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## A New Tool to Tackle the Opioid Epidemic: Description, Utility, and Results from the Maine Diversion Alert Program

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### Abstract

**Study Objective**—The opioid epidemic continues to impact the United States, and new strategies are needed to combat this epidemic. The objective of this study was to analyze 2015 drug arrest data from Maine's Diversion Alert program ([diversionalert.org](http://diversionalert.org)), compare arrest data between the first quarters of 2015 and 2016, and provide an analysis of the sex differences in the arrests as well as information about DA use.

**Study Design**—A population-based, descriptive study using data from the Maine Diversion Alert Program. The study population consisted of persons arrested for prescription, non-prescription or illicit drugs.

**Data Source**—Diversion Alert database.

**Measurements and Main Results**—The Diversion Alert program addresses Maine's prescription drug abuse epidemic with innovative resources that provide access to drug arrest data for health care providers to identify and respond to patients at risk for overdose, those engaged in illegal prescription drug distribution, and those who are in need of treatment. Drug arrest data from 2015 (2,723 arrests) and the first quarter of 2016 (788 arrests) were compared and analyzed. The drugs implicated in the arrests were organized by Drug Enforcement Agency Schedule category and whether they were pharmaceuticals (synthesized and distributed by a pharmaceutical

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company) or nonpharmaceuticals (grown or synthesized in clandestine laboratories). The majority of arrests were for possession (64.5%) followed by trafficking (23.8%). Heroin was listed in over three quarters (76.4%) of the Schedule I arrests, followed by marijuana (11.7%) and “bath salts” (6.3%). Cocaine and crack cocaine were implicated in almost half (46.7%) of the Schedule II arrests, followed by oxycodone (21.0%) and methamphetamine/amphetamine (15.8%). Buprenorphine was responsible for almost all (96.7%) of the Schedule III arrests. The benzodiazepines alprazolam (34.3%), clonazepam (33.8%), diazepam (11.9%), and lorazepam (8.5%) were listed in the preponderance of the Schedule IV arrests. Arrests increased in 2016 by 49.2% for heroin ( $p<0.01$ ) and 170.0% for methamphetamine ( $p=0.0005$ ) relative to 2015. Arrests for trafficking increased by 42.9% ( $p<0.05$ ). Males outnumbered females 2:1 in DA. Schedule IV agents accounted for only 6.8% of arrests for males versus 11.5% for females ( $p=0.0001$ ). Conversely, Schedule I agents were implicated in 33.0% of arrests for males versus only 27.3% for females ( $p<0.005$ ).

**Conclusion**—Diversion Alert is an important tool for providing timely information for health care providers regarding individuals with a history of past misuse of psychotherapeutic agents, particularly opioids and stimulants.

### Keywords

Diversion Alert; Maine; buprenorphine; cocaine; crime; heroin; opioid; oxycodone

A variety of strategies are currently already in place or are being optimized to combat the opioid epidemic. These include implementing state Prescription Drug Monitoring Programs (PDMPs) nationally and improving their interstate data sharing and usability, maximizing participation in drug take-back programs, greatly increasing the availability of short-acting opioid antagonists (naloxone)<sup>1</sup>, developing more difficult to abuse opioids<sup>2,3</sup>, implementing more judicious and cautious opioid prescribing, and realigning patient expectations regarding pain management. Although the quality of data is generally low, empirical evaluations of some of these interventions have been underwhelming thus far. For example, evidence is contradictory as to whether PDMPs reduce opioid mortality.<sup>4</sup> Similarly, the quantity of opioids returned to Maine’s drug take-back programs<sup>5</sup>, relative to the substantial volume dispensed<sup>6</sup>, is extremely modest. Lastly, and perhaps most concerning, abuse-deterrent opioids have been linked to facilitating transition from noninjectable routes of abuse (e.g., oral and nasal) to intravenous and other injectable routes.<sup>7</sup> Considering that the number of drug overdoses in Maine increased by 31% from 2014 to 2015, and doubled in Maine’s most populous county<sup>8</sup>, there is a clear need for novel approaches.

