



## Unsolicited reporting notifications (URNs) through Maryland's prescription drug monitoring program (PDMP): Characteristics of providers

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### ABSTRACT

**Objectives:** Unsolicited reporting is the activity of analyzing Prescription Drug Monitoring Program (PDMP) data and then sending unsolicited reporting notifications (URNs) to prescribers to notify them of their outlier prescribing behavior. We aimed to describe information about prescribers who were issued URNs.

**Methods:** A retrospective study of Maryland's PDMP data from Jan.2018-Apr.2021. All providers who were issued  $\geq$  one URN were included in analyses. We summarized data on types of URNs issued by provider type and years in practice using basic descriptive measures. We also performed logistic regression analysis to provide odds ratio and estimated marginal probability of issuing  $\geq$  one URN to providers in the Maryland health care workforce in comparison with physicians as reference group.

**Results:** A total of 4,446 URNs were issued to 2,750 unique providers. Odds ratio (OR) and the population estimated probability of issuing URNs were higher among nurse practitioners [OR: 1.42, 95% Confidence Interval (CI): 1.26-1.59] followed by physician assistants [OR: 1.87, 95% CI: 1.69-2.08], compared to physicians. Physicians and dentists with >10 years in practice comprised the majority of providers who were issued URNs (65.1% and 62.6%, respectively), while majority of nurse practitioners had been in practice for <10 years (75.8%).

**Conclusion:** Findings indicate a higher probability of issuing URN for Maryland's physician assistants and nurse practitioners, compared to physicians, and an overrepresentation of physicians and dentists with longer and nurse practitioners with shorter practice experience. The study suggests education programs on safer prescribing practices and management of opioids should target certain types of providers.

### 1. Introduction

Prescription opioid deaths comprise a sizable portion of overdose deaths in Maryland and in the US more broadly (Gladden et al., 2019; Mattson et al., 2018; Wilson et al., 2020). Recent data shows over 16,000 overdose deaths involving prescription opioids in the US in 2020 (Centers for Disease Control and Prevention, 2020). Since 2015, there have been more than 350 overdose deaths involving prescription opioids annually in Maryland. In 2020, there were 445 such fatalities, representing a 20.6% increase from the 369 reported in 2019 (OCC, 2021).

Maryland's Prescription Drug Monitoring Program (PDMP) is a core component of the State's strategy to combat prescription opioid misuse and to prevent overdoses that involve prescription opioids. The PDMP issues "unsolicited reporting notifications" (URNs) to providers when their prescribing patterns fall outside guidelines or when there are potential concerns about patients' behavior (e.g., prescriptions from multiple doctors). URNs include a letter describing the metric along with educational information about standards for prescribing controlled substances. This proactive reporting style of PDMP is considered a national best practice and has been adopted by most states with PDMPs (PDMP Center of Excellence at Brandeis University, 2014).

**Abbreviations:** URNs, Unsolicited Reporting Notifications; PDMP, Prescription Drug Monitoring Program; OPER, Office of Provider Engagement and Regulation; SUD, Substance Use Disorders; CRISP, Chesapeake Regional Information for our Patients; DEA, Drug Enforcement Administration; NDC, National Drug Code.

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### 1.1. URNs Issued by Maryland's PDMP

As with most states, Maryland issues different types of URNs based on the specific prescribing circumstances. *Multiple Provider Episodes* URNs have been issued since August 2016. They alert providers when one of their patients has active opioid or benzodiazepine prescriptions from multiple prescribers and the prescriptions have been dispensed at multiple pharmacies over a limited time period. An *Overdose Fatality* URN notifies providers of the opioid-related overdose death of a patient if the provider had prescribed an opioid or benzodiazepine to that patient within 3 months of the death; they have been issued since October 2019. *Dangerous Drug Combinations* URNs were first issued in June 2020. They are sent when a provider prescribes multiple medications (i.e., an opioid, a benzodiazepine, and a muscle relaxant) to the same patient on the same day. The other types of URNs either are not currently active or are recently added to Maryland's PDMP (Maryland Department of Health, 2022; The Maryland Department of Health, 2020).

Maryland's Office of Provider Engagement and Regulation (OPER), which manages the state PDMP, reviews prescription monitoring data monthly to identify providers who should receive a notification based on the described metrics. Providers may receive multiple notifications for the same patient. Providers will only receive an *Overdose Fatality* URN for a unique patient once given the nature of the metric.

