Prescription Drug Monitoring Programs:
An Assessment of the Evidence for Best Practices

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Prepared by

Thomas Clark
John Eadie
Peter Kreiner, Ph.D.
Gail Strickler, Ph.D.

The Prescription Drug Monitoring Program Center of Excellence
Heller School for Social Policy and Management, Brandeis University

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* A list of the members of the PDMP COE Expert Panel and their affiliations can be found at www.pdmpexcellence.org.

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I. Introduction

The role of state prescription drug monitoring programs (PDMPs) in facilitating appropriate prescribing of controlled prescription drugs and helping to address the prescription drug abuse epidemic has been highlighted in recent studies and in the 2011 White House Office of National Drug Control Policy's Prescription Drug Abuse Prevention Plan (GAO, 2002; Pradel et al., 2009; Baehren et al., 2010; Katz et al., 2010; Johnson et al., 2011; Office of National Drug Control Policy, 2011). A special concern for PDMPs is the diversion of opioid pain relievers into nonmedical use and abuse.

A PDMP is a statewide electronic database that gathers information from pharmacies on dispensed prescriptions for controlled substances (most states that permit practitioners to dispense also require them to submit prescription information to the PDMP). Many PDMPs now provide secure online access to this information for authorized recipients. Prescription data (usually for the past year, and including information on date dispensed, patient, prescriber, pharmacy, medicine, and dose) are made available on request from end users, typically prescribers and pharmacists, and sometimes distributed via unsolicited reports. Recipients of PDMP data may also include practitioner licensure boards, law enforcement and drug control agencies, medical examiners, drug courts and criminal diversion programs, addiction treatment programs, public and private third-party payers, and other public health and safety agencies. States vary widely in which categories of users are permitted to request and receive prescription history reports and under what conditions.

PDMPs represent a substantially underutilized resource in efforts to improve public health outcomes and address prescription drug abuse (Katz et al., 2010). Key reasons for this underutilization include differences in the data PDMPs collect, whether and how they ensure data quality, the kinds of data analyses and reports they produce, to which users and under what conditions they make data available, and differences in an array of other procedures and practices. With respect to many of these practices, there is not widespread understanding of which constitute "best practices"; that is, which practices are associated with maximizing PDMP effectiveness. The purpose of this white paper is to describe what is known about PDMP best practices, describe and assess the evidence supporting their identification as best practices, and document the extent to which PDMPs have implemented these practices.

The paper is structured as follows:

- Section II provides background on the history of PDMPs and a conceptual framework for assessing their effectiveness. The contexts in which PDMPs developed have been an important influence on the range of PDMP practices and the extent of their current adoption. Practices can be organized in terms of PDMP workflow and functions (e.g., data collection, analysis, and reporting). Their effectiveness can be assessed by observing their differential impact in achieving intermediate objectives, such as increasing the utilization of PDMPs by all appropriate end users, and ultimate goals, such as improving patient health and reducing the diversion of prescription drugs into illegal use (drug diversion) and overdose.

- Section III provides an overview of the paper's methods and discusses types of evidence for effectiveness, the relative strength of the methods and evidence, and how the current evidence base for potential PDMP best practices was assessed.
- Section IV describes candidate PDMP best practices, the extent to which they are implemented by PDMPs, and the evidence base for each practice, and identifies barriers to their adoption.
- Section V discusses conclusions and recommendations regarding PDMP best practices. It includes a table summarizing the types of evidence that currently exist for each practice and the strength and consistency of evidence within those types. This section also outlines a research agenda, suggesting the kinds of studies needed to produce a stronger evidence base for practices we believe have the greatest potential to improve PDMP effectiveness.
- Section VI provides the references we have examined in developing this white paper. These references are summarized in two tables in an appendix: one providing an overview of the peer-reviewed, published literature on PDMP practices and effectiveness, and a second providing an overview of other literature of evaluation studies and reports, case studies, anecdotal information, and expert opinion.

II. Background

A brief history of PDMPs

Through 1989, nine PDMPs had been established. Two were located in state Attorneys General offices (California, 1939 and Pennsylvania, 1972); two in Departments of Public Safety (Hawaii, 1943 and Texas, 1981); two in Departments of Health, Bureau of Narcotics Enforcement (New York, 1970 and Rhode Island, 1978); one in a Department of Substance Abuse Services (Illinois, 1961); one in a Board of Pharmacy (Idaho, 1967); and one in a Department of Consumer Affairs, Bureau of Health Professions (Michigan, 1988). All of these programs collected information about Schedule II prescriptions[1] only, and all used state-issued serialized prescription forms. The use of these multiple-page forms allowed the original prescription records to be sent to the PDMP for key-punch data entry, while the pharmacy, and in most cases the prescriber, kept a copy.

Reflecting their locations primarily in state agencies concerned with public safety and drug enforcement, these early PDMPs all provided solicited reports, and most provided unsolicited reports to law enforcement personnel and regulatory agencies or professional licensing agencies. None provided reports to prescribers or pharmacists. The reports and, where relevant, PDMP investigations focused on prescribers selling prescriptions, pharmacies selling controlled substances illegally, and organized doctor shopping rings. For example, narcotics enforcement in New York, using PDMP data, focused on Quaalude and barbiturate prescription abuse associated with sleep clinics in the late 1970s and early 1980s, and subsequently on stimulant prescription abuse associated with weight clinics (Eadie, 2010).

With support from the U.S. Drug Enforcement Administration (DEA), the existing PDMP administrators created the Alliance of States with Prescription Monitoring Programs in November 1990. The Alliance was founded to provide a forum for support and information exchange among PDMPs, states where efforts were under way to establish a PDMP, and states where creation of a PDMP was being considered. At this time, PDMPs expanded data collection beyond Schedule II prescriptions. In the context of computer-based information technologies, a second generation of PDMPs came into existence that collected prescription information electronically, without the use of serialized prescription forms. Examples included the Oklahoma PDMP in 1990, located in the Department of Public Safety, and the Massachusetts PDMP in 1992, located in the Department of Public Health.

The Nevada PDMP, implemented in 1997 and located in the state Board of Pharmacy, ushered in a new era of PDMPs by providing data directly to prescribers and pharmacists. Initially, Nevada proactively sent unsolicited reports to the health care practitioners who had issued and dispensed prescriptions to

[1] The Controlled Substances Act, passed in 1970, established the five-tiered schedule of controlled substances that is now in effect. Drugs are assigned to one of these categories, or schedules, based on the substance's medicinal value, harmfulness, and potential for abuse and diversion. Schedule II is the most restrictive of the schedules of legally available controlled substances.

possible doctor shoppers—that is, individuals receiving multiple simultaneous prescriptions of commonly abused drugs. This resulted in a rapid demand for reports upon request (Prescription Drug Monitoring Program Center of Excellence [PDMP COE], Notes from the Field [NFF] 2.5). While the reports initially were sent by fax, Nevada developed in 2001 an online system that began issuing reports based upon users' direct inquiries. Kentucky soon followed Nevada's lead, implementing a program in 1999 and developing online capabilities within a few years. In 1994, the Alliance initiated a process to help standardize electronic formats for data collection. This resulted in the publication of the American Society for Automation in Pharmacy's (ASAP) first version of guidelines for pharmacies to submit controlled substances prescription data to PDMPs. The standards have been updated frequently to incorporate enhancements in electronic system capabilities, and all PDMPs are now using a version of an ASAP standard.

Early studies in New York indicated that the state's PDMP had greatly impacted stimulant, barbiturate, and later benzodiazepine prescribing and abuse (Fisher et al., 2011). Other studies suggested that serialized prescription forms required by PDMPs had a so-called "chilling effect" on legitimate prescribing (Joranson & Dahl, 1989; Pearson et al., 2006; Fornili & Simoni-Wastila, 2011). In 1996, OxyContin was introduced, and sales of prescription opioids began to increase markedly. After a slow rise in 1984, the numbers of first-time illicit users of pain relievers doubled between 1994 and 1998. Unintentional drug overdose death rates, while increasing through the 1990s, began to increase more steeply in the early 2000s, largely attributed to increased prescription opioid prescribing and abuse (Hall et al., 2008; Bohnert et al., 2011).

An element of the federal response to the increasing death rate was the creation of the Harold Rogers Prescription Drug Monitoring Program Grant Program in the Department of Justice, Bureau of Justice Assistance (BJA) in federal fiscal year 2002. BJA also designated the National Association for Model State Drug Laws (NAMSDL) to assist states in developing PDMP legislation. At about the same time, Purdue Pharma, manufacturer of OxyContin, began to support the creation of new PDMPs with technical as well as monetary assistance, specifying PDMP characteristics that it deemed desirable. In 2005, Congress passed the National All Schedules Prescription Electronic Reporting (NASPER) Act, authorizing additional federal funding for PDMPs; the Substance Abuse and Mental Health Services Administration (SAMHSA) was designated as the lead agency for NASPER.

In 2008, in collaboration with the Alliance of States with Prescription Monitoring Programs and the Heller School of Social Policy and Management at Brandeis University, BJA formed the PDMP Training and Technical Assistance Center, charged with assisting PDMPs in planning, implementing, and enhancing their programs. Two years later, BJA funded the PDMP COE at the Heller School in order to provide practice-relevant information, evaluation, and expertise to PDMPs and their stakeholders, including the development of best practices. As the founder of these efforts and as the nation's primary public funder of PDMPs via the Harold Rogers Grant Program, BJA has maintained a consistent focus on developing PDMP best practices and encouraging innovative applications of PDMP data. As will be noted in this paper, BJA gives priority funding consideration to states proposing to implement evidence-based practices that contribute to PDMP effectiveness.

As a result of increased public and private support and the growing recognition of PDMPs' potential to address the prescription drug abuse epidemic, PDMPs proliferated rapidly. In 2001, 16 states had passed legislation authorizing the creation of a PDMP; by June 2012, 49 states and one territory had passed such legislation, and 41 states had an operating PDMP.

The environment in which the newer PDMPs were implemented differs technologically and politically from that of PDMPs implemented through the early 2000s, generating an array of newer PDMP practices and a great diversity of practices across all PDMPs. For example, PDMPs implemented since 2001 have typically included a secure online portal for authorized providers to access PDMP data about their patients. All older PDMPs, except one, have evolved to permit provider access, often requiring new legislation authorizing such access, and then a costly retrofitting of PDMP operations to accommodate online and other new technology and new user demands. In contrast to the oldest PDMPs, newer PDMPs are often prohibited by law from providing unsolicited reports on patient or health care provider activity to law enforcement agencies or providers (PDMP COE survey of PDMPs, 2010). Although the wide range of practices carried out by different PDMPs suggests the possibility of evaluating the effectiveness of individual practices, the diversity of practices itself constrains the extent to which individual practices can be isolated and assessed across PDMPs, since other practices most often cannot be held constant.

Although PDMPs currently differ in their relative emphasis on improving medical care versus reducing drug diversion and abuse, they are well positioned to serve both objectives. Indeed, these objectives substantially overlap since the appropriate prescribing of controlled substances can reduce their diversion and abuse, while law enforcement efforts can protect public health by limiting diversion. This is analogous to the collaboration of public health and law enforcement agencies in reducing automobile accidents, injuries, and fatalities. For example, criminal investigations of doctor shoppers can bring people at risk of overdose and death into drug courts, where they can be placed into drug treatment and supervised, protecting health and saving lives. Likewise, law enforcement efforts to shut down pill mills and doctor shopping rings can have substantial public health benefits by reducing the supply of prescription drugs for street trafficking.

The opportunity therefore exists in establishing PDMP best practices to bring together advocates of effective medicine, drug abuse prevention, drug control, and substance abuse treatment to address common objectives using a common tool: improving the legitimate use of controlled substances and mitigating the prescription drug abuse epidemic by utilizing PDMP data in all their diverse applications. Despite differences in operations and objectives among PDMPs, the history outlined above depicts an environment in which program modification is the norm, with the identification and adoption of new concepts, technologies, and standards as constants. This suggests that development of evidence-based best practices will be welcomed by PDMPs, and their adoption can be expected.

PDMP effectiveness

The established value of PDMPs

Before embarking on a consideration of PDMP best practices, it should be noted that evidence suggests PDMPs are effective in improving the prescribing of controlled substances and addressing the prescription drug abuse epidemic (PDMP COE, Briefing on PDMP Effectiveness, 2012). PDMP data are unique and irreplaceable in identifying questionable activity with respect to prescription drugs, such as doctor and pharmacy shopping, prescription fraud, and problematic prescribing. No other system exists that can compile all controlled substances prescriptions, regardless of who issued the prescription, which pharmacy dispensed it, or the source of payment. According to surveys of PDMP users and a study of emergency department doctors, PDMPs are an important tool in making sound clinical decisions when prescribing or dispensing controlled substances (ASPMP, 2007; Kentucky Cabinet for Health and Family Services, 2010; Baehren, 2010). Evaluations of PDMPs generally report good user satisfaction with the utility of PDMP reports (Virginia Department of Health Professions and Virginia State Police, 2004; Lambert, 2006; Rosenblatt, 2007).

PDMP data can be used to track emerging trends in legitimate prescribing; to evaluate efforts to improve prescribing practices, such as provider education initiatives (Fisher et al., 2011a); and to reduce drug abuse and diversion, such as drug abuse prevention programs and drug control policies (Carnevale & Associates and PDMP COE, 2010; PDMP COE, NFF 3.2). PDMPs currently assist in investigations of diversion of prescription drugs into illegal use (drug diversion) (PDMP COE, NFF 2.3), medical examiner practice (PDMP COE, NFF 2.6), drug courts (PDMP COE, NFF 2.4), and direct intervention with and supervision of doctor shoppers as an alternative to criminal investigation (PDMP COE, NFF 2.1), substance abuse treatment programs (PDMP COE, NFF 2.2), and epidemiological surveillance and early warning systems (Carnevale & Associates and PDMP COE, 2010). Although questions have been raised about the effectiveness of PDMPs (Fornili & Simoni-Wastila, 2011), several studies suggest a connection between PDMP utilization or particular PDMP practices and positive outcomes related to improving, prescribing, and reducing prescription drug abuse (Pearson et al., 2006; Pradel et al., 2009; Reisman et al., 2009; Wang & Christo, 2009; Paulozzi & Stier, 2010; Fisher et al. 2011b; LeMire et al., 2012; Reifler et al., 2012).

Given that PDMPs have already proven their worth in many applications, the question addressed in this white paper is what program characteristics and practices are likely to enable PDMPs to become more effective in collecting, analyzing, disseminating, and utilizing their data. See McDonald et al. (2004) for an earlier compilation of PDMP practices and recommendations for research on their effectiveness.

Conceptualizing effectiveness

The effectiveness of PDMPs can be conceptualized in terms of their impact in ensuring the appropriate use of prescription-controlled substances, reducing their diversion and abuse, and improving health outcomes, both at the patient and community levels. This impact is maximized when prescription history data are, to the extent technologically feasible, complete and accurate; analyzed appropriately and expeditiously; made available in a proactive and timely manner; disseminated in ways and formats that best serve the purposes of end users; and applied in all relevant domains by all appropriate users. This suggests that PDMPs can be thought of as information systems with inputs, internal operations, outputs, and customers who make use of their products. An effective PDMP will optimize all system phases, expand its customer base to include all appropriate users, and make sure these customers are well trained in using the PDMP. Best practices need to be identified for each phase.

Considerable preliminary work has already been done in this regard, including in formulating the Alliance of States with Prescription Monitoring Programs' Prescription Monitoring Program (PMP) Model Act (ASPMP, 2010), developing and continuously updating the standards for transmission of information from pharmacies to PDMPs (standards developed with ASAP), and identifying characteristics and practices of the "next generation" of PDMPs (Eadie, 2011, May and an "ideal" PDMP (Perrone & Nelson, 2012). Although the rationale for the practices mentioned in these documents in many cases seems both logical and plausible, the evidence base supporting them is often experiential and not well documented.

PDMP effectiveness can also be understood in the context of how PDMPs can best work together and in concert with other agencies, organizations, and health information technologies. Best practices will likely include data standardization and sharing among PDMPs and other agencies, as well as cooperative arrangements that maximize the value of PDMP data in their completeness, timeliness, analysis, and dissemination. To increase their effectiveness and impact, PDMPs must be integrated with other systems, including public health, health information exchanges, electronic health records, electronic prescribing, public safety, drug abuse prevention, and drug control. This will ensure that their data are made seamlessly available to all those engaged in improving controlled substances prescribing and addressing the prescription drug abuse epidemic. An important intermediate measure of PDMP effectiveness is therefore the number and type of interorganizational linkages and information-sharing agreements between PDMPs and other agencies. Section IV of this paper covers practices that may increase such linkages.

Toward a checklist of PDMP best practices

This paper can be considered a step toward developing an evidence-based checklist of PDMP best practices that could be used to evaluate a PDMP. Each practice would be defined operationally, and where possible and appropriate, quantitative metrics indicating success in carrying out the practice would be specified. Once parameters are established for each practice's definition and metrics, annual or semiannual surveys of PDMPs could track their adoption. Some candidate practices considered below are sufficiently well-defined and arguably have enough evidential support to already warrant their inclusion in a compendium of best practices, but many need more clarification, specificity, and evidence of effectiveness to support their inclusion. For example, practices in PDMP user recruitment, enrollment, and education need to be evaluated, such as the 2012 statutes in Kentucky, New York, Tennessee, and Massachusetts mandating PDMP enrollment and use. For demonstration purposes only, a checklist of the candidate practices considered below is presented in Appendix A.

III. Methods: Assessing the Evidence Base for Practice Effectiveness

Literature search

As the first step in assessing the evidence base for practice effectiveness, we conducted a systematic review of the medical (PubMed), psychological (PsycINFO), and economics (EconLit) literature through November 2011 for articles pertaining to the effectiveness of PDMPs and PDMP best practices, using a predetermined set of search terms. Search terms included prescription drug monitoring, prescription monitoring, doctor shopping, multiple prescribers, unsolicited reporting, and proactive reporting. All articles from peer-reviewed journals, published in English, were considered for inclusion. Abstracts identified through searches were reviewed to clarify the publication's relevance, and eligible articles were retrieved and read to further verify the study's applicability. These searches were expanded by reviewing the references cited in relevant articles. Articles were excluded if the data did not include outcome measures that would allow us to report on the effectiveness of PDMPs or of the best practice examined. In later drafts of this white paper, the literature search was extended to May 2012.

