

## Research Paper

# Impact of drug utilization management policy on prescription opioid use in Georgia Medicaid

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## Abstract

**Objective** To examine the effectiveness of changes in opioid prescription policies on opioid prescribing and health services utilization rates in Georgia Medicaid.**Methods** This study used data from the Georgia Medicaid patient enrollment, medical and pharmacy claims database from 2009 to 2014. We performed an interrupted time series analysis to examine the effect of the policy changes. Outcome measures assessed the trends in the indicators of potential inappropriate prescribing practices, including overlapping prescriptions of opioid + opioid, opioid + benzodiazepine and opioids + buprenorphine/naloxone, as well as health services utilization, including hospitalization, mean length of stay, outpatient office and emergency room visits.**Key findings** A total of 712 342 opioid users aged 18–64 were included in the study. The policies were associated with significant decreasing trend of opioid + opioid (–0.0011; 95% CI = –0.0020, –0.0002) and opioid + benzodiazepines (–0.001; 95% CI = –0.0022, –0.0006) overlapping while associated with a significant immediate decrease in and opioids + buprenorphine/naloxone after the implementations (–0.0014; 95% CI = –0.0025, –0.0003). Significant immediate decrease in level of office visits and ER visits were seen with the policy implementation (office visit: –0.2939; 95% CI = –0.5528, –0.0350, ER visit: –0.0740, 95% CI = –0.1294, –0.0185). The policies were not shown to be significantly associated with hospitalization and the mean length of inpatient stay.**Conclusions** Our analysis suggests that Georgia Medicaid opioid policies were useful to contain inappropriate opioid use.**Keywords:** Georgia Medicaid; opioid; opioid prescribing; healthcare utilization

## Introduction

The United States has experienced nothing less than a catastrophe related to prescription opioids resulting in increased healthcare costs and medical care utilization, in addition to other societal costs and concerns.<sup>[1,2]</sup> The increasing trend in opioid prescriptions that peaked in 2012 at 255 million prescriptions had decreased slightly to

191 million prescriptions in 2017.<sup>[3]</sup> However, mortality rates related to opioid analgesics continue to surge.<sup>[4,5]</sup> In 2017, opioids contributed to an estimated 47 600 deaths in U.S., accounting for 68% of all drug overdose-related deaths.<sup>[6]</sup> The total economic burden of the opioid crisis was estimated to exceed 95 billion dollars in 2016, accounting for direct and indirect costs and productivity loss.<sup>[7]</sup>

As the opioid catastrophe has permeated the news media and public opinion polls, it is recognized as a major health issue and has been attributed to inappropriate prescribing practices and illegitimate use of prescription opioids.<sup>[8]</sup> Further, aggressive industry marketing of opioids has been shown to be effective in increasing the number of opioid prescriptions, exacerbating issues with misuse and addiction, all contributing to this opioid crisis.<sup>[9, 10]</sup>

Opioid prescribing in the state of Georgia was high<sup>[3]</sup> and it has been estimated that some 390 000 residents in Georgia have had at least one incidence of non-medical opioid use.<sup>[11]</sup> The number of opioid overdose deaths increased by 245% from 2010 to 2017 according to the Georgia Department of Public Health,<sup>[12]</sup> making Georgia one of the states that had a significant increase in opioid overdose-related deaths over recent years.<sup>[6, 13]</sup> In particular, Georgia Medicaid saw an increase in opioid use paralleled by the rise of potential inappropriate opioid prescribing incidence rate from 2009 to 2014.<sup>[14]</sup>

The opioid crisis in Georgia prompted policy changes in Georgia Medicaid that were aimed at restricting the unnecessary use of prescription opioids. Specifically, three policy changes were implemented in 2012 and 2013 targeting at opioid prescribing. The first of these was a limit on the number of prescriptions allowed per recipient per month. On 1 September 2012, this limit was changed from no limitations to six prescriptions. On 1 April 2013, this limit was changed to five prescriptions for opioids per month. The second policy change tightened the refill-too-soon rate for next opioid prescriptions from 75% of days of supply used to 85% of days of supply used. Finally, a policy was implemented to block the concomitant use of any opioid and buprenorphine/naloxone (Suboxone), also implemented on 1 April 2013. The policies were expected to reduce the rates of inappropriate opioid prescribing thus reducing avoidable marginal health services utilization among opioid users, resulting in less economic burden to Georgia Medicaid.

