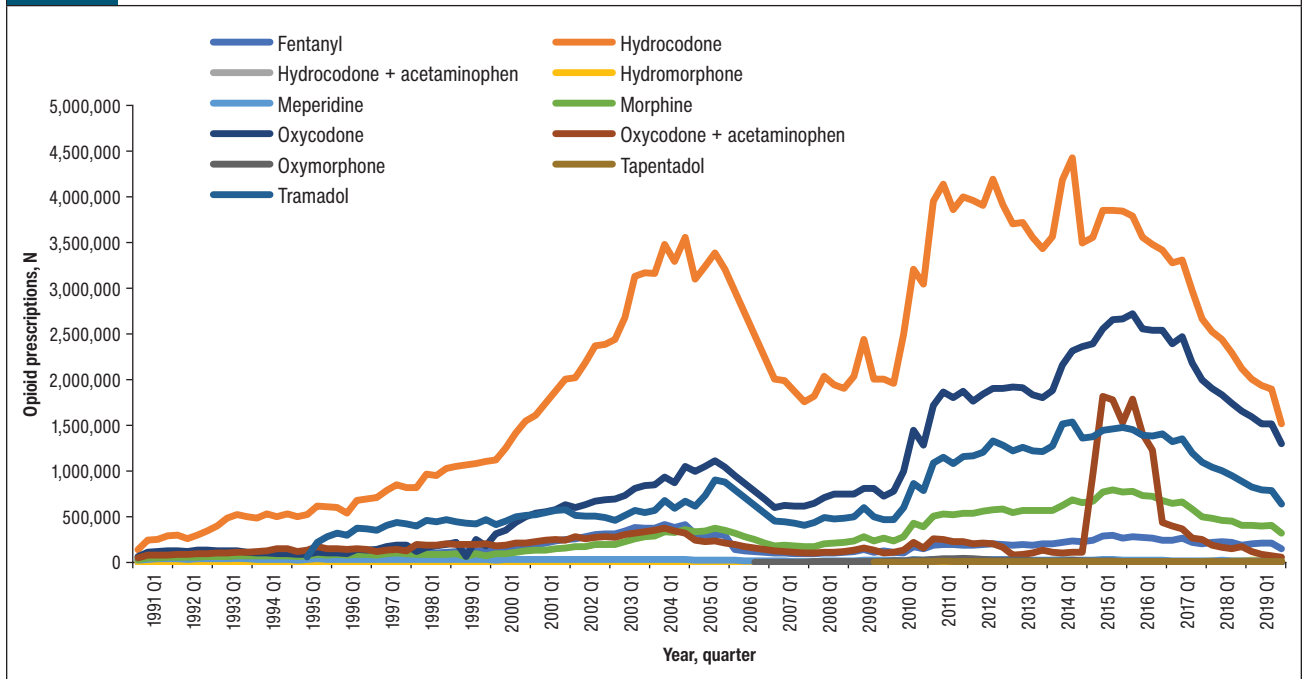
**Table 2** Annual Percentage Changes, Reimbursement, and Number of Opioid Prescriptions in US Medicaid Programs, 1991-2019