Other literature was identified from a review of documents listed on the PDMP COE website (www.pmpexcellence.org), on individual states' PDMP websites, and from discussion with PDMP COE staff. We identified written ("documented") evidence of expert opinion or consensus on best practices from review of the Alliance of States with Prescription Monitoring Programs and National Alliance for Model State Drug Laws websites (www.pmpalliance.org and www.namsdl.org), particularly practices specified in the 2010 Model Act. Other potential best practices were identified from discussions with experts in the field.

Data extraction and categorization of evidence

Researchers extracted data on study characteristics from the articles and other sources of evidence identified, and summarized the combined evidence for each potential best practice in descriptive and tabular formats. The tabular summary of evidence drew upon and was adapted from guidance provided by several sources on grading scientific strength of evidence (i.e., Lohr, 2004; Owens et al., 2010). The criteria outlined by these authors include a hierarchical evaluation of the study design, the risk of bias, the quantity of the evidence (such as the number of studies), the directness of the evidence, the consistency of the evidence, and the precision and magnitude of the estimates. Due to the paucity of studies found on PDMP best practices, we focused our analysis on summarizing the type and level of evidence available, the number of research studies, and where applicable, key findings and consistency of the research evidence. Type of evidence was categorized into two major classes: published or

formally documented studies or consensus statements, and informal, anecdotally reported experience from the field and stakeholder perceptions in support of particular practices. The first category includes randomized controlled trials (RCTs) or meta-analyses of RCTs; quasi-experimental designs (e.g., observational studies with comparison groups); other observational studies without comparison groups (e.g., interrupted time series) and case studies; and written guidelines describing a consensus of expert opinion, such as the Alliance of States with Prescription Monitoring Programs' PMP Model Act (ASPMP, 2010).

The grading system for this category ranks RCTs as the strongest evidence and expert opinion as the weakest. The consistency of the evidence for any given practice refers to the extent to which reported research findings from two or more studies show the same direction of effect. The second informal category of evidence consists of accumulated field experience with practices adopted by some states that suggests their efficacy, and the sometimes convergent perceptions among PDMP administrators and stakeholders (e.g., PDMP end users and advisory boards, legislative committees, and policy experts) concerning the value of a practice, whether proposed or in use. In some cases, these experiences and perceptions may be plausible indicators of possible best practices that will need formal research and evaluation to be adequately assessed.

We recognize that since the field is rapidly evolving, additional studies on PDMPs will likely have been published and new applications of PDMP data implemented between the time of our literature search and the publication of this white paper. This speaks to the need for continued monitoring of the "moving target" that is PDMP research and practice, to which this paper aims to contribute.

IV. PDMP Practices and Evidence for Best Practices

In this section, we survey candidate PDMP best practices, the evidence for their effectiveness, the extent to which they are currently adopted by states, and barriers to their adoption. It is organized by PDMP workflow, starting with data collection, followed by data linking and analysis, user access and reporting, recruitment, utilization, and user education. The last three headings in this section consider candidate best practices to facilitate collaboration among PDMPs and agencies concerned with prescription drug abuse; best practices with respect to PDMP evaluation; and options for the sustainable funding of PDMPs. After each practice is a thumbnail summary of its rationale, evidence base, current adoption status, and barriers to adoption.

In some cases, practices adopted by some states or thought potentially effective have no current evidence in the first category mentioned above (published studies, data analyses, or consensus statements). However, these practices are included for consideration since their possible effectiveness is suggested by evidence in the second category (accumulated experience in their application and/or perceptions of key stakeholders). Note that *all* the practices considered below have at least some support from the second category of evidence; this will be described in the text. However, the thumbnail summary of evidence for a practice will mention such support only when evidence from the first category is absent.

Data collection and data quality

Best practices in data collection, quality, and timeliness will permit more complete, accurate, and up-to-date data analyses and reports to end users. Candidate practices include actions to:

A. Standardize data fields and formats across PDMPs
   1. Collect data on all schedules of controlled substances
   2. Adopt uniform and latest ASAP reporting standard
   3. Collect data on nonscheduled drugs implicated in abuse
   4. Collect positive identification for the person picking up prescriptions
   5. Collect data on method of payment, including cash transactions

B. Reduce data collection interval; move toward real-time data collection

C. Institute serialized prescription forms

D. Integrate electronic prescribing with PDMP data collection

E. Improve data quality: pharmacy compliance, error, and missing data correction

A. Standardize data fields and formats across PDMPs

Currently, PDMPs vary in the data fields and formats collected from pharmacies, limiting the comprehensiveness of data, comparability of data across states, and ease of integration with prescription information collected by potential PDMP collaborators, such as Medicaid, the Indian Health Service (IHS), Department of Veterans Affairs (VA), and Department of Defense (DoD).

1. Collect data on all schedules of controlled substances

Rationale: A possible best practice in data collection, widely adopted but not universal among PDMPs, is to collect prescription history information on all classes of controlled substances (Schedules II-V). This practice is included in the Alliance of States with Prescription Monitoring Programs' PMP Model Act (ASPMP, 2010) and will permit prescribers and pharmacists to examine the full spectrum of controlled substance prescriptions when making clinical decisions about patients. Although opioids are perhaps the most widely abused and diverted drugs, drugs in all schedules have abuse potential. For example, by 2009, there were almost as many emergency department visits associated with misuse or abuse of benzodiazepines (373,200) as for opioids (393,200) (SAMHSA, 2010), and persons who are seriously abusing drugs frequently abuse multiple controlled substances (SAMHSA, 2011). Moreover, suspected questionable activity (e.g., doctor shopping) is associated with being prescribed multiple classes of drugs. PDMPs not tracking all classes will likely underestimate the prevalence of doctor shopping (Wilsey et al., 2010) and thereby fail to inform all affected providers about problematic prescribing and dispensing. BJA has designated collecting data on all schedules a priority for PDMPs seeking funding under its Harold Rogers Grant Program.

Evidence of effectiveness: A preliminary evaluation of Performance Measure Reports submitted by Harold Rogers grantee PDMPs to BJA suggests that states collecting Schedules II-V have lower rates of doctor shopping than states collecting fewer schedules (PDMP COE analysis of Performance Measure Data, 2011).

Current adoption status: According to the Alliance of States with Prescription Monitoring Programs, of 46 states that have established reporting requirements, only 29 require reporting of Schedules II-V; see pmpalliance.org/content/state-profiles-reports.

Barriers to adoption: Tracking all drug schedules involves updating data collection systems and the need for regulation and/or legislation changes.

Summary

Rationale: Prescribers need to examine all scheduled drug classes to make proper prescribing decisions; all classes are subject to abuse; collecting all schedules permits improved detection of questionable activity.

Evidence of effectiveness: Unpublished PDMP COE data analysis, expert opinion (ASPMP Model Act).

Current adoption status: 46 states have established reporting requirements; 29 require reporting of Schedules II-V.

Barriers to adoption: Costs of updating systems, requires legislative and/or regulatory change.

2. Adopt uniform and latest ASAP reporting standard

***Rationale and evidence of effectiveness*:** Having uniform and modernized data collection standards common to all PDMPs would have many advantages, including the facilitation of cross-state data sharing, multistate data analyses, public health analyses, and collaborations with other organizations collecting and making use of prescription history data, such as the Indian Health Service, Department of Defense, VA, Medicaid, and Medicare. The Alliance of States with Prescription Monitoring Programs PMP Model Act 2010 Revision recommends that all PDMPs collect a minimum common set of data fields (ASPMP, 2010). Continuously updated standards for pharmacy data fields and formats, including those reported to PDMPs, are set by the ASAP. The more recent standards make more data fields available, simplify data correction, and permit additional data reporting functionalities, such as tracking method of payment (see **5. Collect data on method of payment**, below) (PDMP COE, NFF 3.1). Updating to more recent ASAP standards may therefore improve the performance and effectiveness of individual PDMPs. A potential best practice is for all PDMPs to move to the latest standard, 4.2, released in 2011, and then move in concert to new versions as they are released. Under its Harold Rogers Grant Program, BJA gives priority consideration to PDMPs proposing to adopt the latest ASAP standard.

***Current adoption status*:** All PDMPs use ASAP standards, but adoption of the most current version by many PDMPs has usually taken years. For example, in February 2012, of 40 operational PDMPs, 5 were using the 2005 version 3.0, 5 were using the 2007 version 4.0, 13 were using the 2010 version 4.1 (data compiled by PDMP COE), and the 17 remaining PDMPs were using older versions.

***Barriers to adoption*:** Barriers to adoption include the need to change some states' laws and/or regulations that identify a specific ASAP version, and the costs and staff time necessary to implement ASAP upgrades for state PDMPs and for pharmacy software systems. Given their cumulative experience in making system improvements, many PDMPs and pharmacies are becoming increasingly efficient in adopting new standards, so the cost of future upgrades will likely decrease.

Summary

***Rationale*:** Uniform data standard may facilitate cross-state data sharing, analyses, and inter-organizational collaboration; more recent standards provide more complete data fields, improve error correction, and provide additional reporting functionalities.

***Evidence of effectiveness*:** Case study, expert opinion.

Current adoption status: Of 40 operational PDMPs (as of February 2012), 5 were using ASAP version 3.0, 5 were using version 4.0, 13 were using version 4.1, and the 17 remaining PDMPs were using older versions.

***Barriers to adoption*:** Upgrade costs, staff resources.

3. Collect data on nonscheduled drugs implicated in abuse

***Rationale and evidence of effectiveness*:** Certain drugs not federally scheduled or scheduled by most states, such as tramadol and certain formulations of butalbital, are sometimes abused, as when mixed in "drug cocktails" with opiates and benzodiazepines. The Alliance of States with Prescription Monitoring Programs' PMP Model Act 2010 Revision suggests that states may wish to track noncontrolled substances that are judged to demonstrate "a potential for abuse" (ASPMP 2010). Some drugs used to manufacture methamphetamine, such as ephedrine and pseudoephedrine, are also unscheduled in most states. PDMPs that track these drugs will likely be better positioned to detect pill mills that specialize in drug cocktail combinations and possible hot spots of methamphetamine production. A comprehensive list of unscheduled substances that merit tracking by PDMPs could be developed. Systematic investigation of the outcomes of such tracking is needed to evaluate it as a possible best practice. No formal studies have yet been conducted.

***Current adoption status*:** Nearly a third of states with active PDMPs are tracking some of these drugs (ASPMP state profiles).

***Barriers to adoption*:** The costs of adding these drugs to PDMP data collection would likely be minimal in most cases, but objections to adding them include concerns about compromising patient privacy, adding to regulatory burdens, and restricting access to substances that are not normally subject to scheduling controls or PDMP reporting. In many states, legislation and/or regulation changes would be required to give the PDMP authority to collect this information.

Summary

***Rationale*:** Some nonscheduled drugs are implicated in abuse and illicit drug manufacture.

***Evidence of effectiveness*:** Expert opinion.

***Current adoption status*:** Approximately one-third of PDMPs.

***Barriers to adoption*:** Concerns about patient privacy, regulatory burdens, unnecessary restriction of access to nonscheduled medications, opposition by pharmaceutical manufacturers.

4. Collect positive identification for the person picking up prescriptions

***Rationale and evidence of effectiveness*:** Prescriptions are often dispensed to (picked up by) persons other than the individual for whom they are prescribed, creating an opportunity for diversion. As noted by the Massachusetts PDMP, "…in 38 percent of cases, the person dropping off or picking up the prescription is not the patient and, therefore, without the customer ID, there would be no record of who dropped off the prescription or picked up the controlled substance" (Massachusetts Department of Public Health [MADPH], request to Public Health Council, 2010). If the identification of the person picking up the prescription is not collected, prescribers and pharmacists are less able to make appropriate clinical decisions because they do not know if patients listed on PDMP prescription history reports actually received the medications. Likewise, the PDMP and other data users are unable to determine whether the patient or someone else had possession of the controlled substances. Unless

identification is obtained by the pharmacy, the pharmacies and PDMPs are missing data that would help track possible diversion. These considerations suggest that collecting customer ID would help assure the proper use of controlled substances and deter prescription fraud, while simultaneously providing information that could be used to detect fraud, especially for cash transactions (see **5. Collect data on method of payment**, below). Research is needed to confirm these hypotheses. How states actually use customer identification information, and the benefits accruing from such use, needs to be studied in order to further understand the value of collecting customer ID.

***Current adoption status*:** Some states, including Connecticut, Delaware, Hawaii, Massachusetts, Michigan, Oklahoma, South Carolina, and Texas, require that the person picking up a prescription show positive identification and that the pharmacy record this information and report it to the PDMP (PDMP COE, Positive customer identification, 2010).

***Barriers to adoption*:** Barriers to adopting positive ID requirements include the need to amend state laws and/or regulations, pharmacy concerns about increasing workload and lengthening transaction times, and patient rights groups' worries that individuals lacking standard state IDs might be denied legitimate prescriptions. Nevertheless, experience in Massachusetts, which recently adopted a positive ID requirement, suggests that these barriers can be overcome by involving pharmacies and patient rights groups in drafting regulations. Examining other states' adoption processes could help to identify model practices in how to institute positive ID requirements.

Summary

***Rationale*:** Collecting positive ID may permit better tracking of controlled substances upon dispensing.

***Evidence of effectiveness*:** Accumulated experience, key stakeholder perceptions.

***Current adoption status*:** A few states collect positive customer ID.

***Barriers to adoption*:** Legislation and regulation changes, increases in pharmacy workload, concerns regarding potential denial of legitimate prescriptions to those without identification.

5. Collect data on method of payment, including cash transactions

Rationale and evidence of effectiveness: Collecting data on method of payment would add value to PDMP reports to end users. Method of payment, in particular cash transactions, can be an indicator of questionable activity such as doctor shopping. PDMP administrators and law enforcement investigators often cite cash payments as suggestive of doctor shopping, especially when the individual has health insurance. Pill mills usually accept only cash payments (Rigg et al., 2010). Paying with cash instead of by credit, health plan, or Medicaid/Medicare reduces the information available to identify the individual and helps to evade monitoring of prescription purchases by third-party payers. For example, cash payments enable Medicaid enrollees to avoid detection by Medicaid Drug Utilization Review systems and to avoid Medicaid patient "lock-in" programs in which patients are limited to a single prescriber and pharmacy. Provided with PDMP sources of payment information, state Medicaid programs could better detect doctor shoppers, place them in lock-in programs and monitor their compliance. According to the Coalition Against Insurance Fraud report *Prescription for Peril* (Coalition Against Insurance Fraud, 2007), persons who abuse prescription opioids incur excess health care costs totaling more than $72 billion

annually to all public and private health insurers, including Medicaid. Recording the method of payment by all PDMPs and transmitting this information to Medicaid and third-party payers would help reduce these costs. Examining the experience of PDMPs that require the reporting of method of payment, including how they use this information in analyses and reports and how they address privacy concerns, would help support such reporting as a best practice.

***Current adoption status*:** States that require reporting method of payment include Alaska, Arizona, Florida, Illinois, Indiana, Kansas, Kentucky, Massachusetts, Michigan, Nevada, New York, North Dakota, and Oklahoma. Increasingly, states are providing data to Medicaid agencies. Six PDMPs were permitted to provide data to state Medicaid agencies in 2006; by 2010, the number had increased to 15 PDMPs (PDMP COE survey of PDMPs, 2010). In 2012, the State of Washington allowed the state workers' compensation program to examine PDMP data.

***Barriers to adoption*:** Barriers to this practice include the fact that some PDMPs do not record method of payment due to use of an older ASAP standard that does not permit transmission of this data element. Concerns also exist about compromising patient privacy.

Summary

***Rationale*:** Information on method of payment may help detect doctor shopping and pill mills, may contribute to safe and effective prescribing by identifying patients at high risk.

***Evidence of effectiveness*:** Accumulated experience, key stakeholder perceptions.

***Current adoption status*:** Several states collect method of payment.

***Barriers to adoption*:** Using older ASAP data collection standards, concerns about patient privacy.

B. Reduce data collection interval; move toward real-time data collection

***Rationale and evidence of effectiveness*:** State PDMPs receive updated prescription dispensing data from pharmacies at varying intervals, ranging from monthly to daily, with most pharmacies reporting every one or two weeks (ASPMP state profiles, 2011). This means that even PDMPs that supply end users with immediately available online reports are delivering data that often do not include patients' most recent prescription purchases. These omissions compromise the utility of prescription history data for clinical practice and drug diversion investigations (PDMP COE, NFF 2.3).

The Alliance of States with Prescription Monitoring Programs' PMP Model Act 2010 Revision recommends that pharmacies submit prescription data "no more than seven days from the date each prescription was dispensed" (ASPMP, 2010). Ideally, PDMP data would be collected in real time, within a few minutes of a drug being dispensed. PDMPs across the country report increased demands from prescribers, particularly emergency department physicians, for prescription histories of their patients that are complete at the time of seeing a patient. The Oklahoma PDMP has implemented real-time data collection, slated to be fully functional by the end of 2012; this will serve as a pilot test of the feasibility and benefits of such a system (PDMP COE, NFF 3.1). Data will be collected on the impact of the Oklahoma initiative on PDMP data quality, utilization by providers, and other outcomes, including overdoses from prescription drugs. Meanwhile, states can take incremental steps to reduce their data

collection intervals from monthly to biweekly, weekly, or daily. States might also look to the Oklahoma experience as a guide to best practices in moving to real-time data collection.

***Current adoption status*:** States vary in their data collection interval, with most collecting every one or two weeks. While only the Oklahoma PDMP has implemented real-time data collection and reporting, 2012 legislation enacted in New York State mandates pharmacies to submit data in real time to its PDMP; this provision goes into effect in 2013.

***Barriers to adoption*:** The technical and logistical obstacles to real-time data collection and reporting are significant but can be overcome, as demonstrated recently by the Oklahoma PDMP (see **PDMP COE, NFF 3.1**). Real-time reporting will be difficult for many states to adopt soon given their limited resources.

Summary

***Rationale*:** More timely data are expected to enable more informed prescribing and improved detection of questionable activity.

***Evidence of effectiveness*:** Expert opinion.

***Current adoption status*:** States vary in data collection interval, most at one or two weeks; one state has implemented real-time data collection.

***Barriers to adoption*:** Cost, staff time, information technology hurdles.

C. Institute serialized prescription forms

***Rationale and evidence of effectiveness*:** Prescription fraud and doctor shopping using counterfeit, copied, or stolen prescription forms is a common source of diverted and abused controlled substances. New York and Texas mandate the use of state-printed serialized prescription forms (in Texas for Schedule II drugs only), each of which has a unique consecutive number; batches of forms are issued to each prescriber. The serial numbers of any stolen forms showing up in the PDMP database are flagged for investigation, as are any duplicated numbers. Experience in Texas (communication from former PDMP administrator) and New York (Eadie, 1990; Eadie, 1993) suggests that serialized forms help to reduce prescription fraud. Research indicates that three PDMP states using serialized forms (California, New York, and Texas) had lower increases in death rates from opioid overdose from 1999-2005 (Paulozzi et al., 2011). Some states require use of so-called tamperproof, but unserialized, prescription forms, but analysis of PDMP data from California suggests that these are not as effective in countering diversion as serialized forms (Gilson, 2011).