The URNs issued by OPER are provided for educational and practice improvement purposes, with the goal of supporting clinical decision-making and reducing the risk of adverse outcomes for patients receiving controlled substance prescriptions. The URN letter includes educational resources and a survey for the provider to provide feedback to Maryland's PDMP. All URNs encourage providers to check the PDMP and screen for substance use disorders (SUD), and additional recommendations are tailored to the type of URN (e.g., *Dangerous Drug Combinations* URNs recommend co-prescribing naloxone with opioids).

### 1.2. The Current Study

Despite their widespread use by state PDMPs, there has been little scientific investigation of URNs. Basic descriptive information about providers who receive URNs is largely unavailable. There are some indications that URNs may be effective (Castillo-Carniglia et al., 2021; Ferris et al., 2019; McDonald et al., 2019; Rhodes et al., 2019; Thomas et al., 2014; Young et al., 2018). However, the empirical studies were limited, mainly observational, and heterogeneous in terms of methodology and the outcomes of interest. Two recent studies suggest that URNs are associated with reductions in the number of opioid prescriptions written by providers and with reductions in patients' use of multiple providers or pharmacies (McDonald et al., 2019; Young et al., 2018).

The purpose of this study is to provide detailed information about URNs in Maryland. Our main objective was to summarize characteristics of providers who were issued URNs (i.e., length of time in practice and provider type) in association with the number and types of URNs issued to providers. Secondarily, we examined URNs issued to providers by provider type, adjusting for the number of each provider type in the state. This objective will enhance our understanding of differences in URNs issued by provider type. Given that scientific information about URNs is limited, our findings provide new information to guide research and practice and identify providers or groups of providers who may need additional education in order to safely prescribe controlled substances.

## 2. Methods

### 2.1. PDMP Data

Maryland's PDMP collects and securely stores information on controlled dangerous substances that are dispensed in the state.

Providers can access the PDMP through the Chesapeake Regional Information for our Patients (CRISP) Unified Landing Page (<https://www.crisphealth.org/>), which is co-located with the state's health information exchange or through select electronic health record integrations within a provider's workflow. URNs are sent to providers at the address they used to register with the Drug Enforcement Administration (DEA). The OPER maintains logs of the number and types of URNs issued. The dataset we used in this study contains linked information from URN logs, drug dispensation data, and the CRISP. The OPER provided us with deidentified data excluding providers with institutional DEA numbers or with DEA numbers that were inaccurate, pending, or that could not be matched to a single prescriber. We included providers who had received at least one of the three types of URNs (Table 1) during the 40-month study period (Jan. 2018-Apr. 2021), and who prescribe in the state of Maryland.

### 2.2. Study Measurements

We measured the number of URNs issued to providers (i.e., one vs. more than one) and whether providers had been issued only one type or a combination of different types of URNs. Prescriber characteristics included provider type and length of time in practice. Provider type was based on CRISP designations and clinical degrees, and included dentists (DDS or DMD), physicians – including those in residency (DO or MD), podiatrists (DPM), nurse practitioners (NP), and physician assistants (PA). An additional category included prescribers with other degree types or without information on the degree. Length of time in practice (i.e.,  $\leq 5$  years, 6-10 years, and  $\geq 10$  years) was calculated by subtracting the year the URN was issued from the earliest year of a Maryland professional licensure.

### 2.3. Data Analysis

Analyses involved basic descriptive measures, including counts, percentages, and means. First, we derived the number of URNs issued, the number issued to unique providers, and the number triggered by unique patients. We described characteristics of providers who were issued URNs, summarizing the number and types of URNs issued by provider type, length of time in practice, and both provider type and length of time in practice.

Additionally, we derived Maryland's number of providers as a denominator from the U.S. Bureau of Labor Statistics (U.S. Bureau of Labor Statistics, 2021) to estimate the probability of URN issuance in the Maryland providers population. It has been estimated that 16,690 physicians, 3,320 nurse practitioners, 2,510 dentists, 2,930 physician assistants, and 240 podiatrists were in the healthcare workforce in Maryland in 2020. Based on our number of providers who were issued at least one URN as the numerator and Maryland's number of providers in each group as denominators, we compared the odds of URNs issuance across groups of providers relative to physicians and provided the marginal probabilities based on the logistic regression.