Some work has evaluated the impact of drug utilization policy changes in Medicaid programs, for example, the impact of excluding opioids from 'preferred list',<sup>[15]</sup> promoting dosing guidelines<sup>[16]</sup> and prior authorization.<sup>[17]</sup> Given the seriousness of the opioid crisis, evaluation of the policies implemented in Georgia Medicaid are important to understanding which tools are most effective, and the expected impact of various policy decisions. Thus, the objective of our study was to examine the effectiveness of changes in opioid prescription policies on opioid prescribing and health services utilization rates in Georgia Medicaid.

## Methods

### Data

We obtained Medicaid data on patient eligibility, medical and pharmacy claims for the period of 1 July 2009 to 31 December 2014 from Georgia Medicaid. The study sample was restricted to patients aged 18–64 years old who had at least one opioid claim (short or long acting extended release opioids) during the study period. **Table 1** provides the list of all opioids used by Georgia Medicaid enrollees in the analyses.<sup>[18]</sup> We included all National Drug Codes (NDC) for opioids that are, or were active during the study period using NDC history data from U.S. National Library of Medicine.<sup>[19]</sup> Patients included in the analysis were required to have been enrolled in Medicaid for at least 6 months during each calendar year for the drug and healthcare utilization claims to be included in the study. Claims for patients with a cancer diagnosis were included in the analysis up until the initial date of the cancer diagnosis and excluded after the diagnosis.<sup>[20]</sup> Cancer diagnoses were identified through International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes including 338.3, 140–172.9, 174–215.9, 217–229.10 and 235–239.9.<sup>[14, 20]</sup> The study was approved by xxx Institutional Review Board.

### Outcome measures

The outcome measures in this study consisted of indicators that identified (1) the total number of potential inappropriate opioid prescribing practices each month and (2) health services utilization rates of opioid users each month during the study period. At the individual level, indicators of inappropriate opioid prescribing practices by healthcare providers were presented using three indicators that include (1) overlapping opioid + opioid prescriptions, defined as opioid prescriptions that overlap by 7 days or more; (2) overlapping opioid + benzodiazepine prescriptions, defined as opioid and benzodiazepine prescriptions that overlap by 7 days or more; and (3) overlapping opioid + buprenorphine/naloxone prescriptions, defined as opioid and buprenorphine/naloxone prescriptions that overlap by 1 day or more.<sup>[14]</sup> The overlapping incidences that occurred across the calendar months were counted at the day of the last prescription.

The outcome measures reflected healthcare utilization during each calendar month and included hospitalization, outpatient office visits and emergency room (ER) visits billed to Georgia Medicaid. Multiple same-day events for any patient were included only if the events were billed from different healthcare facilities. Hospitalization events were identified through place of service code 21 and category service code 010. Office visits were identified through place

**Table 1** Demographic characteristics by year

	2009	2010	2011	2012	2013	2014
Race						
White	43.3%	42.5%	40.8%	39.2%	38.7%	38.6%
Black	50.8%	50.2%	49.5%	50.3%	49.5%	49.6%
Other	5.9%	7.3%	9.7%	10.5%	11.8%	11.85
Gender (female)	58.5%	59.0%	59.3%	58.3%	57.9%	58.6%
Age groups						
18–34	48.4%	52.5%	49.5%	49.1%	49.5%	49.6%
35–44	16.7%	16.0%	15.7%	15.7%	15.8%	16.8%
45–54	18.2%	16.6%	16.3%	15.6%	15.2%	14.6%
55–65	16.7%	14.9%	14.6%	14.4%	14.7%	14.5%
Mean age (years)	37.9184	36.8267	36.6476	36.4559	36.5653	36.6665
Sample size	319 973	397 385	387 691	386 084	372 427	366 157

of service code 11 and category service code 430. ER visits were identified through place of service code 23. We calculated the mean of length of stay since date of admission to date of discharge for each eligible opioid user, each month. We did not have data on health services utilization that may have occurred outside of the Georgia Medicaid system.