Diversion Alert (DA; [diversionalert.org](http://diversionalert.org)) is an innovative new tool that was modeled on a prescription drug arrest registry distributed to prescribers in Waterville, Maine, by the Waterville Police Department beginning in 2008. DA began in Aroostook County, Maine, in 2009 as a countywide resource for health care professionals to identify possible ongoing prescription misuse or diversion, or illicit drug use. DA staff started to contact individual agencies in 2015 to specify drugs when they were not specified on the initial data submission. One of the DA resources is a password-protected online database available statewide since 2013 to registered prescribers and pharmacists to search for patients for whom they have concern. This database of individuals charged with drug crimes includes the

patient's name, date of birth, town of residence, drug-related charge, implicated drugs, and arresting agency. Law enforcement agencies voluntarily submit drug charge data to DA via email on a monthly basis. The database used for DA was specially designed and uses nonproprietary software. In addition to the online database, DA also sends monthly drug arrest reports to registered health care providers, including pharmacists, and provides educational materials on how to respond to patients charged with drug crimes to new DA registrants. In addition to being an informational tool that can be used as one consideration in the selection of pharmacotherapies, DA can also provide novel pharmacoepidemiologic information.<sup>6,9</sup> Our prior investigations analyzed DA arrest data from 2014.<sup>6,9</sup> The objective of this study was to analyze more recent drug arrest data from 2015, compare arrest data between the first quarters of 2015 and 2016, and provide a more refined data analysis including evaluation of the sex differences in the arrests as well as information about DA use.

## Methods

### Procedures

Anonymized DA information was preprocessed by using Excel software (Microsoft Corp., Redmond, WA). DA data are organized by charge such that one person may have separate charges and entries for both trafficking and possession. Prescription drug brand names were replaced with generic names (e.g., Suboxone was replaced with buprenorphine). Marijuana possession cases, unlike trafficking and furnishing, are generally not reported to DA. Arrests involving multiple drugs for the same person were converted to separate rows and linked to a unique identification number. As information may be incomplete at the time of arrest, drugs that were listed as "suspected" were treated equivalently to those where the law enforcement officer was more certain of their identity. Agents listed as "scheduled drug" or "unknown or unspecified narcotic" (9.8% and 1.6%, respectively, of all entries) were treated as missing and were excluded from the drug arrest data. This study was deemed exempt by the Institutional Review Board of Bowdoin College.

### Data Analysis

Statistical analysis was conducted by using SPSS software, version 23.0 (IBM Corp., Armonk, NY). Exploratory analyses were conducted to determine if there were any sex differences in the arrests. A p value less than 0.05 was considered to indicate a statistically significant difference. Maine is divided into 16 counties, with the majority of the population in the southwestern portion of the state (Supplemental Figure 1). A county-level analysis was completed by expressing arrests per 10,000 people as reported by the 2010 U.S. Census. Most analyses focused on arrests in 2015, although comparisons between the first quarters of 2016 and 2015 were also made. Figure 1 was prepared by using GraphPad Prism version 6.00 (GraphPad Software, Inc., La Jolla, CA) and included agents that accounted for at least 1% of the total. Due to the substantial diversity of agents implicated in arrests, data were organized both by categorizing drugs by Drug Enforcement Agency Schedule (I–V or noncontrolled prescriptions) and by grouping drugs as pharmaceuticals (synthesized and distributed by a pharmaceutical company; e.g., oxycodone or hydrocodone) versus nonpharmaceuticals (grown or synthesized in clandestine laboratories; e.g., crack cocaine or

crystal methamphetamine). Spatial mapping was completed with ArcMap, version 10.4 (Esri, Redlands, CA).

## Results

Among 3,140 professionals registered with DA as of December 31, 2015, physicians accounted for the largest portion (44.1%), followed by nurses (17.8%), members of law enforcement (15.6%), physician assistants (7.0%), pharmacists (6.5%), dentists (2.3%), and others (e.g., pharmacy technicians, office managers, mental health counselors); 6.7%). There were 2,243 prescribers and pharmacists who, as of March 2016, were registered to query the DA database online. In addition, 1,577 prescribers and pharmacists received a monthly email with DA arrests for the preceding month.