***Current adoption status*:** Only New York and Texas use state-printed serialized prescription forms (in Texas for Schedule II drugs only).

***Barriers to adoption*:** Barriers to the adoption of serialized prescription forms include concerns that they might reduce access to legitimate prescriptions (the so-called “chilling effect”), incur printing and distribution costs, and require record-checking capabilities into the PDMP and pharmacy workflow. However, prescription data from Texas indicate that the forms have had no chilling effect (the number of Schedule II prescriptions issued has increased every year since the mid-1980s); serialized forms in Texas are sold at cost to doctors and made readily available; and the forms’ serial numbers are easily

scanned into pharmacy databases, along with the prescriber's registration number, minimizing the workflow burden.

Summary

Rationale: Serialized prescription forms appear to reduce prescription fraud and may be superior to unserialized tamperproof forms.

Evidence of effectiveness: Published studies.

Current adoption status: Texas and New York State; formerly California.

Barriers to adoption: Concerns about jeopardizing legitimate prescribing (the chilling effect), incurring printing and distribution costs, implementing record-checking systems.

D. Integrate electronic prescribing with PDMP data collection

Rationale and evidence of effectiveness: As states implement systems of electronic prescribing of controlled substances (EPCS), the opportunity exists to integrate electronic medical records and EPCS systems with PDMP data. PDMPs could expand their data collection fields to include data specific to EPCS issued by prescribers and thereby facilitate communication with providers using an electronic prescribing (e-prescribing) system. This would permit monitoring of prescriptions as they are being issued, prior to dispensing, and after dispensing. Matching the electronic prescription to the dispensing record would assure that the drug and dose dispensed were what was prescribed, enabling prescribers to better monitor patients' compliance with their prescription drug treatment. This issue is timely as electronic prescribing of controlled substances is now expanding. For example, in 2012 legislation, New York State mandated that by the end of 2014 all prescriptions, including controlled substances, must be prescribed electronically with but with few exceptions (the "I-Stop" Program Bill #39, introduced in June 2012).

PDMPs could be made interoperable with e-prescribing systems so that: 1) obtaining an e-prescribing certification for controlled substances would be accepted by PDMPs as authentication for access to PDMP data; 2) as prescribers enter the name of a controlled substance drug for e-prescription, the patient's controlled substances history from the PDMP would appear on their electronic device; 3) as each e-prescription is sent to a pharmacy, a copy would be routed to the PDMP database; and 4) as each e-prescription is dispensed, the PDMP would match the pharmacy's dispensing record to the corresponding e-prescription from the prescriber to identify any alterations and, if any, report them to the appropriate agency.

Current adoption status: In 2012 legislation enacted in New York State, electronic prescribing of all controlled substances is mandated to begin in approximately three years, with limited exceptions. The method for integration with the state's PDMP is expected to be described in implementing regulations.

Barriers: Barriers to PDMP interoperability with e-prescribing include lack of existing information technology protocols, policies, and standards to enable data exchange between systems.

Summary

Rationale: Integrating PDMPs with electronic prescribing may enable more reliable, complete, and timely prescription monitoring.

Evidence of effectiveness: Key stakeholder perceptions.

Current adoption status: None.
Barriers to adoption: Technological and regulatory hurdles.

E. Improve data quality: pharmacy compliance, error, and missing data correction

Rationale: The quality of a PDMP's output—analyses and reports, whether solicited or unsolicited—depends on the timeliness, completeness, accuracy, and consistency of collected data, or inputs. Best practices need to be identified for all stages of data collection and management, but little study of PDMP data quality processes has been conducted. Goals of good data management include:

- attaining a high rate of reporting from all eligible pharmacies (high compliance rate);
- accurate data entry by pharmacy personnel (low initial error rate);
- correction of data when errors are identified (low final error rate after correction); and
- identification and completion of missing data where possible (low missing data rate).

Since no agreed-upon standards for PDMP data quality exist, quantitative benchmarks indicative of success for each of these goals need to be established. Policies and procedures that enable achieving the benchmarks need research and development.

Evidence of effectiveness: Recent experience with real-time reporting of prescription information in Oklahoma (see **B. Reduce data collection interval; move toward real-time data collection**, above) suggests that the advanced information systems required for real-time reporting can play a significant role in improving error correction and detecting and completing missing data, as can moving to version 4.0 or more recent versions of the ASAP reporting standard (PDMP COE, NFF 3.1). For example, ASAP versions 4.1 and later enable pharmacy correction of data errors on a case-by-case basis. Prior versions require the PDMP to return a submitted batch of data found to have unacceptable errors to the pharmacy for correction and return of the whole batch, rendering that batch of data unavailable for provider inquiry until the errors are corrected. It is also possible that other, less technically demanding updates in PDMP data management procedures and policies could produce improvements in data quality.

A survey of a sample of PDMPs comparing approaches to improving reporting compliance and data quality, and linking these to PDMP-quantified performance measures such as data completeness and error rates, would help to identify promising practices. In evaluating a practice, the financial and practical feasibility of instituting the practice would be weighed against the data quality improvement it produced. For more on researching best practices in PDMP data quality, see **Section V. Summary and Recommendations**, below.

***Current adoption status*:** Data quality standards and policies, and procedures in support of achieving acceptable data quality, differ among PDMPs and likely produce varying degrees of success in their attainment.

***Barriers to adoption*:** Barriers to data quality improvement include the cost in staff time of surveying current practices, lack of data quality standards, and lack of resources needed to update data quality systems.

Summary

***Rationale*:** Complete and accurate data can improve reporting, are important for prescribers and pharmacists making patient care decisions, and can help in detecting questionable activity.

***Evidence of effectiveness*:** Accumulated field experience, key stakeholder perceptions.

***Current adoption status*:** States vary in data quality practices.

***Barriers to adoption*:** Cost of surveying current practices, lack of standards, resources needed to update data quality systems.

Data linking and analysis

Best practices in PDMP data linking and analysis will permit better identification of unique individuals in PDMP data, development of standard analyses comparable across states, more reliable estimates of questionable activity, more appropriate and applicable epidemiological investigations, expedited and more reliable analyses, and reports incorporating experienced user knowledge. Candidate practices include actions to:

A. Link records to permit reliable identification of individuals
B. Determine valid criteria for possible questionable activity
C. Conduct periodic analyses of possible questionable activity
D. Conduct epidemiological analyses for use in surveillance, early warning, evaluation, and prevention
E. Develop automated expert systems to expedite analyses and reports
F. Record data on prescriber disciplinary status and patient lock-ins

A. Link records to permit reliable identification of individuals

***Rationale and evidence of effectiveness*:** Reliable identification of unique individuals in PDMP databases, whether patients or prescribers, is vital for accurate analyses and reporting of questionable activity and prescribing trends. Although states have implemented a number of approaches to link patient records, to date, there has been neither a census taken of such approaches, nor an evaluation of their effectiveness.

Standard benchmarks for reliable record linking need to be identified against which different linking algorithms can be tested. Since the capability to link records belonging to an individual is critical to providing accurate prescription information to all users and is essential for analyzing the impact of PDMPs, e.g., measuring the level of questionable activity, this is an area deserving of close examination for developing evidence-based best practices. See **Section V. Summary and Recommendations**, below, for further discussion and recommendations.

***Current adoption status*:** Many states have developed electronic capabilities to link prescriptions dispensed to what is likely to be a single individual in cases where the personal identifying information varies between records, e.g., the same address and prescriber but a differently spelled first name. Such linking is accomplished through vendor proprietary software, off-the-shelf software, or in-house developed or modified software.

***Barriers to adoption*:** Barriers to adopting reliable record linking systems include lack of standard benchmarks to assess linking algorithms and lack of resources to conduct research to develop standards.

Summary

***Rationale*:** Reliable linking of records maximizes identification of unique individuals in PDMP data.

***Evidence of effectiveness*:** Key stakeholder perceptions.

***Current adoption status*:** States vary in whether and how records are linked.

***Barriers to adoption*:** Lack of resources to conduct needed research, no standard benchmarks to assess linking algorithms.

B. Determine valid criteria for possible questionable activity

***Rationale and evidence for effectiveness*:** Despite the relatively widespread use of unsolicited reporting (see **User access and report dissemination, E. Send unsolicited reports and alerts to appropriate users**, below) on individuals exhibiting possible questionable activity (e.g., doctor shopping), there is little commonality in the criteria used by PDMPs to identify them. Validated and standardized criteria are therefore needed to permit reliable identification of questionable activity within and across jurisdictions. Proactive reporting is also applicable to medical providers who, whether intentionally or not, may be engaging in risky or illegal prescribing or dispensing behavior. Alerts concerning questionable activity on the part of providers may be appropriately addressed to licensure boards, peer review committees, third-party payers, Centers for Medicare and Medicaid Services (CMS), and other bodies or agencies concerned or charged with monitoring medical practitioners. When analysis of PDMP data identifies probable criminal activity, such as prescribing by pill mills, referral to law enforcement agencies would be appropriate. To guide such alerts, reliable criteria of questionable activity by providers using PDMP and other data need research and development; see, for instance, DuBose et al. (2011).

Several studies have attempted to shed light on criteria for identifying conditions and behaviors that put patients at risk for prescription drug abuse. Patients who visit a few prescribers (two to five) in a year seem not to be more at risk for opioid abuse than those using only one (Wilsey et al., 2011). Studying a sample of insurance patients on whom they were able to obtain medical records, White et al. (2009)

found that the risk for prescription opioid abuse (over a three-month period) was associated with being age 18 to 34, being male, filling four or more opioid prescriptions, having opioid prescriptions from two or more prescribers and from two or more pharmacies, using early prescription opioid refills, and obtaining escalating dosages. When medical data were allowed to be predictors in the model of risk for prescription opioid abuse, such risk (over a 12-month period) was found to be associated with being age 18 to 34, being male, filling 12 or more opioid prescriptions, having opioid prescriptions from three or more pharmacies, using early prescription opioid refills, and obtaining escalating dosages, in addition to having hospital and outpatient visits and several diagnoses.

In a sample of users of high-dosage buprenorphine, Pauly et al. (2011) compared the patient groups identified by (1) overlapping prescriptions (early refills) and (2) outliers in a distribution of patients based on number of prescriptions, number of prescribers, and number of pharmacies. These researchers found that the two groups had an 85 percent overlap. Other studies have implicated simultaneous, or overlapping, prescriptions for different controlled substances (e.g., opioids and benzodiazepines) as being associated with multiple prescriber episodes (Wilsey et al., 2010) or opioid-related deaths (Webster et al., 2011; Rich & Webster, 2011).

Paulozzi et al. (2012) were able to link a sample of patients in New Mexico who died of an unintentional drug overdose with PDMP data to obtain their prescription histories. Comparing these histories to prescription histories of a control sample with matching exposure periods in the PDMP database, these researchers found that increased risk for overdose death was associated with being male; being older; filling a certain number of prescriptions; filling prescriptions for a sedative/hypnotic, buprenorphine, and specific opioids; and receiving a daily average of 40 or more morphine milligram equivalents. A parallel study in Washington State found that patients receiving opioid prescriptions with an average daily dosage of 100 or more morphine milligram equivalents were 8.9 times as likely to die of overdose as patients receiving an average daily dosage of 1 to 20 morphine milligram equivalents (Dunn et al., 2010). An association between doctor shopping, receiving a high daily dose, and risk of overdose death is also suggested by research conducted by Hall et al. (2008), Gomes et al. (2011) and Peirce et al. (2012).

These studies suggest the utility of including factors other than number of prescribers and number of pharmacies in a specified period of time as criteria for identifying questionable activity or likely doctor shopping behavior. Moreover, indicators of doctor shopping behavior may well vary across states and over time,[2] and it is important to distinguish between (1) criteria that most accurately identify individuals engaged in questionable activity, and (2) criteria that, if used as the basis for sending unsolicited reports, would generate the most benefit in terms of facilitating appropriate prescribing and reducing abuse and diversion.

To date, no studies have compared the effects of unsolicited reporting using different criteria within the same PDMP. Studies to refine the criteria for sending unsolicited reports would appear useful to the extent they can reduce the number of false positives (possibly creating unnecessary patient discomfort) and false negatives, thereby increasing the efficiency of PDMP resources used to generate the reports.

[2] For example, as shown in PDMP COE, Notes from the Field 1.1 and 2.5, as states issue unsolicited reports, the numbers of persons exceeding the thresholds can be expected to decline. Thus a state could lower its thresholds to identify possible doctor shoppers who are obtaining fewer prescriptions.

The purpose of an unsolicited report, however, is to provide prescribers and pharmacists with additional information that they may choose to use (or not) in their clinical decision-making. This line of reasoning suggests that, for maximum effect, unsolicited reporting ought to be coupled with efforts to educate prescribers and pharmacists about how to access and use PDMP data.

Exploratory work being done by the Massachusetts and Nevada PDMPs to automate their reporting to health providers of persons who exceed thresholds should be followed closely, as automation may provide a means by which to increase reporting capabilities while decreasing costs. To avoid bottlenecks in proactive reporting, data quality and criteria for questionable activity need development to the point where unsolicited reports and alerts do not have to be reviewed by hand before they are sent (see **Develop automated expert systems**, below).

***Current adoption status*:** To identify possible doctor shoppers, PDMPs typically use a threshold of a number of prescribers from whom a patient has obtained a controlled substance prescription, and a number of pharmacies that have dispensed the prescriptions, in a specified period of time—often six months but sometimes one month. For example, BJA's required performance measures for PDMP Harold Rogers grantees asks for the number of patients who have obtained, respectively, Schedule II, Schedule II and III, and Schedule II–IV prescriptions from five or more prescribers and had them filled at five or more pharmacies in a three-month period (a 5x5x3 threshold).[3] Some PDMPs use thresholds as high as 10 prescribers and 10 pharmacies in a one-month period (10x10x1).

Several factors appear to account for the different thresholds used across PDMPs. The earliest thresholds (e.g., Nevada's) appear to reflect the judgment of the state's Prescription Controlled Substances Abuse Prevention Task Force that patients engaged in this level of activity are very likely doctor shopping. In other cases, the thresholds used reflect the PDMP's limited resources to generate such reports: Thresholds are set high to identify the persons most significantly involved in doctor shopping and to minimize the number of unsolicited reports that would be called for.

In some cases, thresholds are augmented by the review of a PDMP administrator experienced in identifying likely cases of fraud, abuse, or diversion. Katz et al. (2010) point out that varying the threshold numbers of prescribers and pharmacies from whom a patient has obtained prescriptions enables a PDMP to trade off false positives (flagging via an unsolicited report of patients not engaged in questionable activities or doctor shopping) and false negatives (failing to flag patients actually engaged in questionable activities or doctor shopping). However, as noted above, there are currently no recommended best-practice criteria for identifying patients on whom unsolicited reports should be sent.

***Barriers to adoption*:** Barriers to determining valid criteria for possible questionable activity include lack of a coordinated research program to develop such criteria, the need for a systematic review of existing criteria and their effectiveness, and lack of agreed upon standards by which such effectiveness would be measured, for instance what constitutes an acceptable balance between false positives on the one hand and capturing the full spectrum of questionable activity on the other.

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[3] Through June of 2010, these thresholds applied over a six-month period. In July 2010, the period was changed to three months.

For further discussion and recommendations for research on establishing valid criteria for questionable activity, see **Section V. Summary and Recommendations**, below.

Summary

Rationale: Validated criteria for questionable activity are needed to target unsolicited reports and improve measures of doctor shopping and other questionable activity.

Evidence of effectiveness: Key stakeholder perceptions.

Current adoption status: Variation in thresholds and other criteria used by states.
Barriers to adoption: Lack of sufficient research to validate criteria.

C. Conduct periodic analyses of possible questionable activity

Rationale: PDMP data are unique in providing estimates of possible doctor shopping and other questionable activity, either on the part of patients or prescribers. Such activity is a precursor to controlled substance diversion and abuse, and so is an indicator of a contributing cause of the prescription drug abuse epidemic. Since levels of questionable activity, such as the number of individuals meeting criteria for doctor shopping (see **B. Determine valid criteria for possible questionable activity**, above), are affected by the use of PDMPs, they can also serve as indicators of the impact of the PDMP and of program improvements, possibly providing evidence for PDMP effectiveness.

Current adoption status and evidence of effectiveness: The Virginia PDMP found that the number of individuals meeting thresholds for possible doctor shopping (10x10 and 15x15 in a six-month period) declined following a large increase in data queries to the PDMP, in turn likely the result of improved access to PDMP data (Virginia Prescription Monitoring Program, 2010). Declines in numbers of individuals meeting doctor shopping thresholds subsequent to issuing unsolicited reports, as well as declines in prescribers, pharmacies, and dosage units for individuals reported on, have been observed in Wyoming and Nevada (PDMP COE, NFF 1.1, 2.5). This suggests that states, if they are not already doing so, should be encouraged to conduct periodic threshold and other analyses to track trends in possible questionable activity on the part of patients and prescribers that can then be correlated with PDMP utilization and reporting. PDMPs that are Harold Rogers grantees report such analyses every three months. Such analyses may provide evidence suggesting PDMP effectiveness that could be communicated to stakeholders and funders to build support for PDMPs. Developing standard analyses common to all PDMPs, e.g., using validated thresholds and/or criteria for questionable activity (see **B. Determine valid criteria for possible questionable activity**, above), would permit cross-state comparisons to help evaluate program innovations and provide standard measures by which to gauge the impact of PDMPs over time.

Barriers to adoption: Barriers to conducting periodic analyses of questionable activity include lack of program resources to carry out analyses and the need for standard criteria to permit cross-state comparisons.

Summary

Rationale: Periodic analyses of rates of questionable activity track an indicator of possible substance abuse and diversion, and can help assess the impact of the PDMP and program improvements.

Evidence of effectiveness: Accumulated experience, key stakeholder perceptions.

Current adoption status: Harold Rogers grantees and some other states conduct regular analyses.

Barriers to adoption: Lack of program resources to conduct analyses, no standard criteria for questionable activity.