## 3. Results

From January 2018 through April 2021, Maryland's PDMP issued 4,446 URNs. URNs were issued to 2,750 unique providers and were triggered by 1,551 unique patients. The highest number of URNs issued to a single provider was 18, and the highest number of URNs triggered by a single patient was 41. Thirty-five percent of all URNs were issued in 2020, 26.8% in 2019, 24.0% in 2018, and the remaining 13.8% from January through April of 2021 (Table 2).

### 3.1. URNs by Provider Type

Of the 2,750 providers in the dataset, 60.4% were physicians, 20.7% were nurse practitioners, 14.4% were physician assistants, and 3.6%

**Table 1**  
Description and clinical recommendations for URNs issued by Maryland's PDMP.

Type	Description	Recommendations
<i>Multiple Provider Episodes</i>	Identifies patients receiving prescriptions from multiple prescribers and multiple pharmacies over specified time periods. URNs are issued to providers who prescribed a CS to that patient during the period. The MPE metric is used to identify potential discordant care or potential prescription drug diversion. Issued since August 2016.	<ul style="list-style-type: none"> <li>• Coordinate care with the patients' other prescribers</li> <li>• Co-prescribe naloxone</li> <li>• Discuss safe storage and disposal of controlled substances with patients</li> </ul>
<i>Overdose Fatality</i>	Notifies providers about patient overdose deaths when the death was caused by prescription or illicit opioids and when the provider had prescribed an opioid or a benzodiazepine in the 3 months before the death. The intention is to inform providers that they treat patients who are at risk of experiencing an overdose. Issued since October 2019.	<ul style="list-style-type: none"> <li>• Refer or offer treatment for substance use disorders when indicated</li> <li>• Safely taper patients to a safer dose of an opioid when indicated</li> <li>• Prescribe naloxone to patients likely to witness or experience an overdose</li> <li>• Safely prescribe controlled substances when indicated and when the benefits outweigh the risks</li> </ul>
<i>Dangerous Drug Combinations</i>	In 2020, OPER began notifying providers who prescribed an opioid, a benzodiazepine, and carisoprodol (a muscle relaxant) to the same patient on the same day. This pattern of prescribing puts patients at high-risk adverse events or overdose. Issued since June 2020.	<ul style="list-style-type: none"> <li>• Refer or offer treatment for substance use disorders when indicated</li> <li>• Safely taper patients to a safer dose of an opioid when indicated</li> <li>• Prescribe naloxone to patients likely to witness or experience an overdose</li> <li>• Safely prescribe controlled substances when indicated and when the benefits outweigh the risks</li> </ul>

**Table 2**  
Number (percentages) and types of unsolicited reporting notifications (URNs) issued to Maryland providers, Jan. 2018-Apr. 2021.

URN	N	Jan-Dec 2018	Jan-Dec 2019	Jan-Dec 2020	Jan-Apr 2021
All Types	4,446	1,069 (24.0)	1,190 (26.8)	1,575 (35.4)	612 (13.8)
<i>Multiple Provider Episodes URNs</i>	2,656	*1,069 (40.2)	*829 (31.2)	*613 (23.1)	145 (5.5)
<i>Overdose Fatality URNs</i>	1,600	—	361 (22.6)	*843 (52.7)	396 (24.7)
<i>Dangerous Drug Combinations URNs</i>	190	—	—	119 (62.6)	*71 (37.4)

Note. A star (\*) indicates that the URN was issued for all months in the year that are included in the study period. A triple dash (—) indicates that the URN was not issued during the year.

**Table 3**  
Number (percentage) and types of URNs issued to providers, by provider type, Jan. 2018-Apr. 2021.

	Provider Type				
	All Providers	Physicians	Nurse Practitioners	Physician Assistants	Dentists
No. who received at least one URN, any type	2,750	1,662	570	397	100
Only 1 URN, any type	1,862 (67.7%)	1,128 (67.9%)	356 (62.5%)	267 (67.3%)	93 (93.0%)
≥1 <i>Multiple Provider Episodes URNs</i>	1,874 (68.1%)	1,130 (68.0%)	343 (60.2%)	321 (80.9%)	68 (68.0%)
≥1 <i>Overdose Fatality URNs</i>	1,116 (40.6%)	642 (38.6%)	311 (54.6%)	119 (30.0%)	36 (36.0%)
≥1 <i>Dangerous Drug Combinations URNs</i>	148 (05.4%)	113 (6.8%)	22 (3.9%)	12 (3.0%)	0