Of the 2,723 arrests reported to Diversion Alert in 2015, half were made by city and municipal police departments (53.4%) and one fifth by the Maine Drug Enforcement Agency (21.9%), followed by various Sheriff's Offices (9.0%), state police (6.6%), the U.S. Attorney's Office for District of Maine (6.1%), and by a regional jail (2.7%). Two thirds (66.2%) of those arrested were male. Among the 30 offenses listed, the majority was for possession (64.5%) followed by trafficking (23.8%) including aggravated trafficking (6.0%), and conspiracy to distribute (3.3%). Approximately one of every six arrests (16.7%) involved two or more agents. Schedule II arrests accounted for the largest portion (41.5%) of agents followed by Schedule I (31.1%), and Schedule III (10.1%) drugs. There were many more arrests for noncontrolled prescription agents (8.6%) than for Schedule V drugs (0.2%). Schedule IV agents accounted for only 6.8% of arrests for males versus 11.5% for females ( $\chi^2(1) = 15.08$ ,  $p = 0.0001$ ). Conversely, Schedule I agents were implicated in 33.0% of arrests for males versus only 27.3% for females ( $\chi^2(1) = 8.33$ ,  $p < 0.005$ ).

Figure 1 shows the specific agents implicated in arrests in 2015 by DEA Schedule. Heroin accounted for over three quarters of the Schedule I arrests, followed by marijuana (including hashish), bath salts, and assorted hallucinogens (Ecstasy, psilocybin, and LSD [Figure 1A]). Stimulants including cocaine/crack cocaine, amphetamines, and methylphenidate were involved in twice as many Schedule II arrests (67.0%) as opioids (33.0% [Figure 1B]). Buprenorphine was listed in the vast preponderance (96.7%) of Schedule III arrests (Figure 1C). Two benzodiazepines, alprazolam and clonazepam, were responsible for over two thirds (68.1%) of Schedule IV arrests (Figure 1D). Figure 1E shows that there were many diverse noncontrolled prescription agents, including gabapentin (28.6%), antidepressants (12.1%, e.g. trazodone), and muscle relaxers (11.7% [e.g. cyclobenzaprine]), implicated in criminal activity.

Further analysis examined the charges for each DEA Schedule. Trafficking accounted for one third of Schedule I (35.5%) arrests, and one quarter or less for Schedules II (27.0%) and III (15.6%), but was less common for Schedules IV and V (6.8%) or for nonprescription controlled substances (3.4% [Supplemental Figure 2]). Operating under the influence was responsible for more Schedules IV and V arrests (5.9%) than for Schedules I (0.7%,  $\chi^2(1) = 24.53$ ,  $p < .0001$ ), II (0.7%,  $\chi^2(1) = 28.93$ ,  $p = 0.0001$ ), and III (1.2%,  $\chi^2(1) = 7.33$ ,  $p < 0.01$ ) arrests, or noncontrolled prescription drug arrests (1.0%,  $\chi^2(1) = 7.45$ ,  $p < .01$ ).

Figure 2 shows the arrests per county corrected for population. There was an over 6-fold regional variation in arrests per 10,000 persons (Piscataquis = 5.1 vs Knox = 31.7), although the data from Piscataquis county should be interpreted with caution due to its small size (population 17,535).

Drug arrests increased by 14.0% from the first quarter of 2015 to the first quarter of 2016. This was largely due to elevations in arrests involving heroin (49.2%,  $\chi^2(1) = 7.40$ ,  $p < 0.01$ ) and methamphetamine (170.0%,  $\chi^2(1) = 12.14$ ,  $p < 0.0005$ ). There was also a decrease in arrests involving noncontrolled prescription agents (-27.3%,  $\chi^2(1) = 4.02$ ,  $p < 0.05$ ). A caveat in interpreting these temporal changes is that the number of arrests in which the identity of the drug was unknown decreased by 16.9% ( $\chi^2(1) = 5.99$ ,  $p < 0.05$ ). Trafficking arrests became 42.9% more common during this period ( $\chi^2(1) = 6.33$ ,  $p < 0.05$  [Supplemental Table 1]).

## Discussion

The most important element of this report is to introduce DA to others who may be considering similar programs in order to identify patients who potentially continue to misuse prescription medications and identify those who are in need of treatment. A drug arrest, either for possession or trafficking, is an important event in the lives of patients which, when communicated in a thorough and timely fashion, could impact health care delivery through closer scrutiny of prescriptions of controlled substances and perhaps more importantly, early identification and treatment of patients with a substance use disorder.