D. Conduct epidemiological analyses for use in surveillance, early warning, evaluation, and prevention

Rationale: As part of their standard practice, PDMPs make reports on individual prescription histories available to end users, but some also produce and disseminate other types of data analyses relevant to public health objectives involving prescription drugs. Distributing such analyses, which ordinarily de-identify or encrypt patient and prescriber-specific information, may increase the impact of PDMPs. PDMP data can be analyzed by geographic area (county, zip code, pharmacy, town, etc.) and time period to illuminate trends in both prescribing and questionable activity relevant to drug abuse surveillance and prevention efforts. Under its Harold Rogers Grant Program, BJA gives priority consideration to PDMPs proposing to share data and partner with researchers conducting epidemiological analyses concerned with the prescription drug abuse epidemic.

Evidence of effectiveness and current adoption status: Some states have conducted epidemiological analyses of PDMP data for a variety of purposes. Maine's PDMP provided data on controlled substance prescribing patterns to the National Institute on Drug Abuse's Community Epidemiological Work Group, which reports on emerging drug abuse trends at the state and city levels (personal communication), and researchers have analyzed Maine PDMP data to describe trends in prescribing and questionable activity (Payne & Thayer, 2009). The South Carolina PDMP provided data to the PDMP COE by county and by age group on the prescribing of opioids; analyses identified an unexpected level of young opioid users in two major counties. This information, along with Wyoming PDMP data on the prevalence of doctor shopping by age group, was provided to the U.S. Surgeon General's 2011 Expert Panel on Prescription Drug Abuse in Youth (Eadie, 2011, March). Similarly, the Massachusetts PDMP and Brandeis University researchers have produced geo-spatial analyses of rates of possible doctor shoppers. These analyses indicate that communities with the highest rates also tend to have the highest concentrations of opioid overdoses and deaths (Carnevale & Associates and PDMP COE, 2010; Kreiner, 2011). More recent analyses indicate that communities with high rates of questionable activity are at risk for subsequent increases in rates of fatal and non-fatal opioid overdoses (Kreiner, 2012). Had these analyses been possible in prior years, the Massachusetts PDMP could have issued warnings before the overdoses and deaths became epidemic. Warnings could be sent to all community, state, and national stakeholders, including health care practitioners, law enforcement agencies, educators, substance abuse prevention and treatment organizations, schools, parent-teacher organizations, religious organizations, and other groups.

PDMP COE analyses of de-identified data from states neighboring Georgia identified zip codes within Georgia where Georgia prescribers were issuing unusually large numbers of prescriptions for controlled substances (Carnevale & Associates and PDMP COE, 2010). This information enabled Georgia officials to identify possible pill mills within their state borders, even before their PDMP was enacted into state law. These examples suggest that PDMPs are a rich but underutilized resource for surveillance and evaluation efforts aimed at preventing prescription drug abuse and overdose. To assess the range of application of PDMP data beyond providing prescription history reports, states could be surveyed on the types of further analyses they produce and the end users receiving the prescriptions.

***Barriers to adoption*:** Barriers to further analysis and dissemination include lack of PDMP resources; PDMPs' lack of familiarity with such analytical methodologies; the absence of working relationships between PDMPs and state and community organizations that could benefit from access to the analyzed data, e.g., substance abuse prevention groups; and state restrictions on reporting to or collaborating with outside research organizations.

Summary

***Rationale*:** Epidemiological analyses can assist in drug abuse surveillance, evaluation, and prevention efforts.

***Evidence of effectiveness*:** Unpublished data analyses.

***Current adoption status*:** Several PDMPs have provided analyses for communities and state agencies.

***Barriers to adoption*:** Insufficient program resources or expertise to carry out analyses, absence of cooperative working relationships between PDMPs and other groups, and restrictions on providing data to researchers.

E. Develop automated expert systems to expedite analyses and reports

***Rationale and evidence of effectiveness*:** Reliable and valid analysis of PDMP data to identify questionable activity, track prescribing trends, and conduct other research often involves multiple steps and requires familiarity with prescription information (e.g., drug classifications, standard doses, data ambiguities) gained over years of personal hands-on experience. Automated expert systems that capture at least some of this expertise may increase the speed and accuracy of such analyses and their reporting, freeing up staff time and program resources for other initiatives. Automated systems can also generate unsolicited reports and alerts based on criteria of questionable activity (see **B. Determine valid criteria for possible questionable activity**, above). Given that those meeting such criteria sometimes number in the thousands, automated algorithms to reliably identify such individuals and generate alerts to their prescribers and pharmacists may be the only feasible means to conduct proactive reporting on the necessary scale. Research is needed to document existing PDMP expert systems, evaluate their efficiencies, and help develop software programs and standard algorithms that reliably identify probable questionable activity and accelerate other analyses. Given the wide application of expert systems in other public health and safety contexts, it seems likely that PDMPs would gain in effectiveness by adopting automated procedures in analyzing and reporting their data.

***Current adoption status*:** Some states have explored the design of automated expert systems that can expedite analyses. Massachusetts and Oklahoma are using off-the-shelf business intelligence software to track prescribing patterns and PDMP utilization. States could be surveyed on what, if any, expert systems and software are being used and their impact on improving PDMP productivity.

Barriers to adoption: These include the limited resources of PDMPs, leaving them without staff, time, or funds to explore such issues; the absence of guidance material or information that PDMP administrators could utilize; design and implementation costs for customized systems; and whether a state's software vendor (if it has one) has the capacity and flexibility to implement such a system.

Summary

***Rationale*:** Expert systems and automated analyses and reports may increase the productivity of PDMPs.

***Evidence of effectiveness*:** Accumulated field experience, key stakeholder perceptions.

***Current adoption status*:** At least a few states have explored expert systems.

***Barriers to adoption*:** Limitations of PDMP resources, absence of information or guidance documents, design and implementation costs, software vendor capacity.

F. Record data on prescriber disciplinary status and patient lock-ins

***Rationale*:** PDMPs could enhance their effectiveness if they could obtain and match to prescription records data on prescribers' deaths or disciplinary status, such as a DEA registration suspension. Upon receipt of prescription information from pharmacies, the PDMP could flag any such prescribers, prompting referral to appropriate agencies. The Government Accountability Office (GAO) found in its 2009 examination of Medicaid programs that state Medicaid agencies paid for prescriptions of controlled substances that were issued by deceased prescribers or those barred from such prescribing, or that were dispensed by pharmacies not legally authorized to do so (GAO, 2009). These forms of diversion could be effectively monitored by PDMPs were they able to link to the relevant databases.

Similarly, information from Medicaid or third-party payers on patients who are in a restricted recipient program or "lock-in" to a single prescriber and pharmacy could be recorded by the PDMP. If a check of the PDMP indicates the prescription about to be dispensed is not from the specified prescriber and pharmacy, the pharmacist could take steps to make sure that dispensing is appropriate. This would be consistent with GAO's 2011 recommendation to CMS for the Medicare program that a restricted recipient program be implemented (GAO, 2011). Even if the pharmacist does not detect this prior to dispensing, the PDMP could detect that the prescription was issued and dispensed by an unauthorized prescriber and/or pharmacy and report it to the Medicaid program. Alternatively, the PDMP could make the data available to Medicaid or other third-party payer so it could analyze the data and identify the violation of a lock-in, as has Washington State (see **User access and report dissemination, B. Optimize reporting to fit user needs**, below).

***Evidence of effectiveness*:** The potential effectiveness of giving PDMPs access to data on prescriber disciplinary status and patient lock-ins is suggested by other instances of data sharing that enable identification of problematic prescribing and dispensing, for instance Washington State's provision of PDMP data to its Medicaid program (see **User access and report dissemination, B. Optimize reporting to fit user needs**, below).

***Current adoption status*:** No PDMPs were found that record prescriber disciplinary status or patient lock-ins.

***Barriers to adoption*:** To link to the relevant databases and flag reports, PDMPs will have to implement data-sharing agreements and develop the necessary information systems. Limited program resources pose the biggest obstacle to such development.

Summary

***Rationale*:** Dispensers could check the PDMP for data on practitioner disciplinary status and patient lock-ins to ensure that the presented prescription is advisable to dispense.

***Evidence of effectiveness*:** Key stakeholder perceptions.

***Current adoption status*:** None.

***Barriers to adoption*:** Lack of resources needed to develop systems to record data and automatically flag practitioners and patients when the PDMP is queried.

User access and report dissemination

Best practices in PDMP access and reporting will maximize the availability and utility of PDMP data to the widest range of appropriate end users. Candidate practices include actions to:

A. Provide continuous online access and automated reports to authorized users

B. Optimize reporting to fit user needs

C. Integrate PDMP reports with health information exchanges, electronic health records, and pharmacy dispensing systems

D. Send unsolicited reports and alerts to appropriate users

E. Publicize use and impact of PDMP via websites, presentations, and reports

A. Provide continuous online access and automated reports to authorized users

***Rationale*:** PDMPs began as paper- or faxed-based systems, distributing custom-generated reports to limited numbers of users, mostly on request (solicited reports). Since the advent of electronic databases, many states have moved to automated online systems that make prescription history reports continuously available to authorized and authenticated users at their computer terminals. This is important since medical care is provided by emergency departments, and dispensing is provided by some pharmacies 24 hours a day, seven days a week, year-round.

***Evidence of effectiveness*:** Anecdotal reports and some observational evidence suggest that ease of access to the PDMP encourages its utilization, increasing the number of data queries far beyond what earlier systems envisioned. As its reports are made more widely available to end users, a PDMP's impact appears to increase. Data from Virginia's PDMP show a typical pattern: As the state enabled continuous online access and automated reporting beginning in 2010, data queries, mostly by prescribers, jumped from 75,432 in 2009 to 433,450 in 2010. Simultaneously, and possibly because of this increased PDMP

utilization, the number of individuals in the PDMP database meeting 10x10 and 15x15 over six-month thresholds for doctor shopping declined (Virginia Prescription Monitoring Program, 2010). Continuous online access also encouraged Virginia medical examiners to make PDMP reports a standard element of all case investigations, enabling more efficient determinations of cause of death (PDMP COE, NFF 2.6).

Another example is the new Florida PDMP, which first allowed prescribers and pharmacists to request data online on October 17, 2011. Within the first 10 weeks (as of December 31, 2011), 337,635 patient-specific controlled substance dispensing queries had been performed by prescribers and pharmacies, providing information for safe prescribing and dispensing (Florida PDMP data). Given the tremendous increase in use afforded by online access, it is a high priority for states to move to automated systems that make prescription history data continuously available to end users.

***Current adoption status*:** Currently, all but four states have established or are installing online databases with Web portals for prescriber and pharmacist inquiries. The following states implemented Web portals or online access during 2011 and early 2012: Alaska, Florida, Massachusetts, Oregon, and Washington (PDMP COE Survey of PDMPs, 2011, and communication with Washington State PDMP).

***Barriers to adoption*:** Barriers to implementing such systems include cost, concerns about data security, and information technology bottlenecks.

Summary

***Rationale*:** Continuous online access seems to increase use and impact of a PDMP.

***Evidence of effectiveness*:** Unpublished Virginia PDMP data, Florida PDMP data, case study.

***Current adoption status*:** Most PDMPs.

***Barriers to adoption*:** Cost, technological bottlenecks, data security concerns.

B. Optimize reporting to fit user needs

***Rationale*:** Besides making reports continuously available, PDMPs are beginning to explore reporting functionalities and formats that will further incentivize use of their data by meeting the needs of end users. PDMP reports can be tailored to specific types of end users, for example by highlighting or suppressing certain data fields for law enforcement investigators, or by providing reports of particular interest to licensing boards. Best practices in reporting will be those that best meet end-user requirements.

***Current adoption status and evidence of effectiveness*:** The Massachusetts PDMP plans to enable batch reporting as part of its new online system, allowing prescribers to retrieve automated summary prescription histories for all patients scheduled for upcoming appointments. A full report for any patient can then be downloaded if necessary. The Washington State PDMP has agreed to provide batch transfer of PDMP data to Medicaid for its enrollees, to the Workers' Compensation unit in the Department of Labor and Industries for workers' compensation claimants, and to the Corrections Department for inmates. A review of Washington PDMP data for Medicaid enrollees identified more than 2,000 individuals in 2012 receiving Medicaid and cash-paid prescriptions for controlled substances on the same day. It also found 478 clients for whom cash and Medicaid prescriptions for the same drug were

filled less than 10 days apart and from a different prescriber. (Presentation by Scott Best, Clinical Nurse Advisor, Washington State Health Care Authority at CDC Medicaid Patient Review and Restriction Expert Panel Meeting, August 27-28, 2012, Atlanta, GA). Without the batch transfer of PDMP data, this activity would not have come to light.

PDMPs should be surveyed to document the types of PDMP report customization they currently offer, as well as any innovative reporting functions. To gauge effectiveness, process outcome data on how changes in reporting affect utilization should be sought from PDMPs as well as survey data from end users on the usefulness of customized reports or functionalities. Such information could help determine which of these might be recommended as PDMP best practices in reporting.

***Barriers to adoption*:** Barriers to optimizing reports for end users include the costs of designing and implementing customized report types as well as the need to survey end users on what report types and functionalities would be most useful.

Summary

***Rationale*:** Meeting end-user needs by optimizing reporting helps incentivize use of PDMP data, increasing PDMP impact.

***Evidence of effectiveness*:** Accumulated experience, key stakeholder perceptions.
***Current adoption status*:** A few PDMPs.

***Barriers to adoption*:** Development and implementation costs of new reporting functions and customizations.

C. Integrate PDMP reports with health information exchanges, electronic health records, and pharmacy dispensing systems

***Rationale*:** Integrating PDMP data retrieval with health information exchanges (HIE), electronic health records (EHR), and pharmacy dispensing systems should help reduce the time and effort needed for prescribers and their staff and for pharmacists to access a patient's prescription history. The Office of the National Coordinator for Health Information Technology (ONC) at the Department of Health and Human Services, in collaboration with MITRE Corporation, is leading an effort to develop and test a methodology for seamless transfer of PDMP data to prescribers, dispensers, and emergency departments before patients are seen by physicians and to pharmacies before dispensing. This effort, called "Enhancing Access to PDMPs," plans to utilize systems in which health care providers and third-party payers confirm patients' eligibility for third-party payment prior to patients being treated. The ultimate goal is to provide secure PDMP data in real time to electronic records systems such that medical providers have continuous access to prescription history information vital to safe prescribing of controlled substances.

***Current adoption status and evidence for effectiveness*:** Two pilot projects are planned by the ONC, one in Ohio using a "drug-risk indicator" in the EHR, and one in Indiana involving emergency department staff access to prescription information via EHRs. These efforts, and other initiatives by states to incorporate PDMP data into HIE/EHR, need to be documented and evaluated to determine their feasibility and which of them show promise as models for other states. In advance of full integration

with health information systems, intermediate steps to integrate the PDMP into the provider's workflow can be explored, such as instituting batch reporting on patients scheduled for upcoming visits (see **B. Optimize reporting to fit user needs**, above) and sending unsolicited reports or alerts to prescribers and dispensers that prompt them to consult the PDMP (see **D. Send unsolicited reports and alerts to appropriate users**, below).

Barriers to adoption: Barriers to integrating PDMP reports with health information exchanges and electronic medical records include the need to develop and test data systems, and concerns about data security and patient confidentiality.

Summary

Rationale: Integrating PDMP data with HIEs, EHRs and pharmacy dispensing systems facilitates prescriber and dispenser access to PDMP data.

Evidence of effectiveness: Key stakeholder perceptions.

Current adoption status: None.

Barriers to adoption: Lack of resources needed to develop and test data systems, concerns about data security, and patient confidentiality.

D. Send unsolicited reports and alerts to appropriate users

Rationale: Some PDMPs, in addition to supplying reports when requested or downloaded by end users (solicited reports), also send out unsolicited reports based on PDMP data suggesting questionable activity such as doctor shopping or inappropriate prescribing such as by pill mills. Recipients of unsolicited reports sent by states include prescribers, pharmacists, investigative agencies, and licensure boards. As a minimum requirement for states to receive PDMP funding under NASPER, SAMHSA established that PDMPs must provide unsolicited reports to medical practitioners (SAMHSA, 2005). Unsolicited reports can serve several functions: inform prescribers and pharmacists that patients may be abusing or diverting controlled substances; help prescribers make better decisions about prescribing controlled substances, thus improving patient care; and inform potential end users about the PDMP and its value. Reports sent to investigative agencies and licensure boards can assist in targeting drug diversion reduction efforts and ensuring safe, effective, and legal medical practice.

Evidence for effectiveness: Nevada initiated its PDMP in 1997 by sending unsolicited reports to prescribers about possible doctor shoppers. These reports quickly generated interest in the PDMP among prescribers, sparking further requests for data (solicited reports) (PDMP COE, NFF 2.5). Analyses of Nevada PDMP data from 1997 to 2002 indicate that individuals for whom unsolicited reports were sent exhibited declines in the average number of dosage units and numbers of pharmacies and prescribers visited subsequent to the reports. This suggests the reports may have influenced prescribing by providers treating these patients. Similarly, analyses of data from the Wyoming PDMP suggest that unsolicited reports helped to raise awareness of the PDMP, leading to greater requests for data, with a subsequent decline in numbers of individuals identified in the PDMP database who met doctor shopping thresholds (PDMP COE, NFF 1.1).

Preliminary data from a Massachusetts survey of prescribers receiving unsolicited reports indicate that just 8 percent were aware of all or most of the other prescribers listed on the reports, and only 9 percent judged that the prescriptions listed were medically necessary (MADPH Advisory Council Presentation, 2012). Pharmacists and prescribers in Maine who received automatic threshold reports on patients took a variety of actions in response, including discussing reports with patients, calling pharmacists who had dispensed to the patient, establishing a controlled substances agreement, conducting a substance abuse screening and brief intervention, and referring patients to substance abuse treatment (Sorg et al., 2009). These findings suggest that unsolicited reports can serve important functions in providing new information to practitioners and guiding their clinical practice. A cross-state evaluation of PDMPs by Simeone and Holland indicated that states with PDMPs that engaged in unsolicited reporting reduced sales of controlled substances by 10 percent compared to states without PDMPs, potentially reducing diversion and abuse (Simeone & Holland, 2006).

Further studies are needed to determine the impact of unsolicited reporting and the mechanisms by which such reporting influences doctor shopping and prescribing behavior, especially studies involving matched comparison groups of individuals for whom unsolicited reports are not sent. Unsolicited reports can also prompt regulatory boards to determine if providers are operating outside of accepted standards of care. Guidelines for appropriate reporting to boards need to be developed, taking into account current practices by the states that permit such reporting.

