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The Impact of State Prescription Drug Monitoring Programs on Opioid Prescribing Practices and
Opioid-Related Overdose Death Rates

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Scholarship in Medicine Proposal

Abstract

Objective: Most states within the US have implemented a form of a Prescription Drug Monitoring Program (PDMP). The Centers for Disease Control and Prevention (CDC) has developed a scale to rate each state's requirements of prescribers use of the PDMP on timely submission of the data and consultation when prescribing opioids. This paper looks at the impact of three levels of PDMP ratings (Green, Yellow, and Red) on opioid prescribing practices and opioid-related overdose death rates in 2015 (prior to PDMP rating) and in 2017.

Methods: Data was collected from the CDC Wonder database, a publicly available data set. A one-way ANOVA was run to compare the change in opioid prescribing practices and opioid-related overdose death rates from 2015 to 2017 between the three PDMP rating levels.

Results: The one-way ANOVA showed no difference in change in death rate 2015-2017 between PDMP ratings (p-value 0.18). Similarly, the one-way ANOVA showed no difference in change in prescribing rate 2015-2017 between PDMP rating (p-value 0.18). While there was no difference between PDMP ratings, the prescribing rate from 2015 to 2017 overall went down (p-value <0.0001). However, death rate continues to rise (p-value <0.0001). This suggests a positive impact of any form of PDMP on opioid prescribing practices, but the issues surrounding opioid-

related deaths are multifactorial requiring many different avenues to affect change on the death rate.

Key Words: Opioid Overdose, Prescription Drug Monitoring Programs, Opioid prescribing rates

Introduction/Literature Review

The United States is currently facing an opioid epidemic. Prescribing practices for opioids in the US have resulted in opioid dependence by patients and a resultant crisis in opioid-related deaths. In the United States the drug overdose deaths increased 11.4% from 2014 to 2015 with 52,404 deaths, 33,091 of them involving opioids¹ Following the realization of a problem with overprescribing opioids and the consequences of opioid addiction and subsequent deaths, states have implemented various policies in order to address this opioid epidemic. One of those policy changes was the implementation of Prescription Drug Monitoring Programs (PDMP) by 49 states as of 2014.² Through the use of these PDMPs prescribers can reference a database of patient prescriptions of controlled substances. The aim of the programs is to facilitate changes in prescribing practices and prevent “doctor shopping” for opioid prescriptions by high risk patients.² Identification of high risk patients include risk factors like number of prescribers, number of pharmacies, and type of opioid prescribed.³ All of these factors may be included in the PDMP. Implementation of PDMPs has been associated with over 30% reduction in prescribing rate of Schedule II opioids.⁴

Ohio is a good case study of one way to implement a PDMP. The leading cause of injury-related death in Ohio is unintentional drug overdose.⁵ The Governor’s Cabinet Opiate Action team was created in 2011 in order to improve opioid safety. Part of this policy change was the mandatory use of Ohio’s PDMP. As a result, “the proportion of unintentional drug overdose deaths involving prescription opioids has reduced from 45% in 2011 to 22% in 2015.”⁵

Since the opioid epidemic is a nationwide problem, the Centers for Disease Control and Prevention (CDC) became actively involved in 2014. The CDC's efforts have been directed toward preventing opioid misuse, opioid use disorder, and opioid overdose.⁶ One of these efforts includes identifying and evaluating interventions to reduce prescription opioid overdose deaths. The Prevention Status Reports tracks each state's PDMP requirements and assigns them a rating based on how timely data is submitted to the PDMP and use of the PDMP before the initial prescription of opioids. The ratings are broken down into three categories, Green, Yellow, and Red. A state with a Green rating has the strictest requirement with data submission within 24 and prescriber use of the PDMP before initial opioid prescription as well as at least every three months thereafter. The Yellow rating describes requirements of data submission in more than 24 hours but within one week, and prescribers must consult the PDMP before initial opioid prescriptions and again within one year. States with a Red rating have the most relaxed requirements of data submission in more than one week and are not required to consult the PDMP before initial opioid prescriptions, or no requirements exist for either parameter.⁷ Another aspect of the CDC's involvement is data collection, which has included opioid prescribing rates, opioid-related overdose (fatal and non-fatal), and other aspects of opioid use.

There continues to be research on ways to resolve the issue of opioid misuse and the epidemic it has evolved into. Each state has attempted to make efforts in addressing the problem through different public policies. Some states have taken a stricter approach in enforcing prescribing practices than others. While the effect of PDMPs on prescribing practice and opioid overdose has been investigated as a whole, there has not been an individualized approach on the efficacy of the forms of PDMPs implemented by each of the 50 states.