Numbers do not sum to the total because podiatrists and unspecified provider types are not included (n=21) to preserve confidentiality.

were dentists (Table 3, top row). Relative to physicians, the estimated marginal probability of URN issuance in the Maryland provider population was significantly higher for nurse practitioners and physician assistants, and lower for dentists and podiatrists. Compared to physicians, the odds of having been issued at least one URN were 1.42, 1.87, 0.43, and 0.37 among Maryland's nurse practitioners, physician assistants, podiatrists, and dentists, respectively. We estimate that 10% of Maryland physicians were issued at least one URN during the study period. Corresponding estimates were 17.2%, 13.5%, 4.5%, and 4.0% among nurse practitioners, physician assistants, podiatrists, and dentists in Maryland, respectively. Table 4 shows the estimated marginal probability and odds

ratio for receiving at least one URN for each type compared to physicians.

Two-thirds of the providers were issued just one URN (67.7%), and 32.3% were issued at least two. Dentists were least likely to receive more than one URN. Less than 70% of physicians, nurse practitioners, and physician assistants in our sample received just one URN (respectively, 67.9%, 62.5%, and 67.3%), compared to 93% of dentists (Table 3). More than two-thirds of providers (68.1%) were issued a *Multiple Provider Episodes URN*, 40.6% were issued an *Overdose Fatality URN*, and 5.4% were issued a *Dangerous Drug Combinations URN*. More physician assistants were issued *Multiple Provider Episodes URNs* than any

**Table 4**  
Estimated marginal probability of issuing URN to Maryland providers by provider type.

Provider type	% (95% CI)	OR (95% CI)	P value
Physicians	10.0 (9.5-10.4)	Ref.	-
Dentists	4.0 (3.2-4.7)	0.37 (0.30-0.46)	<0.001
Podiatrists	4.6 (1.9-7.2)	0.43 (0.24-0.80)	0.007
Physician assistants	13.5 (12.3-14.8)	1.87 (1.69-2.08)	<0.001
Nurse practitioners	17.2 (15.9-18.4)	1.42 (1.26-1.59)	<0.001

Note. CI=Confidence Interval, OR=Odds Ratio, Ref=Reference group.

**Table 5**  
Percentage of URNs issued to providers by length of time in practice, by type of URN, and by provider type.

Type of URN	Type of Provider			
	All Providers	Physicians	Nurse Practitioners	Dentists
<i>All Types</i>				
N	2,272	1,599	562	99
≤5 years	25.0%	16.4%	50.7%	20.2%
6-10 years	20.3%	18.5%	25.1%	17.2%
>10 years	54.7%	65.1%	24.2%	62.6%
<i>Multiple Provider Episodes URNs</i>				
N	1,487	1,076	338	67
<5 years	23.7%	17.3%	45.0%	19.4%
6-10 years	22.9%	21.4%	28.1%	17.9%
>10 years	53.4%	61.3%	26.9%	62.7%
<i>Overdose Fatality URNs</i>				
N	977	629	306	36
<5 years	28.4%	14.9%	56.9%	22.2%
6-10 years	17.8%	15.1%	23.5%	13.9%
>10 years	53.8%	70.0%	19.6%	63.9%
<i>Dangerous Drug Combinations URNs</i>				
N	134	112	22	0
<5 years	8.2%	2.7%	36.4%	—
6-10 years	7.5%	6.3%	13.6%	—
>10 years	84.3%	91.1%	50.0%	—
<i>All types of URNs (limited to providers who were issued &gt;1 URN)</i>				
N	739	519	210	NR
<5 years	23.3%	12.9%	49.1%	-
6-10 years	21.7%	20.0%	25.7%	-
>10 years	55.1%	67.1%	25.2%	-

Note. NR= Not reportable due to the very limited number of dentists and the confidentiality circumstances.

Other and unspecified provider types are represented in the “all providers” column. The length of time in practice for physician assistants was unavailable.

other provider type (80.9%), and more physicians were issued *Dangerous Drug Combinations* URNs than any other provider type (6.8%). No dentists were issued *Dangerous Drug Combinations* URN. Among providers who received two different types of URNs, the most common combination was *Multiple Provider Episodes* and *Overdose Fatality* URNs.