### Statistical analysis

The interrupted time series model was produced by aggregating daily patient records of all non-cancer opioid users paid under Georgia Medicaid to monthly inappropriate prescribing events and healthcare utilization rates. The aggregation approach produced 66 data points in our time series. It has been suggested that there should be at least 12 data points before and after each intervention in the model.<sup>[21]</sup> However, two of our evaluated policies occurred on 1 April 2013, which were 7 months away from the first policy on 1 September 2012. Thus, we chose to break the study period into only two segments using 1 April 2013 date as the inflection point. This means we essentially evaluated the impact of all three policies together. We fitted a least square regression model for each of the outcome variables, specified as:

$$\text{Outcome} = \beta_0 + \beta_1(\text{time}) + \beta_2(\text{intervention}) + \beta_3(\text{time} * \text{intervention}) + \varepsilon_t \text{ Model 1}$$

where time is the number of months from the start of the study period (1, 2, 3,..., 66), intervention represents the policy period for time  $t$  (pre-policy period = 0; post-policy period = 1) and time\*intervention is the interaction effect of time trend and the policy.  $\beta_0$  and  $\beta_1$  provide estimates of the baseline level and trend for the variable of interest, respectively.  $\beta_2$  and  $\beta_3$  provide an estimate of the change in baseline level and trend for the variable of interest, respectively.

We performed a Durbin-Watson test to examine the existence of autocorrelation.<sup>[22]</sup> If autocorrelation was detected, the autoregressive moving average (ARMA) model for time series would be performed and segmented regression would include autocorrelation. In addition, we attempted to use fixed effect terms for year and season to control for secular trends in the rate of outcome

measures since long-term temporal changes may be correlated with the Medicaid policy change. If secular trends appeared to be significant, the segmented regression model would include the terms for secular trends and retested.

For the last data point within the study period (December 2014), we calculated both the absolute difference and the relative difference associated with the policy change. To calculate the absolute difference, we contrasted the estimated rate of outcomes from the model with the extrapolated rate of outcomes as if the policies had not occurred according to the number of months passed after the policy:  $\hat{Y}_t$  (with policy) –  $\hat{Y}_t$  (without policy).<sup>[13]</sup> The relative difference was then computed by dividing the absolute difference by the predicted rate of outcomes without policy change.<sup>[23]</sup>

### Results

Data were available for 66 time points for Georgia Medicaid opioid users. A total of 712 342 opioid users were included in the study. The basic demographic information of the patients by year is provided in Table 1. Overall, 451 100 overlapping opioid + opioid prescriptions, 982 604 overlapping opioid + benzodiazepine prescriptions and 3319 overlapping opioid + buprenorphine/naloxone prescriptions were identified through pharmacy claims of Georgia Medicaid among opioid users in the study period. The monthly rates of inappropriate prescribing events and healthcare utilization are presented in Figures 1 and 2.

Table 2 presents results from the regression models. The Durbin-Watson test revealed no significant autocorrelation. The secular trends were not significant for all outcome variables. Thus, we used Model 1 for all the tested outcomes. For inappropriate prescribing, the regression model indicates that there were significant level changes of event rates immediately after the policy, although the level change was only negative for overlapping opioid + buprenorphine/naloxone (–0.0014; 95% CI = –0.0025, –0.0003). The changes in trends were significantly decreasing for overlapping opioid + opioid prescriptions (–0.0011; 95% CI = –0.0020, –0.0002) and overlapping opioid + benzodiazepine prescriptions (–0.001; 95% CI = –0.0022, –0.0006) but not for