An apt model for unsolicited reports and their use is the well-established public health practice of mandated reporting to disease registries operated by state health departments. Such registries include communicable diseases like mumps, rubella, and tuberculosis; positive HIV diagnoses; cancer; and other chronic diseases. Such registries are regularly analyzed, and proactive public health interventions are initiated when outbreaks or epidemics are detected.

While some persons who obtain controlled substances from multiple prescribers and dispensers do so in order to resell the drugs on the street, others obtain excessive drugs for abuse, meeting the Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV criteria for abuse or dependence. Analysis by researchers in Washington State indicates that individuals who consume 100 morphine milligram equivalents or more per day are eight times more likely to overdose than persons consuming lesser quantities (Dunn, 2010). The proactive analysis of PDMP data and distribution of unsolicited reports to help prevent such overdoses would constitute a public health intervention, just like that of other disease registries. In its 2012 Harold Rogers Grant Program solicitation, BJA stated it would give priority consideration to PDMPs proposing to carry out unsolicited reporting.

***Current adoption status*:** As of a survey of 38 states in November 2011, 30 PDMPs are authorized to provide unsolicited reports to providers, but only 16 of them were actually doing so. A smaller number were also providing such reports to law enforcement agencies (eight PDMPs) and licensing boards (seven PDMPs) (PDMP COE Survey of PDMPs, 2011). Mississippi now sends unsolicited reports to individuals whose prescription histories suggest questionable activity, then tracks their prescription behavior using PDMP data. Indiana has instituted “user-led” unsolicited reports: A practitioner who has retrieved PDMP data suggestive of a patient’s questionable activity is enabled to send notifications to

other practitioners concerning the patient. These innovative approaches to unsolicited reporting could be evaluated as possible best practices.

Instead of sending full reports containing patient data, some states send letters or alerts to providers, notifying them that one or more of their patients (identified by a coded number) might be doctor shopping, and recommending that they view PDMP data on the patient. If they are not registered with the PDMP, they can open accounts to access the data. Louisiana has instituted an automated system of generating alert letters to practitioners, minimizing costs and increasing the rate of notification, and Massachusetts is developing a similar system. Given that persons identified as possible doctor shoppers in PDMP databases can number in the thousands, depending on the thresholds or criteria used, automated methods for notifying prescribers seem indicated but are in need of evaluation.

Barriers to adoption: Barriers to issuing unsolicited reports include PDMP-enabling legislation in some states that does not authorize such reporting, lack of staff and information system resources needed to analyze PDMP data to detect questionable activity and to generate and disseminate reports, and a concern expressed by some that unsolicited reports will de-incentivize prescriber-initiated access to the PDMP (even though available information cited above indicates the opposite effect).

See **Section V. Summary and Recommendations** for recommendations for research and development of best practices related to unsolicited reporting.

Summary

Rationale: Unsolicited reports proactively inform end users about the PDMP and of possible doctor shopping, inappropriate prescribing, and drug diversion; help inform safe and effective prescribing and dispensing; and incentivize enrollment and use of PDMP.

Evidence of effectiveness: Published study, case studies, unpublished survey data, expert opinion.

Current adoption status: Thirty PDMPs are authorized to provide unsolicited reports, and 16 actually do so.

Barriers to adoption: Legislative prohibitions, lack of program resources.

E. Publicize use and impact of PDMP via websites, presentations and reports, and analyses

Rationale and evidence of effectiveness: A few PDMPs are proactive in publically disseminating selected findings from their analyses and end-user outcomes via websites, presentations and reports. Many, but not all, PDMPs maintain public websites that are or could be used to publicize reports and findings. Greater public outreach on the part of PDMPs could raise awareness about the prescription drug abuse epidemic and the role PDMPs can play in its mitigation, which in turn could build support for funding their operations. For example, reports making the connection between PDMP activity and declines in doctor shopping and inappropriate prescribing would likely increase the positive perception of prescription monitoring as an effective tool in mitigating drug diversion and abuse. PDMP data on prescribing patterns is also of great interest to those interested in public health, whether for personal or professional reasons, so making it available constitutes a valuable public service. In order to give PDMP stakeholders and the public a wider understanding of the prescription drug abuse epidemic and PDMPs' roles in addressing it, states' websites could link to the websites of the PDMP Training and Technical

Assistance Center and the PDMP COE. A survey of PDMP practices in this area would help identify effective approaches to public education and the sorts of reports and analyses that are appropriate for release and most influential in increasing PDMP awareness.

***Current adoption status*:** States vary to the extent to which they proactively disseminate findings and outcomes related to PDMP data and activities to the wider public. A majority of PDMPs have websites (list available at www.pmpalliance.org/content/state-pmp-websites) that give an overview of program objectives and operations but are largely configured to accommodate authorized PDMP users. However, a few programs also make data analyses available. For example, Maine offers recent PDMP news and an epidemiological evaluation of PDMP data from 2005 to 2008 (www.maine.gov/dhhs/samhs/osa/data/pmp/index.htm), and Virginia posts reports showing increased PDMP utilization and concomitant declines in doctor shopping rates (www.dhp.virginia.gov/dhp_programs/pmp/docs/ProgramStats/2010PMPStatsDec2010.pdf). Others, such as Kentucky, link to satisfaction surveys that document the valuable role PDMPs play in clinical practice, and to regular (e.g., quarterly) reports that show prescribing patterns by geographic area, for instance the mostly widely prescribed drugs in each county.

***Barriers to adoption*:** Barriers to publicizing PDMP data and activities include resource limitations in generating data analyses, disseminating reports, and in expanding, updating, and maintaining websites.

Summary

***Rationale*:** Raising awareness of PDMPs via websites, presentations, and reports may help build support and help ensure funding.

***Evidence of effectiveness*:** Accumulated experience, key stakeholder perceptions.

***Current adoption status*:** Some PDMPs publicize findings via data summaries and reports via public websites and other outlets.

***Barriers to adoption*:** Lack of staff resources to produce and disseminate reports, maintain websites.

PDMP recruitment, utilization, and education

Best practices in recruitment, utilization, and education will maximize participation in a PDMP by all appropriate users. They will also promote understanding the value and application of PDMP data in prescribing and dispensing, drug diversion investigations, drug abuse prevention programs, planning and siting drug treatment programs and office-based opioid treatment; and other activities that address prescription drug abuse. Candidate practices include actions to:

A. Enable access to PDMP data by all appropriate users; encourage innovative applications

B. Outreach and recruitment strategies

    1. Proactively identify and conduct outreach to potential high-impact users
    2. Conduct recruitment campaigns
    3. Streamline certification and enrollment processing

4. Mandate enrollment

C. Approaches to increasing utilization

1. Conduct promotional campaigns
2. Improve data timeliness and access
3. Conduct user education
4. Mandate utilization
5. Institute financial incentives
6. Delegate access

A. Enable access to PDMP data by all appropriate users; encourage innovative applications

***Rationale and evidence of effectiveness*:** PDMPs differ in their data access policies, sometimes making it difficult for potential users to access PDMP data, such as health professional licensing boards and law enforcement investigators. Some PDMPs selectively bar access to their data altogether by not expressly authorizing access for substance abuse treatment programs and professionals, medical examiners, Medicaid and Medicare agencies, workers' compensation programs, and other third-party payers. Such restrictions can limit the effectiveness of PDMPs in helping to improve prescribing and in curtailing prescription drug abuse. PDMPs can therefore increase their effectiveness by seeking to widen access to their data by all legitimate users, making sure sufficient safeguards and training are in place to maintain confidentiality of prescription records, and prevent misuse of patient and prescriber information.

BJA gives priority consideration for funding under its Harold Rogers Grant Program to PDMPs proposing to widen data utilization. In particular, local, state, and federal law enforcement agencies and investigators should be given case-appropriate access to PDMP reports (PDMP COE, NFF 2.3). California and Texas, which have long provided both unsolicited and solicited reports to law enforcement agencies, and New York, which has provided such reports to narcotic enforcement investigators within the Department of Health, have lower than average death rates from unintentional opioid overdoses (Eadie, 2011b; Paulozzi, 2010). To help curb prescription forgeries and theft, prescribers could be encouraged to consult PDMP databases periodically to ensure that their DEA controlled substance number is not being used surreptitiously (self-lookup).

To maximize end-user participation, PDMPs first need to identify which types of potential users are overly limited or barred from using PDMP data and those who are simply unaware of the PDMP. They can then undertake initiatives to enable such use, such as legislative and/or regulatory reform or outreach to agencies or professional organizations.

In addition, PDMP stakeholders should be encouraged to promote innovative applications of PDMP data, along with evaluations of their effectiveness. New applications, perhaps involving new categories of users, may eventually become best practices that states can adopt in realizing the full potential of PDMPs.

***Current adoption status*:** Depending on the state, PDMP end users typically include prescribers, dispensers, medical licensing boards, and law enforcement investigators. Some PDMPs, however, have widened their user base to include medical examiners, drug treatment programs and treatment professionals, criminal justice diversion programs such as drug courts, "pre-criminal" intervention programs (PDMP COE, NFF, 2.1), and drug prevention initiatives (PDMP COE, NFF 3.2). Washington State's new PDMP provides data to Medicaid, the Workers' Compensation unit in the Department of Labor and Industries, and the Corrections Department (communication from PDMP administrator). A 2012 statute authorizes the New York State PDMP to provide data to local health departments for purposes of public research and education. Other categories of users could include health care systems' peer review organizations (the North Dakota PDMP is authorized to provide data to peer review organizations) and third-party payers' health care professional reviewers.

PDMPs with more inclusive data access policies can serve as models for programs seeking to expand their user base. For example, Kentucky's PDMP permits use of its data by drug diversion investigators (PDMP COE, NFF 2.3) and drug courts (PDMP COE, NFF 2.4), Virginia's by medical examiners (PDMP COE, NFF 2.6), and other states by outpatient drug treatment programs (PDMP COE, NFF 2.2). A compilation of all appropriate end users, developed in consultation with state PDMPs and the PDMP Training and Technical Assistance Center, would provide direction in maximizing appropriate use of PDMP data. Developing case studies of how data are applied by these end users and in innovative applications (see **the PDMP COE "NFF" series**) will also assist in moving this process forward.

***Barriers to adoption*:** Barriers to permitting greater access to PDMP data include the absence of specific authorization for certain users written into a state's enabling PDMP legislation and/or regulations; concerns of prescribers and pharmacies about professional licensing boards or law enforcement agencies being able to see information about their prescribing and dispensing behavior (sometimes described as fear of so-called "fishing expeditions" by investigators); concerns about revealing the identity of patients in drug treatment programs; lack of PDMP resources to undertake outreach and legislative initiatives; and lack of awareness of PDMPs on the part of potential end users.

Summary

***Rationale*:** Permitting and encouraging use of PDMP data by all appropriate users, and in innovative applications, will help to maximize PDMP utilization and impact.

***Evidence of effectiveness*:** Case studies.

***Current adoption status*:** States vary in restricting or encouraging use of PDMP by different categories of users.

***Barriers to adoption*:** Legislative prohibitions on PDMP data access by potential users, concerns about misuse of data by law enforcement and substance abuse treatment agencies, lack of awareness of PDMP.

B. Outreach and recruitment strategies

Enrollment in and use of PDMPs by medical practitioners is key to achieving their full potential in helping to ensure safe prescribing and dispensing, and in reducing diversion and abuse of controlled substances.

One of the most significant challenges facing PDMPs has been the slow increase in enrollment in and use of PDMPs by prescribers and pharmacists. Rates of enrollment among prescribers are well below 50 percent in most states.[4] Best practices, therefore, need to be identified for how PDMPs can most efficiently increase enrollment among user groups, including producing enrollments of, for example, at least 50 percent of those who wrote 10 or more controlled substance prescriptions in the past year, or of prescribers of at least 50 percent of prescriptions written.

To inform best practices in this domain, appropriate rates of enrollment need to be studied, taking into account that many providers prescribe infrequently and that a relatively small proportion of prescribers are responsible for issuing most controlled substance prescriptions. Data from the Massachusetts PDMP indicate that just 30 percent of all those who prescribed an opioid at least once in 2011 were responsible for 88 percent of all opioid prescriptions in 2011 (MADPH Advisory Council Presentation, 2012)**.** This suggests that to maximize the effectiveness of PDMPs, recruitment strategies could profitably be focused on the most frequent prescribers of those controlled substances implicated in abuse and diversion (see immediately below).

1. Proactively identify and conduct outreach to potential high-impact users

Rationale and evidence for effectiveness: Certain categories of potential PDMP users are a high priority for enrollment given the impact their use of PDMP data would likely have in improving prescribing and dispensing, and in reducing diversion and abuse of prescription drugs. Primary among these are the most frequent prescribers of controlled substances, such as the top 10 percent in terms of prescriptions per year (Paulozzi, 2011), as well as those prescribers with relatively high proportions of suspected doctor shoppers in their practices. Such prescribers are readily identifiable using PDMP data and can be encouraged to enroll in and use the PDMP via letters and alerts, either electronically or by mail. In 2010, Utah's PDMP analyzed its data to identify top prescribers, then contacted them electronically, resulting in a rapid rise in enrollment among this group. Massachusetts is currently conducting an initiative to identify prescribers with relatively high proportions of doctor shoppers in their practices; these prescribers are receiving letters suggesting they join and use the Massachusetts PDMP. These prescribers' enrollment in and utilization of the PDMP will be monitored, along with any changes that may occur in the proportion of possible doctor shoppers in their practices.

Current adoption status**:** Contact with other PDMPs is warranted to ascertain which are engaged in similar efforts and assess outcomes, including on enrollment, utilization, prescribing, doctor shopping rates, and proportions of doctor shoppers among identified frequent prescribers. Outreach to frequent prescribers for enrollment in the PDMP will need to be coordinated with licensure boards and investigative agencies in case any of the identified practitioners happen to be subjects of disciplinary action or investigations.

[4] According to data during the first half of 2010 from Harold Rogers PDMP Grant Program, of 12 PDMPs with operational online Web portals for prescribers to request prescription history reports, 11 reported 9 to 39 percent of prescribers who issued controlled substances prescriptions were registered. Only one state (Hawaii) reported 100 percent registration.

***Barriers to adoption*:** Barriers to adoption include the limited resources of PDMPs, leaving them with limited staff, time, or funds to conduct outreach to high-frequency prescribers and other target groups.

Summary

***Rationale*:** Recruiting high-frequency prescribers may help to maximize impact of PDMP in improving prescribing, reducing doctor shopping.

***Evidence of effectiveness*:** Accumulated experience, key stakeholder perceptions.

***Current adoption status*:** A small number of states have targeted potential high-impact users.

***Barriers to adoption*:** Lack of program resources to identify and conduct outreach to target groups.

2. Conduct recruitment campaigns

Rationale and evidence for effectiveness: In launching and promoting their PDMPs, most states conduct recruitment campaigns to raise awareness of the PDMP and enroll participants. Virtually all PDMPs engage in one or more forms of recruitment, including a mix of presentations to professional groups, hospitals, and conferences; mail and e-mail campaigns; online training modules and webinars; and Web pages with instructional materials and FAQs. Recently, a few states have initiated targeted outreach to potential high-impact users (see 1. **Proactively identify and conduct outreach to potential high-impact users**, above). Campaigns have included disseminating end-user testimonials about the value of PDMP data, such as those gathered by surveys of PDMP users in Kentucky (Kentucky Cabinet for Health and Family Services, 2010). Some states, such as Massachusetts, take advantage of controlled substance registration requirements to notify prescribers about the PDMP and facilitate enrollment.

Little data exist on the relative effectiveness of various recruitment strategies. To help inform best practices, states' promotional activities should be examined in connection with how they affect rates of enrollment. Historical data on activities and enrollment rates are often available to PDMPs; these could provide some indication of the impact of specific promotional efforts, or types of efforts, as reflected in applications to join the PDMP.

***Current adoption status*:** States that have recently conducted outreach campaigns, or that are in the process, include Massachusetts, North Carolina, Utah, and Vermont. Surveys of both enrolled and non-enrolled practitioners could shed light on which recruitment techniques seem to achieve the most penetration, and which barriers exist to learning about and joining the PDMP. A recent survey found that a significant deterrent to enrollment among pharmacists in Ohio was the perceived time needed to access a PDMP report (Ulbrich et al., 2010). This suggests that educating prospective PDMP participants about the advantages and ease of access to PDMP data would help increase enrollment.

***Barriers to adoption*:** States' resources are limited, especially during this difficult economic period, including funding for activities to recruit participants. Moreover, little evidence exists on the relative effectiveness of recruitment strategies, so programs lack guidance on how to proceed in outreach efforts.

Summary

Rationale: Well-focused recruitment campaigns may boost PDMP enrollment.

Evidence of effectiveness: Accumulated experience, key stakeholder perceptions.

Current adoption status: States have undertaken a variety of recruitment campaigns.

Barriers to adoption: Lack of resources, little evidence on what approaches produce best enrollment outcomes.

3. Streamline certification and enrollment processing

Rationale and evidence for effectiveness: Among the barriers to enrollment in a PDMP is the sometimes burdensome process of certifying a potential user's credentials and establishing secure system access via proper identification, including passwords and biomarkers. Evidence-based best practices in user certification and enrollment would streamline and automate these processes, while maintaining confidentiality and system security. For example, requiring notarization of prescribers' applications for PDMP accounts, although helping to validate an applicant's identity, may present an obstacle to enrollment for busy practitioners. Further investigation of notarization and alternative means of validating identity and credentials is warranted. This is especially important, since without notarization, it would not be difficult for someone to fraudulently claim to be a licensed prescriber or pharmacist, open a PDMP account, and then obtain confidential data that could be used against others, e.g., against a rival in a divorce or domestic custody suit or against an opposing candidate running for political office. Given that a few states have reported such fraudulent activity, this must be examined carefully. Experience in some states, described below, suggests that enrollment and authentication procedures can be safely automated, but long-term data on fraudulent enrollments and security breaches need to be collected to confirm this hypothesis.

Current adoption status: Utah, which mandates prescriber enrollment in its PDMP (see **4. Mandate enrollment**, below), has taken advantage of its cross-agency integration of health provider information to expedite PDMP certification and enrollment. Kentucky, also in response to a utilization mandate, has developed application forms that prescribers can complete online, submit electronically, and simultaneously print for notarization and submission. Connecticut has developed a process through which applicants need not send in paper forms, even after notarization; instead, applicants submit forms by fax, and the PDMP's computers automatically convert the forms to electronic files. Florida's enrollment and authentication procedures are fully automated, involving electronic communication between an online application form and a Department of Public Health database.