Hypothesis

Hypothesis 1: In 2015 higher ratings for PDMP use in 2015 will be associated with lower opioid-related overdose death rates and lower opioid prescribing rates.

Hypothesis 2: Higher ratings for PDMP use in 2015 will be associated with a decrease in opioid-related overdose death rates and a decrease in opioid prescribing rates between 2015 and 2017.

Variables: PDMP ratings in 2015, Opioid prescribing rates in 2015 and 2017, Opioid death rates in 2015 and 2017

Methods

Context/Protocol

The CDC Wonder database was used. The Opioid Overdose data set includes graphs and tables categorized based on overdose rates, prescribing rates, and prescribing practices for opioids. The data from “drug overdose death rates” and prescribing rates by state for all 50 States from the years 2015 and 2017 were used. The data source for Drug Overdose Deaths was from the National Vital Statistics system, which collects drug overdose death counts from all 50 states for each year through state reported deaths. Age-adjusted death rates are reported for each state, which were calculated as “deaths per 100,000 population using the direct method and the 2000 standard population”.⁸ The opioid prescribing rate data was collected through IQVIA Xponent 2006-2018 from a sample of 49,900 pharmacies and U.S. Census Bureau data of resident populations. Prescribing rates per 100 persons were calculated based on total number of opioid prescription dispensed annually at the state level divided by annual resident population.⁹ The Public Health Professionals Gateway: Prevention Status Reports rates each state’s PDMP use. It is based on a 3-tiered rating system and is color-coded green, yellow, and red according to the time between opioid dispersion and data submission; as well as the requirements related to

consulting the PDMP before prescribing opioids and benzodiazepines. The ratings for state PDMP use requirements are described as: Green (“prescribers are required to consult the PDMP before initial opioid and benzodiazepine prescriptions and at least every three months”), Yellow (“prescribers are required to consult the PDMP before initial opioid prescriptions and again within one year”); Red (“prescribers are not required to consult the PDMP before initial opioid prescriptions, OR such a requirement does exist but there is no required subsequent check and/or the policy includes subjective standards or broad exceptions”).⁷ The rating reported for each state’s use of PDMPs came from data provided by the National Alliance of Model State Drug Laws as reported in October 31, 2015. From this data set, the state PDMP use requirement ratings for each of the 50 states in the US was used.

Data Collection

Data for drug overdose death rates and opioid prescribing rates were compared with state PDMP requirement ratings for all 50 States in the US. The data was organized into categories of states based on their PDMP use requirement rating from the Preventions Status Reports (last updated October 2015). There were three categories: Green, Yellow, and Red. For analysis purposes the three categories were assigned numerical values: Green=1, Yellow=2, Red=3. The death rates and prescribing rates from 2015 and 2017 for each state were collected from the CDC Wonder data base Opioid Overdose data set.

Data Analysis

I looked at skewness, kurtosis, and normal quantiles plots for the outcomes (opioid-related death rate, opioid prescribing rate, change in death rate between 2015 to 2017, and change in prescribing rate between 2015 and 2017) and determined that the distribution did not violate the normality assumption. As a result, I used a one-way ANOVA to test if there is a difference in

prescribing rates and death rates by PDMP use ratings (green, yellow, and red). The equality of variance was tested using Levene's test for homogeneity of variance which demonstrated no significant difference in variances. Due to the low number of states with Green and Yellow ratings these two groups were collapsed, and additional analyses were run where comparisons were made between Green and Yellow combined and the Red rating. To account for different levels of opioid death and prescription rates the 2015 values were entered into a linear regression model. The results of these models were no different than the one-way ANOVA models, so the more parsimonious one-way ANOVA models are presented here.

Results

The overall opioid-related death rate increased from 2015 to 2017 ($p < 0.001$). In 2015 the average opioid-related death rate was 23.9 for states with a Green PDMP rating, 21.4 for Yellow rated states, and 16.9 for Red rated states. There appeared to be no difference between ratings in 2015 ($p = 0.087$). This may be due to the low number of states with Green and Yellow ratings. When Red was compared to Green and Yellow combined there was a difference ($p = 0.031$). There was an increase in opioid-related deaths between 2015 and 2017 of 9.6 for Green PDMP rated states. The Yellow rated states death rates increased by 5.5 and the Red rates states had an increase in death rates by 4.33%. The one-way ANOVA showed no difference in change in death rate 2015-2017 between PDMP ratings ($p = 0.18$) (Table 1).