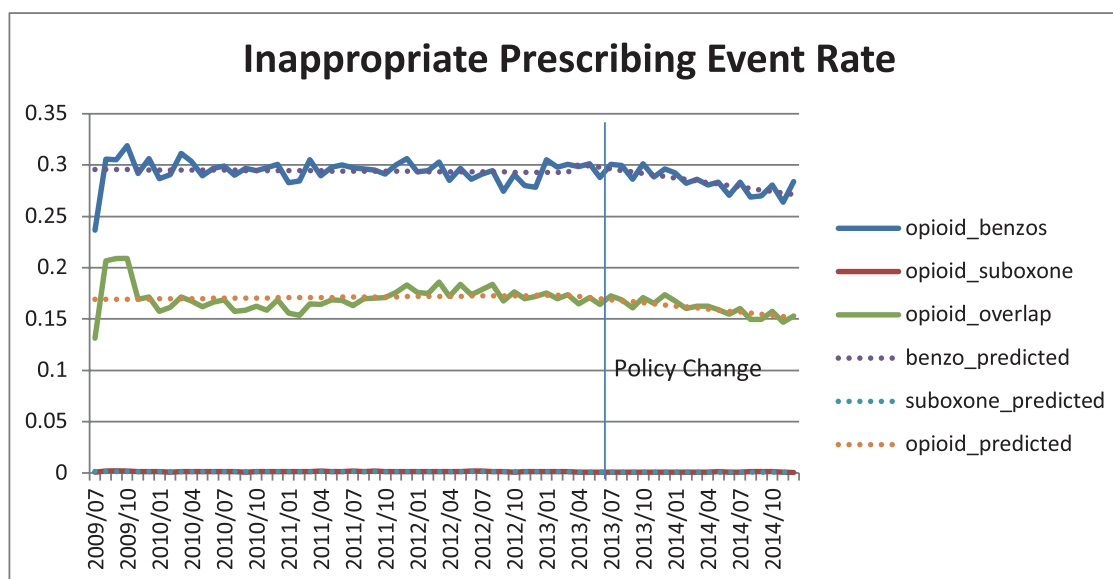
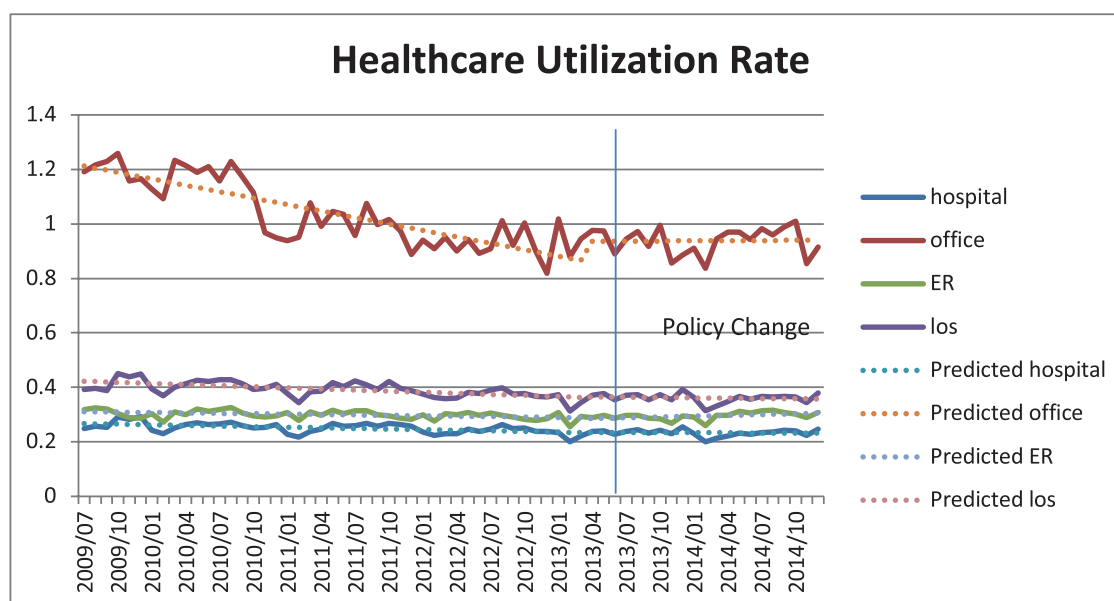


Figure 1 Inappropriate prescribing event rate before and after the policy change.