The opioid epidemic is evolving in Maine. Heroin was the most common Schedule I drug involved in drug arrests, and arrests for this drug significantly increased from 2015 to 2016. However, whereas arrests for opioids like oxycodone were relatively uncommon, stimulants such as cocaine, including crack cocaine, and amphetamines were listed in over half of Schedule II arrests. The results of this analysis are consistent with a previously identified pattern of increased use of heroin in conjunction with reduced use of Schedule II opioids.<sup>6</sup> It is important to note that over 80% of people who inject heroin started with prescription opioids<sup>10</sup>, so this may be a reflection of an evolution in the opioid epidemic overall. The pronounced elevation of methamphetamine arrests warrants further attention. The volume of buprenorphine arrests, especially for trafficking, might appear concerning, particularly due to its primary indication for treatment of individuals who are addicted to opioids<sup>11</sup> in conjunction with reports of misuse.<sup>2,3</sup> We postulate that although buprenorphine may be used for euphoria in some buprenorphine-naïve patients, the majority of buprenorphine is being used in those who are self-treating symptoms of withdrawal in the context of an opioid use disorder; therefore, our data illustrate the need for increased access to prescribed and monitored buprenorphine therapy and associated psychosocial treatments. As buprenorphine was responsible for almost all Schedule III arrests and was the second-highest prescription drug, behind only oxycodone, for drug arrests in the first quarter of 2016, naltrexone extended-release injectable suspension, in addition to buprenorphine, should be considered for preferred drug status by private and state health insurance plans.

A county-level analysis was revealing. Cumberland County, home of Maine's largest city of Portland, accounted for 21.2% of the state's population but 31.6% of the drug overdoses. Androscoggin County, home of the second largest city of Lewiston, also has a greater proportion of drug overdoses relative to its population.<sup>8</sup> Therefore, our finding that Cumberland and Androscoggin counties were leaders in drug arrests in Maine aligned with our expectations. Further research will be necessary to determine the extent that drug arrests correlate with other measures of drug misuse (e.g., self-report) but, thus far, these findings indicate that arrests may be reflective of an important component of the opioid epidemic that is not fully captured by other indexes.

Lev and colleagues examined the PDMP of over 200 patients in San Diego whose deaths involved prescription drugs and found that less than one third qualified as "doctor shoppers." However, almost three quarters had PDMP data in the year before their deaths, with frequent listings of hydrocodone, oxycodone, alprazolam, and clonazepam. Although it is possible that more consistent use of PDMPs could have prevented at least some of these overdoses, an appreciable subset of patients were procuring prescription agents from sources not covered by the California PDMP.<sup>12</sup> Similarly, only one quarter of individuals arrested for trafficking Schedule II–IV drugs were found to have been prescribed those agents in the Maine PDMP. Further, over half were receiving controlled prescription drugs from only one physician and one pharmacy, whereas only 14% and 7% used three or more prescribers and pharmacies, respectively.<sup>9</sup> These results indicate lower levels of "doctor shopping" and "pharmacy hopping" than previously thought. Together, these data indicate that tools like DA could provide timely information that complements, but does not duplicate, that in PDMPs.

The identified sex differences are also noteworthy. Males outnumbered females 2:1 in DA. Nationally, the ratio of adult males to females with drug abuse violations was much higher at 3.8:1.<sup>13</sup> Interestingly, females accounted for a disproportionate number of arrests for Schedule IV agents, the vast majority (88.5%) of which were for benzodiazepines, and females were underrepresented for Schedule I agents. Benzodiazepines are less frequently associated with overdose when used as monotherapy.<sup>14</sup> However, overdoses involving benzodiazepines, typically in conjunction with other drugs such as opioids,<sup>14</sup> increased 4-fold nationally.<sup>19</sup> Elderly patients who present to the emergency department related to benzodiazepine use are 54% more likely to have a serious outcome when a benzodiazepine was combined with an opioid.<sup>20</sup> These agents continue to be widely used, particularly among the elderly,<sup>20</sup> and are a prominent concern in Maine.<sup>6,9</sup> Unlike opioids, benzodiazepines can cause life-threatening withdrawal symptoms (e.g., seizures) and require a slow titration to discontinuation, making benzodiazepines technically difficult for prescribers to stop prescribing. Benzodiazepines also cause motor and cognitive impairments, and the elderly are more sensitive to these effects,<sup>15</sup> which likely contributed to their involvement in operating under the influence arrests and falls.<sup>20</sup> Opportunities exist to increase awareness and educate primary care providers, psychiatrists, geriatricians, and pharmacists about appropriate benzodiazepine tapering strategies. This is important because unlike heroin, cocaine, and methamphetamine, benzodiazepine arrests nearly always involve prescription medication formulations.