Year	Reimbursement spending, \$	Annual change, %	Opioid prescriptions, N	Annual change, %
1991	29,195,773		2,085,391	
1992	44,538,549	52.55	2,734,743	31.14
1993	64,916,563	45.75	3,482,878	27.36
1994	75,925,767	16.96	3,633,176	4.32
1995	105,813,881	39.36	4,439,587	22.20
1996	159,475,406	50.71	5,677,386	27.88
1997	213,435,616	33.84	6,843,358	20.54
1998	279,866,173	31.12	7,926,992	15.83
1999	339,176,726	21.19	8,575,453	8.18
2000	527,353,298	55.48	10,844,223	26.46
2001	767,367,952	45.51	14,346,964	32.30
2002	907,541,051	18.27	16,709,389	16.47
2003	1,067,091,633	17.58	20,358,882	21.84
2004	1,322,145,581	23.90	24,164,768	18.69
2005	1,222,990,508	-7.50	23,938,404	-0.94
2006	807,207,585	-34.00	18,708,582	-21.85
2007	568,717,818	-29.55	13,431,512	-28.21
2008	643,382,612	13.13	14,175,880	5.54
2009	684,450,077	6.38	15,806,289	11.50
2010	741,978,450	8.41	20,625,701	30.49
2011	1,092,866,901	47.29	31,878,305	54.56
2012	1,001,875,103	-8.33	32,522,630	2.02
2013	935,827,292	-6.59	30,513,436	-6.18
2014	1,139,987,425	21.82	34,264,434	12.29
2015	1,320,303,300	15.82	41,620,846	21.47
2016	1,134,970,630	-14.04	39,327,865	-5.51
2017	914,467,582	-19.43	31,020,962	-21.12
2018	691,791,168	-24.35	23,866,082	-23.06
2019	615,082,188	-11.09	19,099,429	-19.97
<b>Total</b>	<b>19,419,742,606</b>		<b>522,623,546</b>	

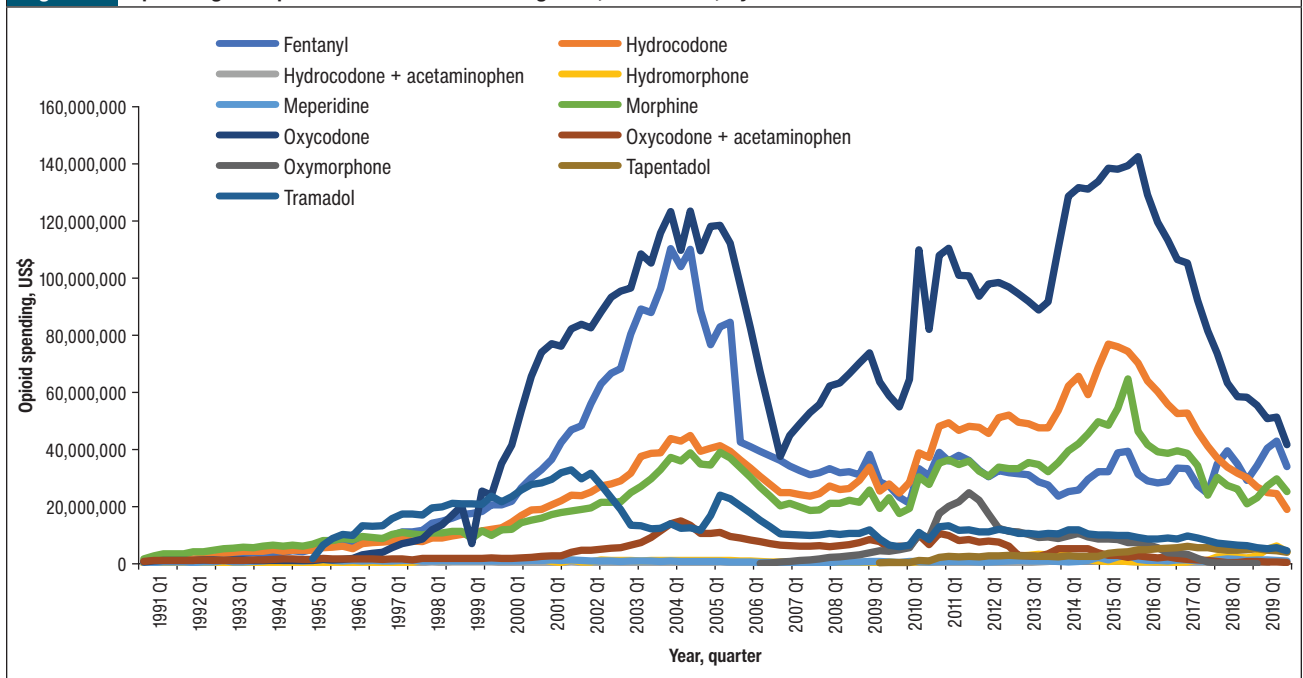
Spending on hydrocodone increased from approximately \$5.8 million in 1991 to approximately \$295.9 million in 2015. The highest annual spending amounts between 1991 and 2019 were approximately \$217.4 million in 2015 for morphine, and approximately \$84 million in 2011 for oxymorphone. From 1991 to 2019, the total spending on hydrocodone plus acetaminophen was \$46 million, which was the lowest amount spent on any opioid medications (Figure 2 and Appendix Table 2).