Such approaches could serve as models for other states for how to incentivize and process enrollments, should evaluation confirm their security and efficacy. A survey of other PDMP enrollment procedures could help identify those that minimize the time and inconvenience for potential participants. Enrollment data from PDMPs can help validate hypotheses about which procedures are most effective in accelerating the enrollment process.

There is also a need to study the feasibility of using the federally required certification of prescribers to authorize their electronic prescribing of controlled substances prescriptions. States could potentially use

the federal certification to accept and enroll users in their PDMPs, thus saving the prescriber from duplicative authentication procedures and expediting the PDMP enrollment procedure. This kind of study is urgent as e-prescribing of controlled substances is expected to advance quickly, especially as New York State has passed a 2012 statute mandating e-prescribing of controlled substances within a few years.

Barriers to adoption: Barriers to streamlining certification and enrollment processing include lack of secure online information systems that can replace in-person notarization as a means to authenticate applicants. In particular, the need exists to explore federal certification of prescribers to issue electronic prescriptions for controlled substances, as a shortcut in state authentication systems.

Summary

***Rationale*:** Streamlined certification and enrollment processes may increase enrollment and utilization.

***Evidence of effectiveness*:** Accumulated experience, key stakeholder perceptions.

***Current adoption status*:** A few states have explored various steps in streamlining enrollment.

***Barriers to adoption*:** Lack of information systems and validated processes that would facilitate certification and enrollment, including possible use of federal certification of prescribers for electronic prescribing.

4. Mandate enrollment

***Rationale*:** In most states with operational PDMPs, enrollment and utilization are voluntary. This makes it necessary for states to conduct recruitment campaigns to increase awareness of the PDMP and induce prescribers and pharmacists to enroll (see **2. Conduct recruitment campaigns**, above). Such campaigns can be expensive, resource-intensive, and time-consuming; PDMP administrators frequently report that campaigns fail to produce high rates of participation. Another option, not yet widely adopted but gaining in prevalence, is to make enrollment in a PDMP mandatory for certain user groups, such as prescribers and dispensers (NAMSDL, 2012a).

***Evidence of effectiveness*:** The effectiveness of prescriber- and pharmacist-mandated enrollment in producing greater utilization of PDMPs needs to be assessed, taking into account any unintended consequences, such as resistance on the part of some doctors to a perceived regulatory burden and/or infringement on their autonomy, or the inability of enrollment and certification systems to handle a surge of applications. One PDMP has expressed concern about a legislative mandate for enrollment because it may not provide funding for processing applications. Examining states' experience could shed light on whether mandates are more successful than voluntary campaigns in producing high rates of enrollment and utilization, and if so, which ancillary systems and policies enable successful mandates. Utah, with a relatively small number of prescribers, has been able to implement mandated enrollment using its advanced health management information system. How and whether larger and less technologically advanced states could carry out such a mandate are open questions needing investigation.

***Current adoption status*:** Since 2007, Arizona has required that practitioners who possess a registration under the U.S. Controlled Substances Act must also be registered with the PDMP. Utah has recently (July

2010) mandated that prescribers join its PDMP, making enrollment a prerequisite for practitioners to renew their federal or state licenses to prescribe controlled substances. More than 90 percent of those with licenses to prescribe controlled substances in Utah are now enrolled in its PDMP (personal communication from Utah PDMP administrator). Similarly, Minnesota requires PDMP enrollment for pharmacists as a precondition for license renewal, and in Louisiana, recent legislation requires the medical directors of pain clinics to enroll in and use the PDMP. Kentucky, New Hampshire, Tennessee, and Massachusetts have passed laws in 2012 mandating registration and use of the PDMP by prescribers (NAMDSL, 2012a and 2012b, communication with Massachusetts PDMP). A New York 2012 statute (the "I-Stop" Program Bill #39, introduced in June 2012) mandates use of the PDMP prior to prescribing or dispensing controlled substances, with limited exceptions—effectively mandating enrollment as well. A 2012 Massachusetts statute mandates that all prescribers of controlled substances enroll in the PDMP program over a three-year period as they establish or renew their state controlled substances registrations. Maine requires registration but not utilization.

Barriers to adoption: Barriers to mandating PDMP enrollment include the need for possibly significant revisions in PDMP legislation and regulations, possible opposition from provider groups wary of state intrusion on medical practice, and lack of funding and other program resources to support implementation. A facilitating factor might include the perception that prescriber use of a PDMP is becoming a "duty of care," given its role in promoting safe prescribing, especially as online PDMP reports become available to practitioners.[5] This suggests that public and provider education about the value of PDMP data for medical practice might help build support for enrollment mandates, should a consensus emerge that they constitute a best practice for building PDMP participation. See Section V. Summary and Recommendations for further discussion of mandates to enroll in and use PDMPs.

Summary

Rationale: Mandating enrollment may increase provider utilization of a PDMP.

Evidence of effectiveness: Accumulated experience, key stakeholder perceptions.

Current adoption status: A few states mandate enrollment.

Barriers to adoption: Need for legislative/regulatory change, provider resistance to mandates, and lack of program resources to implement mandate.

C. Approaches to increasing utilization

Like enrollment, actual use of the PDMP—such as requesting a report via fax or accessing an online database – is optional for prescribers and pharmacists in most states. This raises the question of which strategies work best to increase voluntary utilization by registered users and the further question of whether mandating the use of a PDMP might constitute a best or promising practice. Even in states with

[5] Concerns among doctors that they would become legally liable for failure to consult the PDMP could perhaps be offset by reductions in malpractice insurance premiums for physicians who integrate use of the PDMP into their practices (see **5. Institute financial incentives**, below).

comparatively well-established PDMPs, awareness of and enrollment in a PDMP do not always entail its utilization (Feldman et al., 2011).

1. Conduct promotional campaigns

***Rationale and evidence for effectiveness*:** As noted above, states have undertaken outreach initiatives to inform practitioners and the public about the benefits of consulting the PDMP to help assure safe prescribing and dispensing. They have also sought to provide reassurances about patient privacy and explain that fears about the so-called chilling effect (unwarranted reductions in prescribing pain medication as a consequence of prescription monitoring) may be overblown. Published data are scarce on the impact of consulting a PDMP on prescribing, but a recent study of emergency physicians indicated that when informed of a patient's prescription history, they prescribed more controlled substances for some patients but less for others, when compared to their not being informed of patient histories (Baehren et al., 2010). A Canadian study found no significant differences in changes in opioid dispensing rates between provinces with and without PDMPs (Fischer et al., 2011). Dissemination of these and any similar findings that eventually come to light might encourage PDMP utilization by allaying prescribers' concerns about intrusive monitoring of their medical practice and any chilling effect this might have (Barrett & Watson, 2005; Twillman, 2006; Fornili & Simoni-Wastila, 2011). Further study is needed to understand how utilization of PDMP data influences prescribing decisions.

The impact of promotional campaigns on utilization will be reflected in the number of data queries to the PDMP, comparing the periods before and after the campaigns, although controlling for confounding factors may prove difficult. Recent data analyses from Virginia suggest that a well-focused outreach campaign, along with program improvements, can increase both enrollment and utilization by prescribers and dispensers (Virginia Prescription Monitoring Program, 2010). It is likely that other states could produce similar analyses to help evaluate the effectiveness of their campaigns.

Current adoption status: As noted above (see **2. Conduct recruitment campaigns**), states have mounted a variety of promotional efforts to recruit PDMP users and educate them concerning the use and value of PDMP data. Massachusetts has mandated prescriber education for the prescribing of controlled substances; such education includes information on how to download and interpret prescription history data (communication with Massachusetts PDMP). For more on prescriber education, see **3. Conduct user education**, below.

***Barriers to adoption*:** Scarce resources for PDMPs and prescriber education limit the reach of efforts to increase PDMP utilization.

Summary

***Rationale*:** Increasing awareness of a PDMP and the value of its data by means of promotional campaigns and prescriber education may increase utilization.

***Evidence of effectiveness*:** PDMP data showing increased utilization following a campaign.

***Current adoption status*:** Many states conduct campaigns, varying in their characteristics; at least one state mandates prescriber education on prescribing controlled substances, including on use of PDMP data.

***Barriers to adoption*:** Lack of resources for outreach and prescriber education.

2. Improve data timeliness and access

***Rationale*:** Experience from states suggests that improving the timeliness and accessibility of PDMP data encourages utilization. Moving from a paper- or fax-based system to continuous online access, as all but four PDMPs have done (efforts are under way in those four states to establish online systems), dramatically increases the ease and probability of providers making voluntary queries or solicited reports to the system.

Evidence of effectiveness and current adoption status: In Virginia, initiating round-the-clock access to PDMP data with auto-response software in 2010, along with a promotional campaign (see **1. Conduct promotional campaigns**, above), resulted in a sharp rise in user registrations and data requests (Virginia Prescription Monitoring Program, 2010). It also encouraged Virginia medical examiners to include use of PDMP data in their routine practice (PDMP COE, NFF 2.6). Similarly, as Massachusetts implemented the first phase of its online PDMP starting in 2010, prescribers and dispensers joined and utilized the system in increasing numbers. Another program improvement that may spur greater utilization is shortening the required reporting interval for pharmacies.[6] Shortening the interval to daily or making it available in real time, as recently implemented in Oklahoma, makes prescription histories more up-to-date, increasing their value for end users and incentivizing utilization (PDMP COE, NFF 3.1, and see **Data collection and data quality, B. Reduce data collection interval; move toward real-time data collection**, above). Oklahoma will be tracking the user response to its real-time reporting initiative, so some quantitative measure of the impact of this program improvement on utilization will be forthcoming. A survey of other states' histories of program improvements, correlated with quantifiable changes in PDMP utilization, would identify the types of improvements that best enable and incentivize use of PDMPs.

***Barriers to adoption*:** The primary obstacle to improving data access is lack of program resources to develop an online automated response system. Resource limitations also inhibit efforts to reduce the reporting interval (and thus increase the timeliness of data), as do technological and regulatory hurdles. The Oklahoma PDMP real-time reporting project provides a case study on how these can be overcome; see PDMP COE, NFF 3.1 and **Data collection and data quality, B. Reduce data collection interval; move toward real-time data collection**, above.

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[6] The median reporting interval for states is weekly, according to the Alliance of States with Prescription Monitoring Programs state profiles report, available at pmpalliance.org/content/PMP-data-collection-frequency.

Summary

Rationale: Improving timeliness and accessibility of PDMP data may increase utilization and PDMP impact.

Evidence of effectiveness: Case study, unpublished PDMP data on utilization.

Current adoption status: Many states have implemented continuous online access; some have shortened data collection intervals.

Barriers to adoption: Lack of resources to implement online systems and reduce data collection interval.

3. Conduct user education

Rationale and evidence for effectiveness: A good understanding of PDMPs, how to use them, and the value of their data for prescribers, pharmacists, and other end users would likely encourage enrollment in and effective utilization of PDMPs. In its recent funding announcement under the Harold Rogers Grant Program, BJA gave priority consideration to PDMPs proposing to conduct education and outreach to enrolled and prospective PDMP users. States have experimented with various educational formats, including in-person presentations to prospective user groups, online short courses and Webinars (LeMire, 2010), and paper-based and Web page materials, such as prescriber "toolkits" on how to use PDMP data and links to Screening, Brief Intervention, and Referral to Treatment (SBIRT) resources. Two published studies suggest that provider education can influence their prescribing behavior (Cochella et al., 2011; Fisher, 2011), but comparative studies of current approaches to prescriber education, their impact on PDMP utilization, and outcomes of such utilization would help identify best practices in this domain. (add www. in footnote below for style consistency; see early pages)

Education initiatives targeted to law enforcement agencies on the value and use of PDMPs are also needed to help encourage increased utilization in diversion investigations. Current efforts by states and national organizations to educate the law enforcement community about PDMPs need to be identified, cataloged, and evaluated. Other end-user groups, such as substance abuse treatment clinicians, medical examiners, drug court professionals, and prevention workers, are also candidates for education on PDMPs. To determine best practices in education on PDMPs, field research and evaluations are needed to ascertain what educational programs exist, their costs, and their impact in assisting end users to address prescription drug abuse and diversion. Research and evaluation on education initiatives could be conducted using data from the Prescription Behavior Surveillance System under development by the PDMP COE with funding from BJA, U.S. Food and Drug Administration (FDA), and CDC.

Since many prescribers have insufficient training in the use of opioids and other prescription controlled substances, proposals for mandatory prescriber education have been discussed in the Office of National Drug Control Policy national action plan to address the prescription drug abuse epidemic (Office of National Drug Control Policy, 2011) and in the context of developing national Risk Evaluation and Mitigation Strategies (REMS). Such education could include training in not only the proper use of these drugs but also their misuse and abuse by bona fide patients; the nature and extent of doctor shopping; the extent of theft, counterfeiting, and forgery of prescriptions (Boeuf et al., 2007); and how to access

and use PDMP data. States' experience in provider education, for example in Massachusetts, which requires prescriber education on controlled substance prescribing, can serve as guides to educational mandates. The extent to which mandates are feasible and what sorts of education actually change prescriber behavior, including integrating use of PDMPs into clinical practice, are open questions in need of study (Tufts Health Care Institute Program on Opioid Risk Management, 2011).

***Current adoption status*:** To date, only a limited number of educational programs specifically on PDMPs have been developed for prescribers, for example by Connecticut, North Dakota, South Carolina, and Utah (presentations at the 2010 National PDMP Meeting in Washington, D.C.). These could be evaluated to shed light on their comparative effectiveness in terms of changing prescriber behavior and clinical outcomes. Kentucky, Louisiana, Massachusetts, and Montana statutes require education of certain users as a condition of being given access to PDMP data (NAMSDL, 2012c).

***Barriers to adoption*:** PDMPs usually have limited budgets that necessarily restrict the scope of their educational efforts. In addition, little evidence exists on what approaches to prescriber education, and the education of other potential users of PDMPs, actually work to induce greater use of PDMPs. Without such information, states may be reluctant to pursue educational initiatives.

Summary

***Rationale*:** Education of prescribers and other potential end users may encourage awareness and effective use of PDMP data.

***Evidence of effectiveness*:** Published studies.

***Current adoption status*:** Some states have fielded seminars, tutorials, Webinars, and other presentations on the value and uses of PDMP data.

***Barriers to adoption*:** Lack of resources and lack of evidence on which educational approaches produce the greatest changes in prescriber and other end-user behavior.

4. Mandate utilization

***Rationale and evidence of effectiveness*:** Mandating that providers make use of a PDMP, like mandating enrollment (see **B. Outreach and recruitment strategies, 4. Mandate enrollment**, above), may be more efficient and cost-effective in increasing PDMP utilization than encouraging optional participation. The recent move to mandate utilization by some states suggests that some PDMP stakeholders believe that requiring use of the PDMP will work better than voluntary approaches to increasing utilization. However, no research yet exists to support this claim. Because mandates are now being adopted by some states, their efficacy in increasing PDMP use needs study, as do the mechanisms for encouraging and monitoring prescriber compliance and the impact of a mandate on prescribing, patient outcomes, doctor shopping, overdoses, and drug-related deaths. Incentives for compliance need investigation; for example, PDMP stakeholders and regulatory bodies could consider, with public and private third-party payers, making the review of PDMP data when prescribing controlled substances a condition of payment. As in mandating enrollment in a PDMP, mandating utilization may have unintended consequences that experience in states with mandates might bring to light.

***Current adoption status*:** A small but growing number of states statutorily require or recommend that prescribers, pharmacists, and/or addiction treatment providers consult their PDMPs, sometimes only in specific circumstances (NAMSDL, 2012b). In Nevada, statute NRS 639.23507 states that prescribers "shall" obtain a PDMP report when first prescribing a controlled substance for a new patient who they suspect might be doctor shopping, and for patients for whom they have not prescribed controlled substances in the last year. In Oklahoma, prescribers must consult the PDMP when prescribing methadone for treating pain. Recently passed legislation in Ohio requires its medical and pharmacy licensing boards to adopt rules mandating use of its PDMP, which they have done (Ohio Administrative Code Sections 4731-11-11 and 4729-5-20). In Louisiana, medical directors of pain clinics are now responsible for joining and querying the PDMP to help ensure compliance with a patient's treatment agreement. West Virginia requires that opioid addiction treatment programs access the PDMP when beginning treatment and at 90-day intervals, and Vermont requires use of its PDMP data by physicians who treat patients for opioid dependence with buprenorphine (Office Based Opioid Treatment, or OBOT). Kentucky, Massachusetts, New York, and Tennessee have passed laws in 2012 requiring use of the PDMP by prescribers (NAMSDL, 2012b, communication with Massachusetts PDMP).

***Barriers to adoption*:** Monitoring required prescriber use of its system by a PDMP requires staff time and resources that may be unavailable to some PDMPs, presenting a barrier to assuring that prescribers adopt this practice. Other potential barriers include resistance to mandates by providers and enactment of the required legislative or regulatory changes. However, should findings from existing initiatives prove positive, other states could be encouraged to undertake the necessary legislative and regulatory changes to mandate utilization, and make resources available to implement utilization requirements.

See **Section V. Summary and Recommendations** for a recommendation to study the efficacy of mandates in comparison to voluntary approaches with regards to increasing PDMP utilization.

Summary

***Rationale*:** Mandating utilization may improve prescribing, patient safety, drug treatment, and licensing board monitoring.

***Evidence of effectiveness*:** Accumulated experience, key stakeholder perceptions.

***Current adoption status*:** Several states mandate utilization by different categories of end users under varying circumstances.

***Barriers to adoption*:** Provider resistance to mandates, need for legislative and/or regulatory reform, lack of program resources to monitor compliance.

5. Institute financial incentives

***Rationale and evidence for effectiveness*:** Greater utilization of the PDMP by prescribers could perhaps be encouraged by financial incentives, but little data exist on such approaches. One suggestion is to make lower medical malpractice insurance premiums contingent on regular use of PDMP data. There is a need for studies examining whether prescriber use of PDMP data reduces the number of patient-initiated lawsuits stemming from alleged mis-prescribing of controlled substances; such findings could help establish the rationale for charging PDMP-using prescribers lower insurance premiums. Similarly,

health insurance carriers providing somewhat higher office visit fees to prescribers who consult the PDMP through pay for performance initiatives might also incentivize greater use. Investigation is needed to determine whether any states or agencies have implemented financial incentives to encourage PDMP use, and if they have, what impact they may have had on utilization, prescribing practices, doctor shopping, and other forms of drug diversion.