**Figure 2** Healthcare utilization rate before and after the policy change.

overlapping opioid + buprenorphine/naloxone. The baseline trend, which is the natural trend for inappropriate prescribing events, was not significant in any of the three outcomes.

Estimates from the regression model indicate mixed results for the monthly overlapping prescriptions incidences. In month 66, the absolute difference for overlapping opioid + opioid prescriptions was 0.0272 and the relative difference was 17.95%, indicating a 17.95% increase in overlapping opioid + opioid prescriptions. Similarly, the absolute difference was positive as 0.0442 and the relative difference was positively 16.29% for overlapping opioid + benzodiazepine prescriptions. The only inappropriate prescribing outcome that was shown to decrease by 111.22% (−0.0011 in absolute difference) was overlapping opioid + buprenorphine/naloxone prescriptions. Overall, the policy was associated with a decrease in overlapping opioid + buprenorphine/naloxone prescriptions, which was driven by the immediate level change after implementation of the policies.

Similarly, the healthcare utilization outcomes, including hospitalization rates, office visit rates, ER visit rates and mean length of stay, showed immediate level changes after the implementation of the policies (hospitalization: −0.0283; 95% CI = −0.0915, 0.0350, office visit: −0.2939; 95% CI = −0.5528, −0.0350, ER visit: −0.0740, 95% CI = −0.1294, −0.0185, Length of stay: −0.0401, 95% CI = −0.1271, 0.0470), although the changes for hospitalization rates and length of stay were not significant.

The changes in trend of hospitalization and length of stay were also not significant, while there were significant increases in healthcare utilization for the other two outcomes. The baseline trend appeared to be a significant predictor of post-policy healthcare utilization for all four variables. With the immediate level decrease and trend increase over time after policy implementation, the healthcare utilization rate at the end of the study period was reduced compared to the estimated level without policy change. This was consistent for all healthcare utilization outcome variables. The relative decrease in utilization rate was as large as 14.07% for office visits and 14.14% for emergency room visits, namely 0.1322 fewer office visits and 0.0432 fewer emergency room visits per opioid user.

## Discussion

This study was the first to evaluate the impact of Georgia Medicaid policies targeted at avoidable opioid usage. The three policy changes limiting the numbers of opioid prescriptions per recipient per month, tightening the refill-too-soon rate and limiting simultaneous prescribing of opioids + buprenorphine/naloxone had mixed effects on outcomes. Limiting access had the anticipated effect of immediately decreasing inappropriate prescribing events and healthcare utilization upon implementation. However, mixed results were obtained for the trends in overlapping opioid use. Despite the instant decrease in outcome variables, the estimated outcome difference indicated either an increase in potential inappropriate opioid prescribing or a limited decrease in health services utilization, except for the 111.22% decrease in opioid + buprenorphine/naloxone overlapping incidences.

Drug utilization management, including drug limits, is one policy strategy to decrease the negative impact of inappropriate prescription opioid use. Among Medicaid programs, quantity limits are frequently used to manage opioid use in comparison to alternative drug utilization policy strategies (e.g. prior authorization and step therapy).<sup>[22]</sup> Findings from our study indicate that drug limits reduced the overall utilization of opioids in the Georgia Medicaid population, however there was no impact on the potential inappropriate use of prescription opioids. Our findings are largely consistent with a previous study which showed mixed results. The study found that a Medicaid policy implemented to limit short-acting opioids resulted in a significant 3% decrease of 0.2 mg oral morphine equivalents (OME).<sup>[24]</sup> However, the policy failed to reduce the proportion of patients who purchased more than 120 mg OME per day and the proportion of patients purchasing long-acting opioids from the pre- to post-implementation period.