It is noteworthy that a not insignificant number of arrests involved noncontrolled prescription substances, the preponderance of which have an action on the central nervous system. Although the vast majority of noncontrolled prescription agents are used responsibly, a subset of the general population is known to have experimented with nonoral routes of administration, have taken much higher than the recommended doses, or have discovered that certain drug combinations produce effects different from those obtained in isolation. Reeves and coworkers provide numerous examples of misused prescription agents,<sup>17</sup> which include many of the agents listed in Figure 1E. Gabapentin, implicated in over one quarter of noncontrolled drug arrests, was approved as an antiepileptic agent, but off-label use for neuropathic pain and anxiety is widespread. Misuse of gabapentin may be due to a variety of factors including its use as a cutting agent for heroin, its ability to produce mild euphoric and sedating effects, or its use to self-medicate for pain or withdrawal from other substances.<sup>18</sup> It is important to note that although gabapentin is not a controlled substance, its chemical cousin, pregabalin, is. The skeletal muscle relaxant cyclobenzaprine blocks muscarinic acetylcholine<sup>17,21</sup> and histamine receptors as does quetiapine,<sup>22</sup> promethazine,<sup>17</sup> and amitriptyline.<sup>23</sup> Misuse of anticholinergics and antihistamines may produce a complex subjective state that includes stimulant, euphoric, sedative, and hallucinogenic effects, which has been observed in inmates and appreciated by correctional health care professionals.<sup>17</sup> Additional research is necessary to identify any mechanistic commonalities of these substances and further determine the profile of patients who are arrested for these versus other prescription or illicit drugs.

There are some limitations to the data contained in DA and this report. First, some entities may not report to DA because data submission is voluntary. DA also does not report on arrests involving minors. Together, this may lead to underestimation of the scope of the problem or underidentification of patients with an overt substance use disorder. Second, DA reports involve people who have been arrested, not convicted, of a drug-related crime. This is logical because the legal process is protracted. Identification of a person with a substance use disorder occurs subsequent to an arrest. This provides an opportunity for a provider to identify the problem, discuss it with the patient, and offer various treatment options. Third, DA reports the drug based on the information available at the time of arrest (i.e., field tests) but not from any more detailed analytical chemistry findings that may be obtained subsequently. The false-positive rates of these field tests is concerning.<sup>25</sup> Different agencies may not list different formulations of the same drug (e.g., fentanyl patch vs fentanyl analogues such as sufentanil and carfentanil) consistently in their reporting to DA. Fourth, DA has been criticized for infringing on privacy rights of patients. However, arrest records are public knowledge, and DA simply provides a more efficient mechanism for providers to access this information. A fifth caveat is that Figure 1 is organized based on the structure imposed by the Controlled Substances Act. Similar regulatory systems in the United Kingdom have been criticized as being arbitrary.<sup>24</sup> Although the Controlled Substances Act is the current framework that the health care delivery and the U.S. criminal justice system is built upon, future updates on DA arrests may include alternative systems of data organization, especially considering the variety of noncontrolled prescription agents whose misuse potential may be underappreciated by some health care providers.