***Current adoption status*:** As of this writing, we know of no examples of financial incentive programs designed to elicit greater PDMP utilization.

***Barriers to adoption*:** No precedent exists for adopting this practice, so pilot programs should be considered.

Summary

***Rationale*:** Financial incentives may increase PDMP utilization.

***Evidence of effectiveness*:** Key stakeholder perceptions.

***Current adoption status*:** None.

***Barriers to adoption*:** Lack of evidence for effectiveness, lack of precedents.

6. Delegate access

***Rationale and evidence for effectiveness*:** Allowing prescribers to delegate access to PDMP records by office staff (sometimes called "sub-accounts"), may help increase utilization of PDMP data to detect patients at risk and improve prescribing. However, the extent to which delegate accounts increase PDMP utilization is unknown.

***Current adoption status*:** Twelve states permit prescribers to delegate access to PDMP records (NAMSDL, 2011b), and statutes adopted in 2012 in Kentucky, New York, and Tennessee authorize use of delegates. Some PDMPs permit prescribers to delegate only licensed health care professionals, e.g., nurses, while others allow non-licensed administrative staff to be delegated. New York's new statute requires the delegates to be employees of the same practice as the prescriber. Methods to allow prescribers to establish sub-accounts for delegates and to oversee and supervise their data acquisition, as well as methods to hold prescribers accountable for their delegates' activities, are not standardized. The specific policies and procedures governing delegates, their relative security, and the extent to which they increase the legitimate use of PDMP data in a practice need study. A first step would be to survey states' current policies, followed by a comparative analysis of their impact on utilization.

Barriers to adoption: Increasing staff access to PDMP data has raised concerns about maintaining patient privacy and confidentiality. Those concerns must be addressed by each state in order for delegate accounts to gain acceptance. Master account holders may find monitoring of sub-accounts for which they are responsible burdensome.

Summary

Rationale: Delegating access may increase PDMP utilization.

Evidence of effectiveness: Accumulated experience, key stakeholder perceptions.

Current adoption status: Twelve states allow delegated access.

Barriers to adoption: Concerns about data security and patient confidentiality, the need to monitor delegate account users by master account holders.

Interorganizational best practices for PDMPs

PDMP interorganizational best practices will permit data sharing across PDMPs and integrate PDMP data into the health care system, drug abuse prevention efforts, and the work of investigative agencies. They will enable efficient collaboration among PDMPs and outside organizations engaged in improving patient health and mitigating prescription drug abuse. They will also enable linking PDMP data with other prescription and health data to permit combined analyses and facilitate data access. Candidate practices include actions to:

A. Enact and implement interstate data sharing among PDMPs
    1. Model memoranda of understanding (MOUs)
    2. Standardize data collection fields, formats, and transmissions standards
    3. Identify individuals in multistate data
    4. Standardize measures for identifying questionable activity
    5. Data encryption and de-identification

B. Collaborate with other health agencies/organizations in applying and linking PDMP data
    1. Department of Veterans Affairs
    2. Indian Health Service
    3. Department of Defense
    4. Centers for Medicare and Medicaid Services
    5. Private third-party payers

A. Enact and implement interstate data sharing among PDMPs

***Rationale*:** Since doctor shopping and other forms of prescription drug diversion often cross state lines, PDMP data from a single state are limited in their capacity to identify individuals potentially in need of intervention, whether by prescribers or investigative agencies. For example, a review of data in the Kentucky PDMP identified that the prescriptions dispensed by Kentucky pharmacies were issued by prescribers located in all 50 states, the District of Columbia and Puerto Rico; 93.2 percent were issued by Kentucky prescribers, and an additional 5.7 percent were issued by prescribers in adjoining states. Examination of Massachusetts PDMP data found similar patterns.

Combining data from neighboring states and states known to be major sources of diverted prescription drugs will help increase the capacity to identify diversion and doctor shopping for all participating states. The same advantages accrue in the discovery and investigation of pill mills and aberrant prescribing. The Alliance of States with Prescription Monitoring Programs' PMP Model Act 2010 Revision recommends that exchange of PDMP information be permitted among states (ASPMP, 2010). Under its Harold Rogers Grant Program, BJA has given priority consideration to PDMPs proposing to implement interstate data sharing.

***Current adoption status and evidence of effectiveness*:** As of 2011, 28 states have provided for data sharing between PDMPs under a variety of statutory and regulatory protocols, including the Prescription Monitoring Information Xchange (PMIX) architecture and the Rx Check Hub, the PMPi Hub, and the Health Information Design (HID) Hub for data sharing (NAMSDL, 2011a). Live data are now being exchanged between Kentucky and Alabama, and between Indiana, Ohio, and several other states to help identify cross-border doctor shopping and diversion. These states, and others soon to follow, are in effect pilot testing the various protocols, and so can help identify best practices in all aspects of data sharing. These include:

1. Model memoranda of understanding (MOUs)

   States need MOUs with their partners to ensure that data are shared fairly, securely, and in compliance with the regulations of all participating states. Existing MOUs, including master templates developed for PMIX and PMPi, can be evaluated as possible models for states considering data-sharing agreements.

2. Standardize data collection fields, formats, and transmissions standards

   States sharing their data need a minimum set of common data fields, encoded and transmitted in a shared format, such as ASAP 4.2. Different standards for these parameters may exist in current data-sharing projects, which presents the opportunity for comparison using criteria of completeness, reliability, functionality, and ease of adoption. Common data protocols also need to be developed to permit the matching and integration of PDMP data with prescription information being collected by non-PDMP organizations such as the VA, Medicaid, and third-party payers. See **Data collection and data quality**, above, for more on data collection standards; the recommendations made there can be extended to multistate standards and initiatives.

3. Identify individuals in multistate data

   The usefulness of PDMP data depends greatly on the reliable identification of particular individuals who might be engaging in questionable activity. Research is needed on the best methods for identifying and linking the records of specific individuals in multistate PDMP data. Current practices among states can be assessed in comparison to what, according to evidence and expert opinion, is considered the state of the art in identifying individuals in data sets like those of PDMPs. Work on developing best practices for linking data within individual PDMPs (see **Data linking and analysis, A. Link records to permit reliable identification of individuals**, above) should be extended to cooperative development of multistate data-linking capabilities.

4. Standardize measures for identifying questionable activity

   States sharing data with one another or non-PDMP agencies may wish to collaborate on developing reliable measures of questionable activity, such as doctor shopping, that apply across state lines or that are appropriate to certain populations. Current efforts to test such measures, should any exist, need to be identified and evaluated with respect to the current literature (e.g., Buurma, 2008; White, 2009; Katz, 2010) and other published studies relevant to this question (see **Data linking and analysis, B. Determine valid criteria for possible questionable activity**, above).

5. Data encryption and de-identification

   To conduct analyses of PDMP data for epidemiological, surveillance, and evaluation purposes, records must be de-identified to suppress patient-level information, while maintaining linked individual records in a data set. Methods of encryption appropriate for use by states need to be identified and tested. Currently, a workgroup of the Integrated Justice Information Systems (IJIS) institute is reviewing the methodologies available for linking of patient records within PDMP databases and anonymization of the data. These would enable de-identified PDMP data from multiple states to be utilized by a surveillance system (e.g., the Prescription Behavior Surveillance System mentioned in PDMP recruitment, utilization, and education, above) to track doctor shopping, pill mill prescriptions, and other diversion of prescription drugs across state lines. While the workgroup's review is not yet complete, its findings suggest that less expensive and publicly available systems for linking are not as effective as some proprietary "gold standard" products. PDMPs may need additional resources to enable optimum data encryption, while maintaining accurately linked individual records.

Barriers to adoption: Interstate data-sharing agreements involve legal, regulatory, and policy changes requiring coordination between multiple stakeholders, putting demands on scarce PDMP resources. Some states do not yet have statutory or regulatory authority to share data. Some PDMPs have yet to complete the implementation of PDMP operations or other significant enhancements necessary for initiating interstate exchange of data. In addition, many data-sharing initiatives have not completed standardization to the PMIX architecture that will make sharing among all states feasible.

Summary

***Rationale*:** Practices that enable cross-state and interorganizational data sharing will increase the application and utility of PDMP data.

***Evidence of effectiveness*:** Expert opinion.

***Current adoption status*:** A few states are currently sharing data; MOUs, data standards, methods of identifying individuals, and encrypting data vary across states and data-sharing initiatives.

***Barriers to adoption*:** Need to complete PDMP implementation and enhancements in some states, completing standardization of exchange hubs to PMIX architecture, and states' statutory, regulatory, and resource limitations.

B. Collaborate with other health agencies/organizations in applying and linking PDMP data

***Rationale*:** PDMP collaboration with health agencies, such as by matching PDMP data with other medical information, promises to improve patient protection, safety, and health, and increase health data accuracy and interagency communication. It will also increase the visibility and penetration of PDMPs in multiple health contexts, while fostering development of best practices in data integration across systems. Recent experience in Washington State involving the batch transfer of PDMP data on Medicaid patients (see **User access and report dissemination, B. Optimize reporting to fit user needs**, above) strongly suggests that collaboration with public health agencies will be effective in helping to improve controlled substance prescribing, and mitigate prescription drug abuse and diversion. Below we describe the status of some current and prospective initiatives that suggest the importance of integrating major health systems with PDMPs to maximize the value of prescription data.

***Current adoption status and evidence of effectiveness*:**

1. Department of Veterans Affairs

   The VA was granted statutory authority to share its prescription data with state PDMPs in the Budget Reconciliation Act of 2011. The sharing can begin only after the VA completes regulations authorizing it. Regulations, systems, and protocols to support VA-PDMP data sharing could be documented and evaluated as models for other interorganizational collaborations in addressing prescription drug abuse and diversion. Cooperative work with the VA may also open up new and important avenues for research that could lead to improved medical care and patient safety. For example, if PDMP data can be matched to medical care treatment in VA records, a more thorough understanding of the progression of proper opioid prescribing could be gained, as well as a better understanding of iatrogenic opioid addiction.

2. Indian Health Service

   The IHS is working with BJA, IJIS Institute, the PDMP Training and Technical Assistance Center, and the PDMP COE to share its pharmacies' data with state PDMPs. The effort includes development of software enabling IHS pharmacies to put their data into the formats each state requires for pharmacy data collection and subsequent transfer of data to each PDMP. Efforts will be undertaken to establish PDMP accounts for IHS prescribers and pharmacists so they can access PDMP data for their patients, with accompanying training in use of PDMP data. In

addition, new methodologies need to be developed and authorized for IHS professional supervisors to obtain and review PDMP data as they pertain to the practices of prescribers and dispensers within the IHS system. The IHS system includes quality assurance practices in which professional supervisors oversee the work of prescribers and dispensers. PDMPs have not previously provided data to health care systems' quality control mechanisms, with the exception of North Dakota and South Dakota, which authorize peer review committees to access data.

Study of the IHS data-sharing initiative will assist PDMPs in their efforts to link with other health care systems, including the VA, DoD, and CMS. This is particularly important because VA pharmacies use the same pharmacy software system as IHS pharmacies. Successful implementation of IHS pharmacy systems for sharing data with state PDMPs will therefore expedite the VA's ability to send data to state PDMPs when their regulations are completed.

3. Department of Defense

The DoD health care system is discussing the possibility of linking its pharmacy data with PDMPs and making state PDMP data available to its prescribers and pharmacists. Given reports on the extent of controlled substances abuse and misuse among military personnel and their families, this effort is important and should be brought to fruition. Linkage is needed with the DoD health care system (for active duty personnel) and Tricare (for dependents and retired military personnel). Legislation authorizing sharing of data between DoD facilities and PDMPs may be required as a prerequisite to sharing.

4. Centers for Medicare and Medicaid Services

Sixteen states have made PDMP data available to their state Medicaid agencies and/or fraud investigation units, and the GAO has recommended increasing use of PDMPs by Medicaid agencies and Medicare. The Alliance of States with Prescription Monitoring Programs' PMP Model Act 2010 Revision also recommends providing PDMP data to Medicaid agencies and Medicare (ASPMP, 2010). However, there is no linkage of PDMPs with the Medicare program, and, as yet, very limited national level policy dialogue with the U.S. Department of Health and Human Services' Centers for Medicare and Medicaid Services (CMS) regarding the coordination of PDMPs with the Medicaid and Medicare programs. Such a dialogue is important because multiple potential best practices could be considered, including:

- Documenting how state Medicaid agencies have used the PDMP data they have received, and how that may have impacted the quality and cost of care for Medicaid recipients.
- Developing recommended audit procedures for state Medicaid agencies and Medicare organizations to use with PDMP data to identify and monitor persons who should be locked in to single prescribers and pharmacies, i.e., placed in restricted recipient programs.
- Developing Medicaid and Medicare policy on encouraging or mandating prescribers to obtain PDMP data prior to issuing the first controlled substance prescription to a patient and periodically thereafter.
- Developing procedures for Medicare program reviewers or auditors to access and utilize PDMP data and developing model state legislation to authorize such access.

5. Private third-party payers

The Coalition Against Prescription Fraud has identified that private insurance payers expend in excess of $24.9 billion annually for enrollees who abuse opioid prescriptions (Coalition Against Insurance Fraud, 2007). Workers' compensation programs that pay claimants' costs for treatment and rehabilitation following work-related accidents have found opioid misuse to be a significant problem. A recent WorkCompCentral news release stated, "The use of opioids in the nation's workers' compensation systems remains a top concern of major insurers, state regulators, and third-party administrators, according to a survey conducted by the president of a consortium of pharmacy benefit managers" (WorkCompCentral, 2012)**.** The National Council on Compensation Insurance found that a single opioid product had become the highest-costing pharmaceutical for workers' compensation programs (Lipton, 2011).

One study suggests that PDMPs are associated with lower claim rates for opioid analgesics at the county level (Curtis et al., 2006), but additional research on the role PDMPs can play in reducing costs is needed. Insurers with policies limiting patients to one prescriber and pharmacy (lock-ins) could suggest or require that prescribers consult PDMP data to confirm patient compliance. The PDMP COE is planning to follow the Office of National Drug Control Policy's call for the PDMP COE to convene a meeting with PDMPs and third-party payers in order to open dialogue regarding how they may coordinate activities and work together to interdict the national prescription drug abuse epidemic (ONDCP, 2011). A major topic to be explored is the potential sharing of PDMP data with all third-party payers.

***Barriers to adoption*:** Developing collaborative data-sharing agreements and the requisite information-sharing protocols with the agencies mentioned above will involve regulatory and policy changes at the state and national levels involving multiple stakeholders. This will require sustained commitment from leaders in the PDMP community and their counterparts within each agency to ensure the allocation of adequate attention and resources.

Summary

***Rationale*:** Coordination of PDMPs with wider health systems will enable enhanced use of PDMP data to improve prescribing and patient health and, as a byproduct, to reduce excess public and private costs.

***Evidence of effectiveness*:** Expert opinion (ASPMP Model Act), accumulated experience.

***Current adoption status*:** Data sharing between IHS facilities and PDMPs is under way and between Medicaid programs and PDMPs; the VA is working on regulations to implement such sharing, and the PDMP COE is planning an initial meeting with third-party payers.

***Barriers to adoption*:** Regulatory and organizational.

Evaluation of PDMPs

Evaluation practices and use of evaluation findings for quality improvement enable PDMPs to respond to changing demands and conditions, and ensure their systems and policies permit maximum appropriate use of high-quality, timely PDMP data. Candidate practices include actions to:

A. Conduct satisfaction and utilization surveys of end users
B. Conduct audits of PDMP system utilization for appropriateness and extent of use
C. Use PDMP data as outcome measures in evaluating program and policy changes
D. Analyze other outcome data (e.g., overdoses, deaths, hospitalizations, ER visits) to evaluate the PDMP's impact

A survey of PDMP administrators conducted in 2006 found that two states out of 18 responding (and 23 PDMPs active at the time) had completed or were conducting evaluations of the public health impact of PDMP implementation (Katz et al., 2008). Currently, three states have worked with researchers to produce evaluation reports of their PDMP: Kentucky (Blumenschein et al., 2010), Maine (Lambert, 2007), and Virginia (Virginia Department of Health Professions, 2004). At least six others have contracted with researchers to conduct evaluations (Kansas, Massachusetts, North Carolina, North Dakota, Oregon, and Washington), and other states are in discussions with researchers regarding evaluations and other work (e.g., Florida and Texas). This increase appears to reflect a growing interest by PDMP administrators in addressing end-user needs (e.g., timely and accurate provision of data to prescribers, pharmacists, law enforcement agencies, regulatory agencies, and others) and in demonstrating program utilization and impact, to assure state legislators that the PDMP is a good investment in an environment of scarce resources.

A. Conduct satisfaction and utilization surveys of end users

Rationale: Satisfaction and utilization surveys of PDMP users can provide important feedback for purposes of program enhancement and increasing user buy-in. Such surveys can be conducted online, by mail, or by phone, and give PDMP administrators insight into aspects of their system that are working well, areas for improvement, and barriers to greater use of the PDMP. Surveys can help build support of the PDMP by end users, who can be important allies in passing legislative changes desired by the PDMP and in securing stable funding.

Current adoption status and evidence of effectiveness: Kentucky, Maine, Massachusetts, and Virginia have reported findings from satisfaction and utilization surveys of end users of their PDMPs (e.g., Rosenblatt, 2007; Sorg et al., 2009; and survey reports linked at the Kentucky PDMP website). Survey feedback from law enforcement and regulatory agencies led Massachusetts to develop an online PDMP

portal for their use in active investigations. Accentra Health, in partnership with the Oregon Health Sciences University and the Oregon PDMP, is conducting a survey of prescribers to learn how they use PDMP data in clinical decision making and how these data affect their prescribing practices.

***Barriers to adoption*:** Barriers to conducting surveys include lack of staff time and expertise to design and field surveys, and to analyze and report out data. However, states can look to other PDMPs to assist in developing survey instruments (e.g., by modifying existing instruments), and methods for data collection and analysis.

B. Conduct audits of PDMP system utilization for appropriateness and extent of use

***Rationale*:** As discussed earlier, a PDMP's usefulness is maximized if the most active prescribers make frequent use of the PDMP. PDMP utilization audits can show how often these prescribers query the database and download reports. Audits can also be conducted to gauge the impact of viewing prescription history data on prescribing practices. For example, an audit might examine a prescriber's prescriptions for a patient following a query of the PDMP on that patient, to determine whether any of the controlled substance indicators found to be associated with risk for abuse or overdose were present. An alternative audit might compare a prescriber's prescriptions for a patient prior to and following one or more queries of the PDMP about that patient. Such audits could be conducted for multiple prescribers and patients, if longitudinal data exists. Audits can also track PDMP utilization by level of prescribing, medical specialty (if this information is made available to the PDMP), and the level of suspected questionable activity within a practice. As mandates for PDMP utilization are adopted, audits will become increasingly relevant for determining prescriber and dispenser compliance.