The estimated reimbursement price per prescription of hydrocodone increased significantly from \$6.25 in 1991 to

**Figure 1** Utilization Trends for Opioids in US Medicaid Programs, 1991-2019, by Quarter



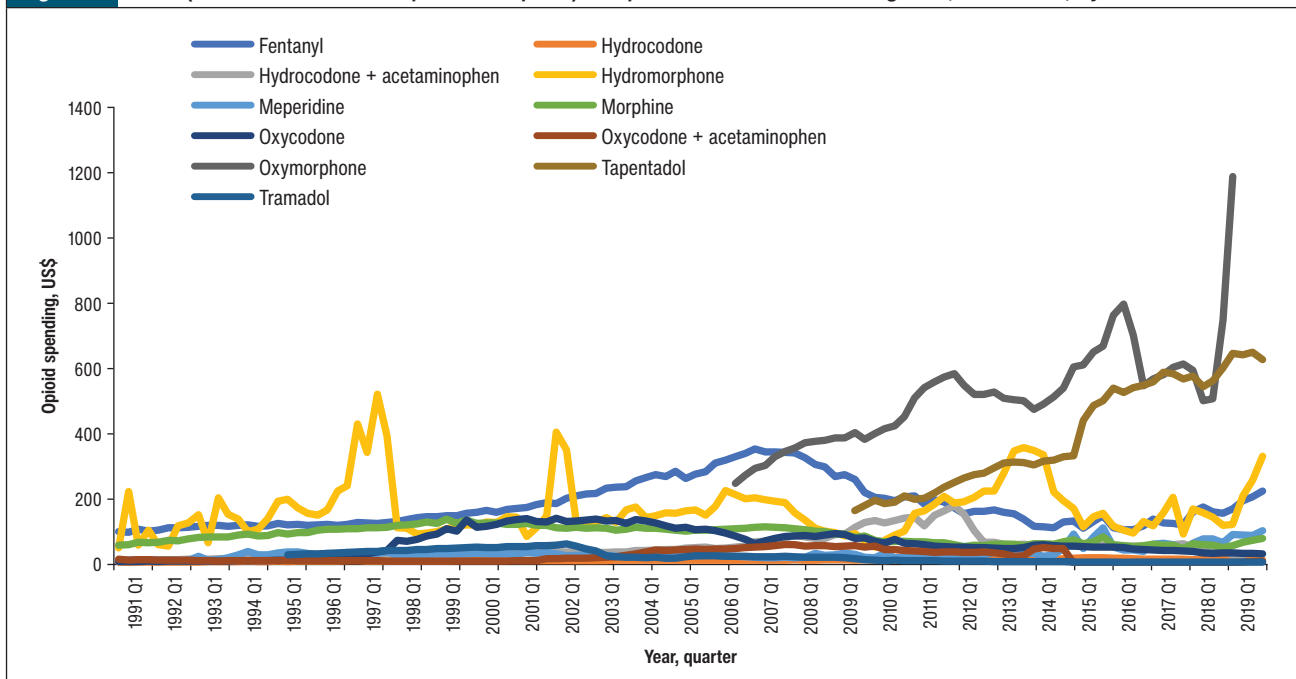
**Figure 2** Spending on Opioids in US Medicaid Programs, 1991-2019, by Quarter



\$14.17 in 2015, an increase of 127% (Figure 3). Overall, the price per prescription of hydrocodone did not exceed \$20. In 1991, the price per prescription of fentanyl was estimated to be \$100.48; however, in 2007, the price of fentanyl reached approximately \$353.41, an increase of 252%.