### 3.2. URNs by Length in Practice

Information on the length of time in practice was unavailable for physician assistants but was available for most of the other provider types (n=2,272), including 96.2% of physicians, 98.6% of nurse practitioners, 99% of dentists, and 57.1% of other providers. There was a substantial variation in the proportion of providers who were issued URNs by length of time in practice (Table 5). The majority of physicians and dentists who had received URNs had more than 10 years in practice (65.1% and 62.6%, respectively), compared to just 24.2% of nurse practitioners. By contrast, one-half of nurse practitioners who were issued URNs had 5 or fewer years of practice experience, whereas the corresponding proportions were 16.4% for physicians and 20.2% for dentists. A similar pattern was observed in analyses for *Multiple Provider Episodes* and *Overdose Fatality* URNs, and also when we restricted analyses to providers who received more than one URN. Most providers who re-

ceived *Dangerous Drug Combinations* URNs had more than 10 years in practice (84.3%), including 91.1% of physicians and 50% of nurse practitioners.

## 4. Discussion

The purpose of this study was to examine characteristics of providers who were issued URNs in Maryland from January 2018 to April 2021, including provider type and number of years of experience. Our findings add to the limited body of literature describing information about providers who receive unsolicited reporting notifications by PDMPs. We found that the issuance of multiple URNs per provider was not uncommon, and many providers had been issued multiple types of URNs.

### 4.1. Types of URNs Issued to Providers

The URN most commonly issued to providers was *Multiple Provider Episodes*, followed by *Overdose Fatality*, and *Dangerous Drug Combinations* URNs. The higher proportion of *Multiple Provider Episodes* URNs issued is consistent with the nature of the metric, both patients' and providers' behaviors have an essential role in triggering this type of URN. A single patient triggers *Multiple Provider Episodes* URNs for more than one provider, whereas once a patient triggers an *Overdose Fatality* URN, that patient's death makes it impossible to trigger further URNs. The number and types of URNs issued varied over the study period, which reflects procedural changes in the types of URNs issued by Maryland's PDMP since the program was initiated (Maryland Department of Health, 2016, 2019, 2020). *Multiple Provider Episode* URNs were issued throughout the entire study period, whereas *Overdose Fatality* and *Dangerous Drug Combination* URNs were introduced during the study period. Variation in the number of each type of URN issued over time reflects differences in when each type was introduced and the nature of the metric (i.e., triggered by provider or patient), as well as by changes in prescribing practices. Findings should be interpreted in the context of the dates the OPER commenced issuance of each type of URN. Therefore, it is not appropriate to interpret differences in the number of URNs issued by type as representative of trends in prescribing.

Maryland's PDMP has recently started to use an updated edition of the National Drug Code (NDC) list to match products for *Multiple Provider Episodes* URNs. This change may affect the trend in the issuance of *Multiple Provider Episodes* URNs over time because fewer drugs may be captured to trigger a notification by matching the updated list. By contrast, matching products to the NDC list was removed from the *Dangerous Drug Combinations* metric, which may explain the recent observed increase in that type of URN.

Checking patient records to identify additional prescriptions, additional providers, or even a history of substance use disorder is an important strategy for preventing outlier prescribing, overdose deaths, and duplicate prescriptions from multiple providers. Providers in Maryland are now required by law to view the patient's records on PDMP before initiation of a new course of treatment with an opioid or benzodiazepine in order to prevent over-prescription of opioids or overlapped prescription of dangerous drug combinations. Further investigation of PDMP data taking into account whether the PDMP was viewed by a provider could shed light on whether checking patient records prevents outlier prescribing. Unfortunately, such an investigation is not yet feasible because there is no formal procedure to verify whether a provider viewed the PDMP, or whether that task was delegated to other staff.