The opioid prescribing rate from 2015 to 2017 overall went down ($p = < 0.001$). In 2015 the average opioid prescribing rate was 73.2 for states with a Green PDMP rating, 85.3 for Yellow rated states, and 75.9 for Red rated states. There appeared to be no difference between ratings in 2015 ($p = 0.62$). Even when Red was compared to Green and Yellow combined there was still no difference ($p = 0.66$). The opioid prescribing rates for each group of PDMP ratings all decreased

between 2015 and 2017. As a group, Green states averaged a decrease in prescribing rates by 14.2%. Red states decreased prescribing rates by 15.8%. Yellow states decreased prescribing rates by 13.1%. The one-way ANOVA showed no difference in the change in prescribing rate 2015-2017 between PDMP rating ($p = 0.18$) (Table 1).

Table 1. Opioid-related death rates and Opioid prescribing rates between 2015 and 2017 by PDMP rating

	PDMP rating	Number of states	2015 mean (std)	2017 mean (std)	Change in rate 2017-2015 mean (std)	F-test Value f(df1, df2)	p-value
Opioid-related death rate						1.79 (2,47)	0.18
	Green	4	23.9 (7.77)	33.45 (11.30)	9.6 (4.71)		
	Yellow	4	21.4 (5.12)	26.93 (4.92)	5.5 (5.63)		
	Red	42	16.9 (6.79)	21.21 (10.55)	4.3 (5.38)		
Opioid prescribing rate						0.67(2,47)	0.52
	Green	4	73.2 (24.92)	59.03 (21.32)	-14.2 (5.01)		
	Yellow	4	85.3 (28.77)	69.48 (25.44)	-15.8 (3.65)		
	Red	42	75.9 (18.40)	62.78 (16.25)	-13.1 (4.59)		

Discussion

Comparing PDMP ratings, Green has the strictest timeline for consulting the PDMP while Red is the most relaxed. As such, it was hypothesized that opioid-related death rates and opioid prescribing rates would be lower in the group of states with a Green rating. While prescribing

rates did decrease from 2015 to 2017 in all 3 rating groups, there was not a difference in the change between PDMP ratings. This decrease in prescribing rates seems to continue the trend as shown in a study by Bao et al that associated a reduction in prescribing rates between 2001 to 2010 for Schedule II opioids in states that had implemented a PDMP.⁴ Similarly, a comparison of prescribing practices of PDMP registrants vs non registrants showed following implementation of the PDMP both groups had declines in opioid prescriptions.¹⁰ This suggests that simply having a PDMP in place impacts prescribing practices.

In contrast, the opioid-related death rates continue to increase across ratings. Additionally, there was not a difference between PDMP ratings for opioid-related death rates. One study compared prescription overdose death rates between 1999 and 2014 to a measure of how robust of a PDMP a state has contradicts the findings of no difference between PDMP ratings. This study showed states with more robust PDMPs had fewer prescription opioid overdose deaths than those with weaker programs.¹¹ “America’s Opioid Epidemic: a Comprehensive Review and Look into the Rising Crisis” explains that while stricter regulations on prescribing practices and PDMPs have been implemented opioid related overdoses continue to rise. The article goes on to discuss many possible factors that may play into this, including the increase in availability of illicit synthetic opioids like fentanyl and adulteration of other drugs with fentanyl since 2000, as well as access and the cost of treatment of overdose.¹²

Conclusion

This study was a further demonstration that overdose death rates continue to climb even with strict reference to PDMPs. Although opioid prescription rates decreased across all three PDMP ratings, neither prescription rates nor overdose death rates had a difference between PDMP ratings. This may be due to the low number of states in the Green and Yellow rating groups.

While Prescription Drug Monitoring Programs are able to target prescription opioids, they do not monitor illicit opioids. The overdose death rates data did not discriminate between prescription vs illicit use-related deaths. Thus, the outcome variable of opioid-related deaths includes deaths that may not be affected by the PDMPs. Another limitation is there may be confounders or effect modifiers that were not adjusted for that would change these results. For example, state laws/policies that may have taken effect between 2015 and 2017 with an impact on opioid-related deaths and opioid prescribing.

In addition, opioid prescribing practices is only one factor contributing to opioid abuse leading to overdose deaths. The implementation of PDMPs is a good start, however there are many aspects to the problem. Access to treatment for opioid abuse, treatment for overdose, and the cost of both treatments are just a few other components of understanding how to address this epidemic. It is important to continue to find and address obstacles to getting the opioid epidemic under control.

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