Our findings suggest that additional research is needed to examine the impact of quantity limits and other drug utilization strategies on the inappropriate use of prescription opioids in other states and populations, especially in light of new quantity limit forms (e.g. 5- and 7-day limits).<sup>[25]</sup> For example, a recent study showed that the implementation of a 5-day quantity limit policy coupled with an electronic medical record alert was

Table 2 Segmented regression results

Outcome	Intercept ( $\beta_0$ )	Baseline trend ( $\beta_1$ )	Level change ( $\beta_2$ )	Change in trend ( $\beta_3$ )	Post-reform trend ( $\beta_1 + \beta_3$ )	Absolute difference	Relative difference
Opioid + opioid	0.1689 ( $P < 0.0001$ )	0.0001 ( $P = 0.4856$ )	0.0493 ( $P = 0.0463$ )	-0.0011 ( $P = 0.0162$ )	-0.0010	0.0272	17.95%
Opioid + benzos	0.2958 ( $P < 0.0001$ )	-0.0001 ( $P = 0.6045$ )	0.0722 ( $P = 0.0024$ )	-0.0014 ( $P = 0.0015$ )	-0.0015	0.0442	16.29%
Opioid + buprenorphine/naloxone	0.0015 ( $P < 0.0001$ )	0.0000 ( $P = 0.3612$ )	-0.0014 ( $P = 0.0121$ )	0.0000 ( $P = 0.0991$ )	0.0000	-0.0011	-111.22%
Hospitalization	0.2679 ( $P < 0.0001$ )	-0.0007 ( $P = 0.0001$ )	-0.0283 ( $P = 0.3752$ )	0.0006 ( $P = 0.2825$ )	-0.0001	-0.0156	-6.72%
Office visits	1.2204 ( $P < 0.0001$ )	-0.0079 ( $P < 0.0001$ )	-0.2939 ( $P = 0.0268$ )	0.0081 ( $P = 0.0012$ )	0.0002	-0.1322	-14.07%
Emergency room	0.3113 ( $P < 0.0001$ )	-0.0005 ( $P = 0.021$ )	-0.0740 ( $P = 0.0098$ )	0.0015 ( $P = 0.0038$ )	0.0010	-0.0432	-14.14%
Length of stay	0.4237 ( $P < 0.0001$ )	-0.0013 ( $P < 0.0001$ )	-0.0401 ( $P = 0.3612$ )	0.0009 ( $P = 0.2489$ )	-0.0004	-0.0214	-5.98%

associated with a decrease in the quantity of opioids initially prescribed and the total dose in comparison with controls.<sup>[26]</sup> Previous research also found that prior authorization policies reduced the number of prescriptions for high-dose opioids and new prescriptions for extended release/long-acting opioids among opioid-naïve patients.<sup>[27, 28]</sup>

Limitations

The conclusions of this study are limited to Georgia Medicaid. We used a structural change model to evaluate new opioid safety measures in Georgia Medicaid. While this program evaluation design appropriately utilized pre-policy periods as the control for the post-policy period it was not intended to provide an external control from which to compare our results. We agree that to generalize our results beyond the intended purpose, an external control would be needed. The use of only Medicaid data in our study, instead of claims data from other payment systems, is again a reflection of the study purpose. In fact, we limited the study population to those between ages 18 and 65 to minimize any overlap between Medicare and Medicaid.

Conclusion

Mixed results of the study indicate that policy changes adopted by GA Medicaid in the hopes of reducing inappropriate prescribing of opioids, with the exception of overlapping opioid + buprenorphine/naloxone prescriptions, have been partially effective at least during the period of this study. It could be due to difficulties in properly implementing the policies in practice settings, such as providers not being informed of the policy changes adopted by GA Medicaid in a timely manner. Little or no change in inappropriate prescriptions of opioids could result in an increase or no change in healthcare utilization. Similarly, though reductions in inappropriate prescriptions may decrease some healthcare utilization, limitations in opioid prescriptions may increase healthcare utilization due to increased pain management concerns among patients. Overall, our results suggest that additional efforts on the part of Medicaid programs are likely needed to produce significant reductions in inappropriate prescribing of opioids and related healthcare utilization.

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Author contributions

All authors conceived the project idea. Y. W. and M.P. carried out the analyses. All authors verified the analytical method. Y.W. and M.P. wrote the manuscript. All authors contributed to the final manuscript.

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Data Availability

The datasets generated and analyzed during the current study are available from Georgia Medicaid upon request.



## Conflict of Interest

None reported.

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