### 4.2. Issuance of URNs By Type of Provider & Provider Experience

Two principal findings of the study are noteworthy to discuss. First, a vast majority of the providers who were issued URNs were physicians, which can be explained by the fact that there are a higher number of physicians in the US healthcare workforce. When we accounted for the number of different providers in the Maryland workforce (U.S. Bureau of



Labor Statistics, 2021), nurse practitioners followed by physician assistants were the types of providers who most commonly issued URNs. Dentists and podiatrists were the least commonly issued URNs of all provider types, possibly because they treat a narrower range of conditions. The differences in the issuance of URNs by provider type indirectly support evidence regarding overprescribing of opioids and benzodiazepines by nurse practitioners and physician assistants. Although relaxing the scope-of-practice (SOP) laws for nurse practitioners is considered a policy change that broadens access to care for patients and reduces the cost of care (Traczynski and Udalova, 2018), evidence shows an increase in number of prescriptions per capita covered by Medicaid after allowing nurse practitioners to prescribe independently (Xue et al., 2016). Our findings are consistent with existing literature demonstrating that nurse practitioners and physician assistants were more likely to overprescribe opioids (Ellenbogen and Segal, 2020; Lozada et al., 2020) or to prescribe stronger opioids or higher doses than physicians (Muench et al., 2019). Furthermore, national data on the distribution of opioid prescriptions and health care supply shows that states with no restrictions on nurse practitioners' opioid prescriptions experienced higher opioid-related deaths (Griffith et al., 2021).

Maryland is among the many states that allow physician assistants to prescribe controlled substances under the supervision of a physician. Notably, the quantity and quality of the supervision of physician assistant practices are subject to each physician's discretion. Our findings suggest that physician assistants and nurse practitioners may need more education about prescribing guidelines and overdose prevention – either through academic detailing or in professional training. Findings also indicate a need for more clarity or standardization about their supervision and oversight.

A second main finding of the study is that physicians with more years in practice were more likely to be issued URNs, indicating that more clinical experience may not mean providers will adhere to safe opioid prescribing guidelines. This finding may represent a cohort effect, wherein more experienced providers received less training in safe prescribing. A possible strategy to address outlier prescribing by experienced physicians would be to re-evaluate requirements for continuing medical education on prescribing controlled substances, particularly for those whose medical training had limited coverage of safe opioid prescribing practices.

The association between years of experience and issuance of URNs for nurse practitioners was the opposite of what we observed for physicians; those with fewer years in practice were more commonly issued URNs than those with more experience. This finding may reflect gaps in nursing education. Although safe prescribing of controlled substances is now covered in most medical schools and residency training programs (The American Medical Association, 2021), the same cannot be said for nursing schools. Only 191 of over 1,631 schools with degree programs for registered or practical nursing pledged to teach the 2016 *CDC Guideline for the Management of Chronic Pain* (American Association of Colleges of Nursing, 2016, 2018). Nurse practitioners may learn to practice safe prescribing through experience over time, and in response to received URN letters. This could suggest a need to incorporate additional training regarding the safe practice of controlled substances within formal nurse practitioner training prior to graduation or upon initial licensure (Maryland Division of State Documents, 2021). Overall, these data suggest that training programs for future prescribers, more specifically for nurse practitioners and physician assistants, should include safe opioid prescribing and management as part of their didactic and experiential activities.

#### 4.3. Limitations

Although these data reflect a high level of reliability due to the State's mandated standards of CRISP usage among providers and pharmacists, some limitations are worth noting. Sample sizes for some provider types (e.g., dentist, podiatrist) were small, and the reported descriptive statis-

tics are therefore based on small (and possibly unreliable) numbers. Information about subspecialties was not available due to issues related to privacy and confidentiality, which limited us from drawing conclusions as to whether URNs were more likely to be issued to providers in specific types of subspecialties. Information on length of practice was unavailable for physician assistants which prohibited us from describing the URNs issued to physician assistants by length of time in practice. It should be noted that receiving an Overdose Fatality URN does not mean that providers' prescriptions were the cause of death. The providers receiving notifications could have treated someone who was in treatment and relapsed, or who was legitimately seeking medication to manage pain and misusing other substances and unaware of the risk. In any of these circumstances, provider screening may have prevented an overdose.

## 5. Conclusion

The goal of sending URNs is to encourage providers to screen their patients who are at risk of overdose carefully, to co-prescribe naloxone, and to offer treatment for substance use disorder if it is needed. Whether the URN along with the educational materials impacted providers' prescribing behaviors is an important research question that has rarely been investigated (McDonald et al., 2019; Young et al., 2018), and the existing evidence is mainly based on observational or non-randomized experimental studies. Although further evaluation of the impact of URNs is warranted, we provide new information about providers who were issued URNs and our findings have implications for short- and long-term strategies to prevent outlier prescribing. In particular, our conclusions about level of experience and provider type in relation to the issuance of URNs underscores a need to re-examine needed changes in training and continuing education.