The price per prescription of oxycodone was \$8.90 in 1991; however, the price of oxycodone increased dramatically, by 1118%, to approximately \$108.44 per prescription in 1999. In 2018, this price declined to approximately \$35 per prescription.

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**Figure 3** Price (Reimbursement Cost per Prescription) of Opioids in US Medicaid Programs, 1991-2019, by Quarter

The lowest price per prescription of oxymorphone was approximately \$247.79 in 2006, but its price increased gradually to \$796.94 in 2016. Overall, the prices of hydrocodone, oxycodone plus acetaminophen, and tramadol were less than \$100 per prescription between 1991 and 2019. The majority of opioid prices increased over time, and the highest average costs per opioid prescription in 2019 were \$1188 for oxymorphone, \$641 for tapentadol, and \$198 for fentanyl.

The data in the **Appendix Figure 1** (available at [www.AHDBonline.com](http://www.AHDBonline.com)) show the market share of opioid medications by utilization (ie, the number of opioid prescriptions). The largest key market share of opioids over the study's 29 years was for hydrocodone. The share of hydrocodone utilization was the highest of all the opioid medications, ranging from 37% to 57% of the market. Conversely, the market share of oxycodone utilization was 19.64% in 1991, which decreased over time.

After 2010, the market share of oxycodone exceeded 21%, and reached approximately 30% in 2018. The combination of oxycodone plus acetaminophen had approximately 13% of the market share in 1991; however, this number gradually decreased, until it declined to 1% in 2013. The average market share of tramadol was approximately 16% from 1995 to 2019, whereas other opioid medications did not exceed 10% of the market share.

The data in the **Appendix Figure 2** (available at [www.AHDBonline.com](http://www.AHDBonline.com)) show the market share of opioid medications by reimbursement (spending). In 1991,

morphine had the highest market share, by reimbursement, at approximately 38%; however, this rate decreased significantly, to approximately 10%, after the 1990s. By contrast, the reimbursement market share of oxycodone was approximately 12.3% in 1991, but that rate dramatically increased, peaking at approximately 44.5% in 2016. Oxycodone, as well as fentanyl and hydrocodone (Appendix, Figure 2) dominated the market, representing the highest percentage of spending on opioid medications from 2000 to 2019. Fentanyl held a significant share of spending in the market between 2001 and 2007; however, after 2007, fentanyl's share in the market declined.

## Discussion

Our study demonstrates a wide view of the most frequently used opioid medications in the US Medicaid population that were reimbursed by the nationwide state Medicaid programs. The total number of all opioid prescriptions for Medicaid beneficiaries increased from approximately 2 million in 1991 to a peak of approximately 41.6 million in 2015, and then decreased to approximately 19.1 million in 2019.

Moreover, the total spending on opioid medications increased from approximately \$29 million in 1991 to a peak of approximately \$1.32 billion in 2015, and then decreased to approximately \$615.1 million in 2019. This reduction in the total spending on opioids after 2015 is likely a result of public health efforts to combat the opioid epidemic and drug abuse nationwide.



Opioid medications are prescribed for the treatment of various conditions, such as cancer-related and noncancer pain<sup>23</sup>; therefore, this trend of high utilization of opioids within the US Medicaid population is not surprising, considering the drugs' benefits for many chronic conditions. A study by Joranson and colleagues on the use of opioids for the treatment of severe pain showed an increase in oxycodone use from 1.6 million grams to 2 million grams between 1991 and 1996, which is similar to the utilization trend of oxycodone according to our findings.<sup>24</sup>