## Conclusion

Maine's experience with DA may offer some lessons for other states considering implementing similar programs.<sup>26</sup> First, a core area for improvement is that DA is highly underutilized. Only one third of licensed allopathic doctors (34.0% medical doctors) and physician assistants (31.7%) were even registered with DA, which exceeded that of pharmacists (16.2%) and doctors of osteopathic medicine (16.1%). There is a tremendous potential for increased education of health care providers regarding DA as a resource to combat misuse of opioids and other psychopharmacologic agents. One possibility that could make substantial progress toward improving usability and increase efficiency would be to merge DA with the PDMP. Second, continuing to refine and standardize data entry for the wide variety of illicit and licit drugs would facilitate data analysis and heighten the utility of DA as a pharmacoepidemiologic tool as well as better inform treatment decisions to combat the opioid epidemic.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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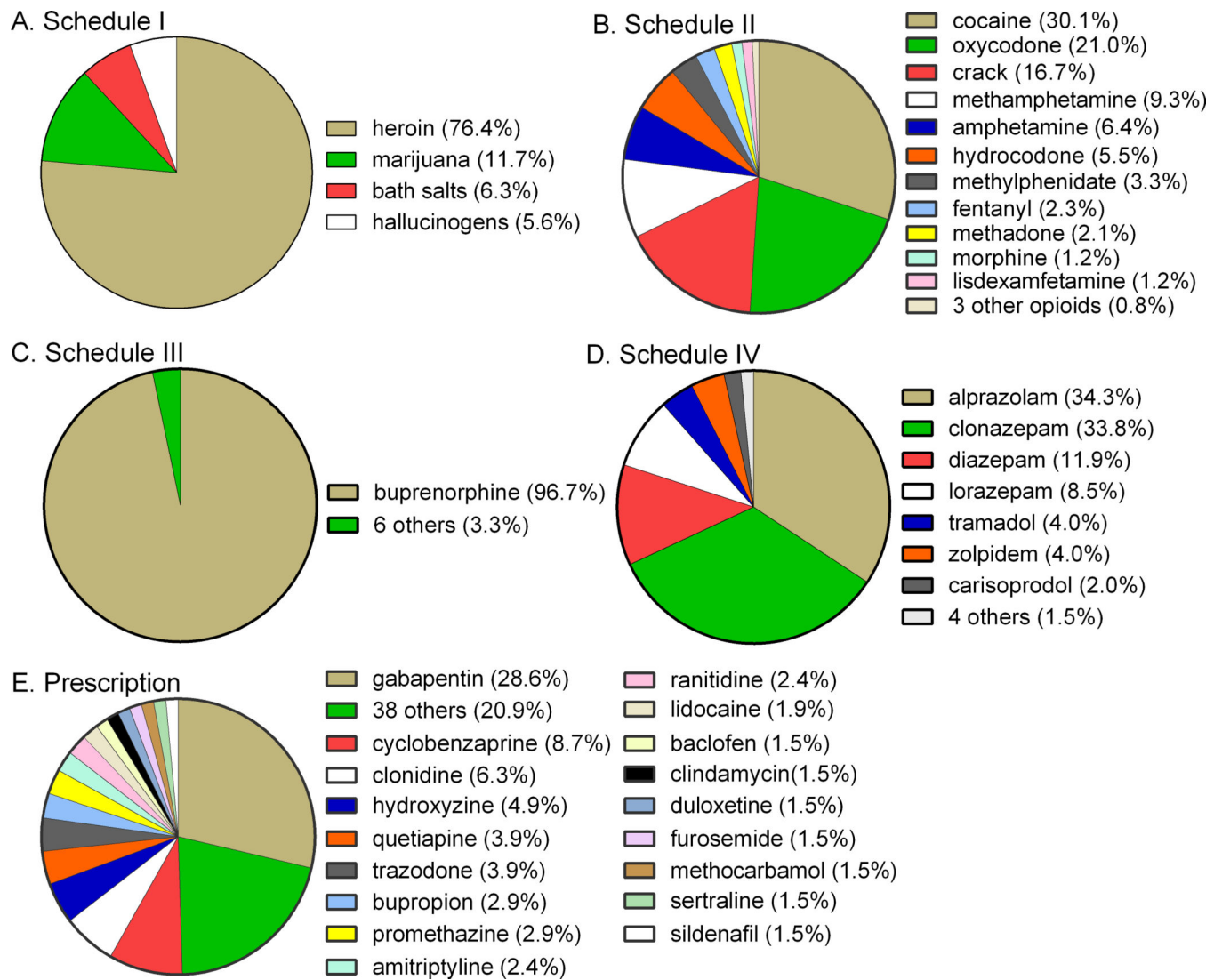
This study was completed with software generously provided by the Husson University School of Pharmacy and the National Institute of Environmental Health Sciences (T32 ES007060-31A1). The authors would like to thank Eileen Johnson for her technical support.