## 6. Contributors

Masoumeh Amin-Esmaili: The study concept, data analyses, drafting, and revising of the manuscript. Anna Gribble: The study concept, revising the manuscript, and approval of the final version. Renee M. Johnson: The study concept, interpretation of data, revising the manuscript, and approval of the final version. Rachel H Alinsky: Interpretation of data, revising the manuscript, and approval of the final version. Natasha Oyedele: Revising the manuscript and approval of the final version. Taylor Parnham: Revising the manuscript and approval of the final version. Himani Byregowda: Revising the manuscript and approval of the final version. Kristin E. Schneider: Revising the manuscript and approval of the final version. Ju Nyeong Park: Revising the manuscript and approval of the final version. Lindsey Goddard: The study concept, revising the manuscript, and approval of the final version. Ryoko Susukida: The study concept and design, interpretation of data, revising the manuscript, and approval of the final version.

## Declaration of Competing Interest

Anna Gribble was the Provider Engagement and Policy Manager with the Maryland Department of Health (MDH) at the time of analysis the data and drafting the report. She worked in the Office of Provider Engagement and Regulation (OPER) and she was responsible for PDMP programmatic activities and policies. Lindsey Goddard is an Epidemiologist. She also works in the Office of Provider Engagement and Regulation (OPER) and she is responsible for data analysis and management for the PDMP. Her staff time was supported by the Maryland Overdose Data to Action Cooperative Agreement from CDC and FY 2020 Harold Rogers Grant, DOJ, BJA. Dr. Park is funded by the COBRE on Opioids and Overdose (P20GM125507) from the NIH and serves as a technical consultant for the Food and Drug Administration (U01FD00745501). All other authors have no competing interest to declare.