The high utilization of opioid prescriptions seen in our study before 2010 could be a result of the prescribers' unfamiliarity with the health consequences of using opioid medications. In their 2010 study of physicians in Wisconsin, Wolfert and colleagues found that the physicians had insufficient awareness about opioid prescribing.<sup>25</sup> Studies have shown that if opioid therapy is not monitored and controlled, high utilization could lead to the inappropriate use of these medications and could increase the number of days that patients spend in the hospital.<sup>26-29</sup>

Our findings show that the utilization of opioid drugs declined after 2006, which can be explained by the pooling of elderly patients to Medicare Part D.<sup>17</sup> This pooling means that the older patients were included in the Medicaid program before 2006, but they were removed after the launch of Medicare Part D.

Our study is comprehensive and distinct, because it examines a long period of 29 years. Our findings show that the most prescribed drug for Medicaid recipients during this study period was hydrocodone, because of its low price, which is less than \$20 per prescription. Individuals could become addicted to hydrocodone when it is used unnecessarily, and the overuse of hydrocodone may lead to health problems.

The shift after 2009 from prescribing hydrocodone plus acetaminophen to prescribing hydrocodone alone is a result of the US Food and Drug Administration (FDA)'s recommendation that was issued that year to encourage healthcare providers to minimize the use of drugs that contain acetaminophen, because of its harmful effect on the liver.<sup>30,31</sup>

Conversely, the medical uses of oxymorphone were low, because of its high price. Also, as a result of its limited benefits, in 2017 the FDA proposed to withdraw oxymorphone hydrochloride from the market<sup>32</sup>; therefore, the use of oxymorphone has declined. In 12 US states, 45% of Medicaid patients were prescribed an opioid therapy in 2009, which is a high rate, but it was limited to only 12 states.<sup>33</sup>

Despite disparate results in various states, a similarity exists in the high utilization rate of opioid medications. It is unclear why the sharp increases in the use of oxycodone plus acetaminophen between 2015 and 2016 (Fig-

ure 1). We have found that the annual spending on oxycodone was the highest among all opioid medications for Medicaid patients (Figures 2 and 3), which increased over the period of our study. Even with the high utilization of hydrocodone over the 29 years of our study, we found that the greatest spending was for oxycodone.

## Limitations

Our study has several limitations. First, as in all studies based on claims data, we were not able to evaluate accurately the use of opioid medications, because of the unknown patient-specific information, patient demographics, and patient comorbidities. In addition, opioid medications have a broad array of indications for many diseases, and we could not determine from the data collected the reasons that these medications were prescribed.

Second, these data include a known error in the 4 quarters of 2006 and in quarter 3 of 2007; however, we adjusted for these errors by calculating the previous and following quarters, to make the data more meaningful.

Third, the prices of opioids in our study are representative of all the Medicaid programs combined throughout the nation; thus, our study is a good baseline for each state to match its opioid prices to our findings.

Fourth, in June 2017, the FDA demanded that oxymorphone hydrochloride be removed from the market; this could explain the negligible use of this medication in the third quarter of our study.

Finally, our findings are not necessarily relevant to the general US population, because the data came only from the Medicaid population, which is not necessarily representative of the entire US population.

## Conclusion

The utilization of and spending on opioid medications increased over time and reached a peak in 2015, which then declined with combating the nationwide opioid epidemic. Our analysis of the utilization and spending trends for opioids shows significant increases in both areas after 1999. These trends started to decrease in early 2016. The reduction in the total spending on opioids after 2015 is likely a result of public health efforts at that time to combat the opioid epidemic and drug abuse nationwide. Despite this decline, the utilization of and spending on opioid medications are still considered to be too high.

Our results present data for healthcare providers to consider the appropriate use of opioids in the Medicaid population. A considerable use of opioid medications may lead to high healthcare costs and drug abuse, resulting in patient safety problems. Effective cost-containment programs and combating drug abuse strategies regarding opioid medications are warranted in the US Medicaid programs.

# Author Disclosure Statement

Dr Alsultan and Dr Guo have no conflicts of interest to report.

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