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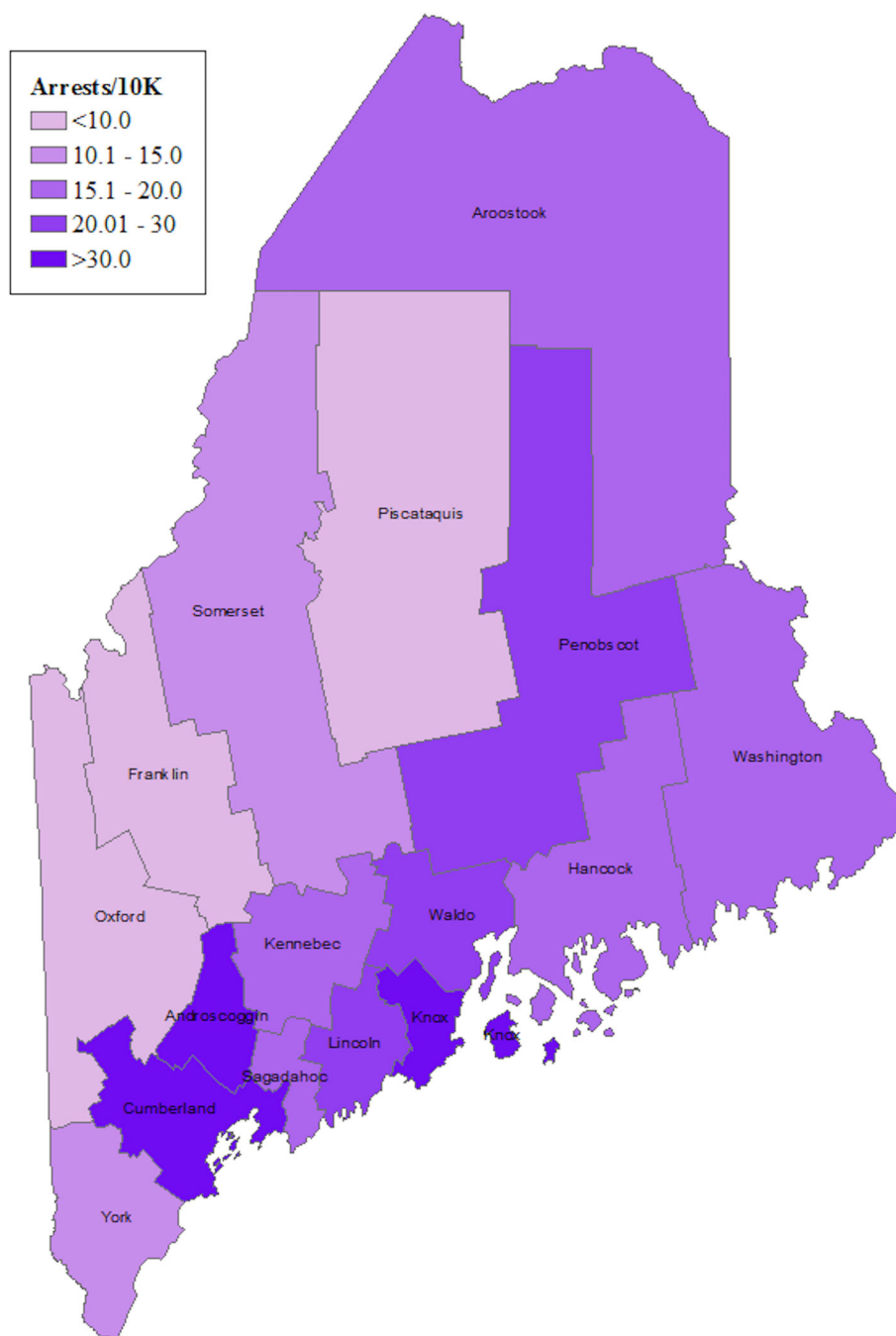
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**Figure 1.**

Arrests reported to the Maine Diversion Alert Program in 2015 for (A) Schedule I (n=744), (B) Schedule II (n=995), (C) Schedule III (n=243), Schedule IV (n=201), and (E) noncontrolled prescription (n=206) drugs.



**Figure 2.** Arrests reported to the Maine Diversion Alert program in 2015 per county per 10,000 people.