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## References

- American Association of Colleges of Nursing, 2016. At White House event, AACN announces commitments by Nursing Schools to combat opioid use disorder, Academic Nursing Pledges Enhanced Education for Advanced Practice Registered Nurses.
- American Association of Colleges of Nursing, 2018. Academic nursing responds to the opioid epidemic. <https://www.aacnursing.org/Policy-Advocacy/Opioids>. (Accessed 10/12/2022).
- Castillo-Carniglia, A., González-Santa Cruz, A., Cerdá, M., Delcher, C., Shev, A.B., Wintemute, G.J., Henry, S.G., 2021. Changes in opioid prescribing after implementation of mandatory registration and proactive reports within California's prescription drug monitoring program. *Drug Alcohol. Depend.* 218, 108405.
- Centers for Disease Control and Prevention, 2020. Wide-ranging online data for epidemiologic research (WONDER). <http://wonder.cdc.gov>. (Accessed 5/14/2022).
- Ellenbogen, M.I., Segal, J.B., 2020. Differences in Opioid Prescribing Among Generalist Physicians, Nurse Practitioners, and Physician Assistants. *Pain Med.* 21 (1), 76–83.
- Ferris, L.M., Saloner, B., Krawczyk, N., Schneider, K.E., Jarman, M.P., Jackson, K., Lyons, B.C., Eisenberg, M.D., Richards, T.M., Lemke, K.W., Weiner, J.P., 2019. Predicting Opioid Overdose Deaths Using Prescription Drug Monitoring Program Data. *Am. J. Prev. Med.* 57 (6), e211–e217.
- Gladde, R.M., O'Donnell, J., Mattson, C.L., Seth, P., 2019. Changes in Opioid-Involved Overdose Deaths by Opioid Type and Presence of Benzodiazepines, Cocaine, and Methamphetamine - 25 States, July-December 2017 to January-June 2018. *MMWR Morb. Mortal. Wkly. Rep.* 68 (34), 737–744.
- Griffith, K.N., Feyman, Y., Auty, S.G., Crable, E.L., Levengood, T.W., 2021. Implications of county-level variation in U.S. opioid distribution. *Drug Alcohol. Depend.* 219, 108501.
- Lozada, M.J., Raji, M.A., Goodwin, J.S., Kuo, Y.F., 2020. Opioid Prescribing by Primary Care Providers: a Cross-Sectional Analysis of Nurse Practitioner, Physician Assistant, and Physician Prescribing Patterns. *J. Gen. Intern. Med.* 35 (9), 2584–2592.
- Maryland Department of Health, 2016. Maryland advisory board on prescription drug monitoring (PDMP) minutes: March 7, 2016.
- Maryland Department of Health, 2019. Maryland advisory board on prescription drug monitoring (PDMP) minutes: November 21, 2019.
- Maryland Department of Health, 2020. Maryland PDMP Technical Advisory Committee Meeting Minutes: July 27, 2020.
- Maryland Department of Health, 2022. Maryland advisory board on prescription drug monitoring (PDMP) minutes: February 16, 2022.
- Maryland Division of State Documents, 2021. Code of Maryland Regulations, Department of Health and Mental Hygiene: Chapter 10.27.07.03. Nurse Practitioner-Scope and Standards of Practice Retrieved from [https://www.dsd.state.md.us/COMAR/subtitle\\_chapters/10\\_Chapters.aspx](https://www.dsd.state.md.us/COMAR/subtitle_chapters/10_Chapters.aspx). (Accessed 4/11/2022).
- Mattson, C.L., O'Donnell, J., Kariisa, M., Seth, P., Scholl, L., Gladden, R.M., 2018. Opportunities to Prevent Overdose Deaths Involving Prescription and Illicit Opioids, 11 States, July 2016-June 2017. *MMWR Morb. Mortal. Wkly. Rep.* 67 (34), 945–951.
- McDonald, D.C., Carlson, K.E., Jalbert, S.K., 2019. An Experimental Test of the Effectiveness of Unsolicited Reporting by a Prescription Drug Monitoring Program in Reducing Inappropriate Acquisition of Opioids. *Pain Med.* 20 (5), 944–954.
- Muench, U., Spetz, J., Jura, M., Guo, C., Thomas, C., Perloff, J., 2019. Opioid-prescribing Outcomes of Medicare Beneficiaries Managed by Nurse Practitioners and Physicians. *Med. Care* 57 (6), 482–489.
- OIOC, 2021. Maryland Opioid Operational Command Center (OIOC): 2020 Annual Report. <https://beforeitstoolate.maryland.gov/resources-2/>. (Accessed 10/25/2021).
- PDMP Center of Excellence at Brandeis University, 2014. Guidance on PDMP best practices: Options for unsolicited reporting.
- Rhodes, E., Wilson, M., Robinson, A., Hayden, J.A., Asbridge, M., 2019. The effectiveness of prescription drug monitoring programs at reducing opioid-related harms and consequences: a systematic review. *BMC Health Serv. Res.* 19 (1), 784.
- The American Medical Association, 2021. Teaching resident physicians about safe opioid prescribing. <https://www.ama-assn.org/education/improve-gme/teaching-resident-physicians-about-safe-opioid-prescribing>. (Accessed 4/29/2022).
- The Maryland Department of Health, 2020. The 2020 Maryland PDMP Annual Report health.maryland.gov/pdmp/Documents/2020 Annual Report.pdf. (Accessed 4/29/2022).
- Thomas, C.P., Kim, M., Nikitin, R.V., Kreiner, P., Clark, T.W., Carrow, G.M., 2014. Prescriber response to unsolicited prescription drug monitoring program reports in Massachusetts. *Pharmacoepidemiol. Drug Saf.* 23 (9), 950–957.
- Traczynski, J., Udalova, V., 2018. Nurse practitioner independence, health care utilization, and health outcomes. *J. Health Econ.* 58, 90–109.
- U.S. Bureau of Labor Statistics, 2021. May 2020 State Occupational Employment and Wage Estimates: Maryland. [https://www.bls.gov/oes/current/oes\\_md.htm#](https://www.bls.gov/oes/current/oes_md.htm#). (Accessed 3/16/2022).
- Wilson, N., Kariisa, M., Seth, P., Smith, H.T., Davis, N.L., 2020. Drug and Opioid-Involved Overdose Deaths - United States, 2017-2018. *MMWR Morb. Mortal. Wkly. Rep.* 69 (11), 290–297.
- Xue, Y., Ye, Z., Brewer, C., Spetz, J., 2016. Impact of state nurse practitioner scope-of-practice regulation on health care delivery: Systematic review. *Nursing Outlook* 64 (1), 71–85.
- Young, L.D., Kreiner, P.W., Panas, L., 2018. Unsolicited Reporting to Prescribers of Opioid Analgesics by a State Prescription Drug Monitoring Program: An Observational Study with Matched Comparison Group. *Pain Med.* 19 (7), 1396–1407.