***Current adoption status and evidence of effectiveness*:** To our knowledge, no states are systematically auditing PDMP utilization data to evaluate appropriateness of use. However, some states are taking steps prior to such evaluation. Utah, upon determining that many of the most frequent 25 percent of prescribers were not registered with the PDMP, contacted these prescribers to remind them that Utah's law requires that they register with the program. Within one day, more than 100 of these prescribers registered with the PDMP (presentation at West Regional PDMP meeting, 2010). Massachusetts is also contacting prescribers with high proportions of possible doctor shoppers in their practices, recommending that they enroll in and use the PDMP (communication with Massachusetts PDMP). Utilization data of these prescribers could be analyzed to monitor how often they query the PDMP. We expect that states instituting mandates for utilization (e.g., Kentucky, Massachusetts, New York, and Tennessee) will begin regular audits of prescriber queries to their PDMPs.

***Barriers to adoption*:** The primary barrier to auditing PDMP utilization is the staff time required to extract and examine data. States that adopt mandates for use will of necessity have to shift resources to conducting compliance audits. This may reduce resources for other activities unless additional funds and staff are made available.

C. Use PDMP data as outcome measures in evaluating program and policy changes

Rationale: While PDMPs can have an impact on prescription drug overdoses and other health outcomes, many other factors not under the control of the PDMP can affect such outcomes. A more proximate outcome for PDMP activities is the number of patients possibly engaged in abuse or diversion. As discussed previously (see **Data linking and analysis, C. Conduct periodic analyses of questionable activity**, above), this outcome can be measured to an extent using PDMP data. Similarly, as valid and reliable indicators of suspected problematic prescribing on the part of individual providers become available using PDMP data, these too could serve as outcome measures to track the impact of efforts to curtail such prescribing.

Current adoption status and evidence of effectiveness: Wyoming has tracked the number of patients meeting a threshold for doctor shopping following the PDMP's initiation of unsolicited reporting, and found that this number declined markedly over a two-year period, suggesting the effectiveness of unsolicited reporting. A second effect noted by the Wyoming PDMP was an increase in prescriber registration with and use of the PDMP paralleling the distribution of unsolicited reports (NFF 1.1). Nevada's PDMP noted similar trends in both the number of patients meeting the threshold for doctor shopping and in prescriber registration with the PDMP following its initiation of unsolicited reporting (NFF 2.5). Unpublished data from Oklahoma and North Carolina on trends of doctor shopping rates show similar effects: As use of the PDMP increases, numbers of individuals meeting thresholds for questionable activity as measured by PDMP data decline (communications with Oklahoma and North Carolina PDMPs).

Barriers to adoption: Limited PDMP resources may affect the extent to which data analyses on outcome measures constructed using PDMP data can be designed and carried out, and then integrated with process evaluation data on program activities that might influence these measures, for instance efforts to increase utilization and send unsolicited reports.

D. Analyze other outcome data (e.g., overdoses, deaths, hospitalizations, ER visits) to evaluate the PDMP's impact

Rationale: As noted, a number of factors can affect health outcomes besides PDMP operations. This fact has complicated studies of the impact of PDMPs across states (e.g., Simeone & Holland, 2006; Paulozzi et al., 2011), to the point where an effect of PDMPs or a PDMP practice (in these cases, unsolicited reporting) is difficult to detect, at best. An alternative approach, planned in several states but not yet implemented, is to examine *changes in* health outcomes such as overdose rates at the county level within a state, in relation to: (1) the proportion of prescribers in each county who have registered with the PDMP and regularly query it, and (2) specific PDMP practices, such as unsolicited reporting (e.g., the proportion of patients in a county about whom unsolicited reports have been sent, or the proportion of prescribers in a county to whom an unsolicited report has been sent).

It is important to examine changes in health outcomes in relation to these PDMP-related factors because high rates of such outcomes may well have triggered a response by the PDMP (unsolicited reports) or practitioners (registration with and use of the PDMP). A study would test for decreases in adverse health

outcomes, by county, subsequent to the presence of these factors. Sufficient time, perhaps years in some cases, may be needed to measure these impacts as persons experiencing overdoses have frequently been abusing prescription drugs for multiple years. An effective intervention may prospectively reduce the numbers of new persons from meeting DMS IV criteria for dependence on or abuse of prescription opioids or other controlled substances, but may be less protective for those already meeting those criteria.

***Current adoption status and evidence of effectiveness*:** Although a number of states have recognized the value of evaluating PDMP activities, to our knowledge no states have completed systematic empirical studies of their effectiveness using health outcome data such as described above. Nor have there been studies of the impact of a PDMP's evaluations of any sort—that is, of whether PDMPs that are conducting or have conducted evaluations are more effective than those that have not. However, with respect to PDMP impact on health outcomes, it should be noted that overdose death and prescription monitoring data from Wilkes County in North Carolina gathered by Project Lazarus (www.projectlazarus.org) suggest that an increase in use of the North Carolina PDMP by county prescribers may have contributed to a sharp decrease in their controlled substance prescribing to county resident overdose decedents. This in turn may have been a factor in the decline in the yearly number of overdose deaths among county residents from 2008 to 2011 (PDMP COE, NFF 3.2).

***Barriers to adoption*:** The level of effort required to design and field PDMP evaluations using health outcome data is considerable, requiring intensive data collection and analysis over a multiyear period. Most PDMPs will not have the trained evaluators needed to conduct such evaluations, but universities and private research institutions are often willing to form partnerships with PDMPs in such endeavors given the increased interest in PDMP studies, provided that funding can be identified for their work.

Summary

***Rationale*:** Evaluation of PDMP activities can inform and improve activities and demonstrate the value of a PDMP.

***Evidence of effectiveness*:** Accumulated experience.

***Current adoption status*:** At least 10 states have evaluated or are evaluating their PDMP using satisfaction surveys and outcome measures constructed from PDMP data; a few are planning health outcome evaluations.

***Barriers to adoption*:** Primarily resources needed to conduct or contract for an evaluation.

Funding PDMPs

Best practices in consistent, long-term funding will enable a stable platform for PDMPs to operate, implement new technologies as needed, and maintain sufficient staffing levels. Adequate funding facilitates data access for authorized users, implementation of interoperability between PDMPs, and effective analysis of prescription information. Candidate best practices in funding include efforts to:

A. Secure funding independent of economic downturns, conflicts of interest, public policy changes, and changes in PDMP policies

B. Enact legislation to maintain sufficient funding over time

C. Conduct periodic review of PDMP performance to ensure efficient operations and identify opportunities for improvement

Note: Information discussed in this section comes from a survey of state PDMPs conducted by the PDMP Training and Technical Assistance Center at Brandeis University, interviews with PDMP administrators, and analyses of data reported to BJA by PDMPs receiving funds under the Harold Rogers Prescription Drug Monitoring Program Grant Program.

A. Secure funding independent of economic downturns, conflicts of interest, public policy changes, and changes in PDMP policies

***Rationale*:** To ensure a viable and effective PDMP in a time of shrinking public revenues, prescription monitoring advocates and stakeholders must take advantage of all available funding opportunities. These fall into four general categories: grants, licensing fees, general revenue, and board funds. Other less common sources of support include settlements, insurance fees, private donations, and asset forfeiture funds.

***Current adoption status and evidence for effectiveness*:** As described below, many PDMPs employ more than one method of securing financial support, each of which has its advantages and disadvantages.

a. Grants. There are 36 PDMPs that receive funding through some type of grant (federal: 36 PDMPs; industry: 2 PDMPs; state: 1 PDMP). Grant funding can be used to start planning the establishment of a PDMP (BJA Harold Rogers grants), implement a PDMP (Harold Rogers and NASPER[7] grants), operate a PDMP (National Association of State Controlled Substances Authorities [NASCSA] grants), enhance a PDMP (Harold Rogers, NASPER, and NASCSA grants), and promote a PDMP through education (NASCSA grants). Currently, there are 18 PDMPs that have grants as their sole funding source; 14 of them passed enabling legislation or have become operational since 2007. The availability of grant funding has facilitated the creation or enhancement of the majority of PDMPs. However, there are problems in relying on grants to fund a PDMP. Funds are limited in amount, often made available only for specific purposes, subject to periodic renewal, and limited in duration; there is no guarantee that a PDMP will receive a grant award or a renewal.
b. Licensing fees. There are 15 PDMPs that receive funding through a registrant's licensing fee. A state may assess a fee for prescribing/dispensing controlled substances or to practice medicine or pharmacy; a portion of the collected fees are used to support the PDMP. There are 14 PDMPs that obtain funding from controlled substance registry license fees, and three that obtain funding from state health license fees. There are

[7] The NASPER grant program is currently unfunded but has provided support to PDMPs in earlier years.

currently five PDMPs that have licensing fees as their sole funding source; four became operational prior to 2007. Although licensing fees provide a steady source of funding, in most cases, the percentage of the licensing fee allocated to the PDMP is small. In order to increase the percentage or amount, legislative action may be required. Some licensees may have objections to supporting a program that they may not use routinely.

c. General revenue. There are 10 PDMPs that receive funding through dedicated monies from a state's general revenue fund. There are four PDMPs that have general revenue monies as their sole funding source, all of which became operational prior to 1997. Although funds from a state's general revenue fund provide a steady source of support, the amount can be influenced by economic and political conditions. In times of economic distress, a state may be forced to reduce budgets or reapportion monies. Programs that increase public and lawmakers' awareness of PDMP's contribution to addressing the prescription drug epidemic, and that demonstrate its role in reducing health-related costs, will be most successful in securing general revenues.

d. Board funds. There are six PDMPs that receive funding from monies allotted to licensing boards, most commonly boards of pharmacy; two have board funds as their sole funding source. Although board funds provide a steady source of support, in most cases the percentage of the funds allocated to the PDMP is small. Additionally, a board has several responsibilities requiring funds, so increasing funds or providing adequate funds for a PDMP may be difficult, if not impossible. Some licensees may disagree about supporting a program that they may or may not use routinely.

e. Other. This category of funding is less common, but reflects the varied funding options that can be employed:

- Settlements—Two PDMPs are funded through monies obtained from settlements: one settlement from a pharmaceutical company and one from tobacco companies. Settlements can result in a large amount of funds for a PDMP, but they are finite and, typically, the settlement money is deposited into a state's general revenue fund.

- Insurance fees—One PDMP is funded through fees on health insurance providers. Even though the insurers reap savings by utilizing a PDMP, there may be resentment that the cost of the PDMP is borne solely by those with insurance.

- Private donations—One PDMP has established a direct support organization, a 501(c)(3) corporation, to raise funds for the PDMP. This is a creative way to provide monies for a PDMP, but fundraising efforts must be maintained, could result in conflicts of interest, and do not guarantee consistent funding over time.

- Asset forfeiture funds—One PDMP receives asset forfeiture funds from sheriffs' offices and police departments, donated through its direct support organization.

The current funding mechanisms have both positive and negative aspects. Ideally, funding should be obtained from those entities that benefit from the existence of the PDMP, contribute to the prescription drug abuse problem, or profit from the sale of controlled substances.

Those that benefit from PDMPs include prescribers, dispensers, health licensing boards, law enforcement agencies, insurance providers, hospitals, medical examiners, and substance abuse treatment programs (see **PDMP recruitment, utilization and education, A. Enable access to PDMP data by all appropriate users**, above, for others).

- In many cases, some of these beneficiaries are currently funding PDMPs. As an alternative to a flat fee, fees could be determined by the number of prescriptions or dosage units prescribed and dispensed, number of patients receiving controlled substances, etc.
- A source for funding PDMPs that could be expanded is monies from contributors to the prescription abuse problem. The diversion of prescription medications is nationwide. Individuals are arrested and convicted for diversion, and law enforcement agencies are seizing assets obtained from the illegal proceeds. Law enforcement agencies could contribute such funds voluntarily (see "**Asset forfeiture funds**" above) or a "PDMP fine" could be assessed by a court, which could provide some funding for a PDMP. If a PDMP were instrumental in assisting a law enforcement agency in a diversion investigation, it arguably has a legitimate claim to share the assets obtained as a result of the investigation.

  The entities that profit from sales of controlled substances—manufacturers and distributors—are a largely untapped source for funding. Manufacturers could be assessed a fee on the volume of controlled substances produced, and distributors on the number of controlled substances sold.

Barriers to adoption: Barriers to securing funding by the means described above include opposition from those wanting to limit prescription monitoring, lack of PDMP leadership to spearhead funding initiatives, failure to include all stakeholders in advocating for PDMP support, lack of public awareness of the benefits of PDMPs, and lack of resources and expertise to apply for grants or establish nonprofit corporations.

B. Enact legislation to maintain sufficient funding over time

Rationale: To ensure that a PDMP is adequately funded, states could draft legislation that not only provides monies for effective operation, but also incorporates new technologies and methodologies, as needed. Legislation can specify the source of funds, for what they can be used, and other permissible funding options.

Current adoption status: Below are examples of legislative language on funding, one from the Alliance of States with Prescription Monitoring Programs PMP Model Act and three from Louisiana, Texas, and Florida. Other states' legislative language (not limited to that concerning funding) is available at the Alliance of States with Prescription Monitoring Programs' website (www.pmpalliance.org/content/pmp-laws-and-rules).

The Alliance of States with Prescription Monitoring Programs' PMP Model Act 2010 Revision recommends the funding come from prescribers (ASPMP, 2010). It states, in part:

- "The [designated state agency] may charge each prescriber an amount sufficient to cover the costs of . . . operating the prescription monitoring program. [Note: States may choose to use an alternative method . . . to pay the cost of their . . . monitoring system, for example, through controlled substances registration fees.]"

Louisiana's PDMP statute allows the state's pharmacy board to obtain grant funding if the legislature does not provide full funding. It states, in part:

- "The Board shall have the authority to make application for, receive, and administer grant funding from public or private sources for the development, implementation, or enhancement of the prescription monitoring program."
- "In the event the legislature provides full funding for the prescription monitoring program, no fees shall be levied as provided in this Section."

Texas's statute requires that controlled substance registration fees be used to cover the costs of the PDMP and that the funds can be used only for administration and enforcement of the Controlled Substances Act. The statute also sets a maximum fee amount. It states, in part:

- "The director may charge a nonrefundable fee of not more than $25 before processing an application for annual registration and may charge a late fee of not more than $50 for each application for renewal the department receives after the date the registration expires. The director by rule shall set the amounts of the fees at the amounts that are necessary to cover the cost of administering and enforcing this subchapter."
- "The director shall deposit the collected fees to the credit of the operator's and chauffeur's license account in the general revenue fund. The fees may be used only by the department in the administration or enforcement of this subchapter."

Florida's statute requires that funding come from federal grants or private funding. It establishes a direct-support organization to seek those funds. It states, in part:

- "All costs incurred by the department in administering the prescription drug monitoring program shall be funded through federal grants or private funding applied for or received by the state. The department may not commit funds for the monitoring program without ensuring funding is available. The department and state government shall cooperate with the direct-support organization . . . in seeking federal grant funds, other non-state grant funds, gifts, donations, or other private moneys for the department so long as the costs of doing so are not considered material. Funds provided, directly or indirectly, by prescription drug manufacturers may not be used to implement the program."
- "The department may establish a direct-support organization that has a board consisting of at least five members to provide assistance, funding, and promotional support for the activities authorized for the prescription drug monitoring program.

***Evidence for effectiveness*:** To our knowledge, no systematic study relating legislation on funding to actual PDMP support has been conducted. However, it seems likely that language making provisions for PDMP funds tied to specific sources that will remain available, e.g., provider licensing fees, increases the probability of stable funding.

***Barriers to adoption*:** Enacting legislation to provide stable funding for PDMPs requires marshaling majorities in legislative bodies, which in turn requires building popular support for these programs. As noted above, prescription monitoring advocates may face opposition from those wanting to limit the effectiveness of PDMPs, so they must forge alliances with all concerned stakeholders to ensure sufficient support for the legislation by lawmakers and their constituents.

C. Conduct periodic review of PDMP performance to ensure efficient operations and identify opportunities for improvement

***Rationale*:** A periodic review is beneficial and recommended when a program is funded by monies from public sources or assessed fees. The purposes for the review should be to assess the overall effectiveness of the program, evaluate current performance, evaluate staffing levels, evaluate technological capabilities, and identify areas for improvement. The goals of the review are to ensure the PDMP is operating efficiently and having a positive effect on the health care of citizens, while reducing the incidence of prescription drug abuse and diversion. It also reinforces the perception (and reality) of program accountability. The review should provide specific recommendations to enhance the PDMP's effectiveness and adjust funding levels accordingly. The review should be conducted by stakeholders impacted by the PDMP, such as representatives from health care, regulatory, law enforcement agencies, and patient advocacy entities. Reviews can be coordinated with and draw from internal PDMP evaluations (see **Evaluation of PDMPs**, above).

***Current adoption status and evidence of effectiveness*:** As noted above, a few states have conducted or are in the process of conducting evaluations of their PDMPs. To date, there has been no systematic study of how such evaluations may have influenced funding decisions on the part of legislatures or other funding sources. However, since findings from PDMP satisfaction surveys of PDMP users (primarily prescribers) in states such as Kentucky and Ohio have been very positive, they have likely played a role in motivating continued funding for PDMPs in these states.

***Barriers to adoption*:** PDMPs may not have the resources or expertise to carry out comprehensive program reviews.

Summary

***Rationale*:** Stable and adequate funding of PDMPs is essential for consistent operation and optimum utilization.

***Evidence of effectiveness*:** Accumulated experience, key stakeholder perceptions.

***Current adoption status*:** States differ widely in their approaches to funding PDMPs.

***Barriers to adoption*:** Barriers include state revenue shortfalls, difficulties in negotiating legislative and regulatory changes, and the need to build sufficient constituent support to motivate stable funding.

V. Summary and Recommendations

A comprehensive range of potential PDMP best practices has been identified and discussed in this white paper. The primary objective of this review was to summarize the available scientific evidence on each potential best practice identified. The literature review drew from a number of sources, including published, peer-reviewed academic literature; unpublished evaluation reports and case studies; and written opinions and recommendations on PDMP best practices from experts in the field. A secondary objective of the paper was to identify promising areas for future research based on the findings of this review (see **Recommendations for Research and Development of PDMP Best Practices**, below).

Results

Table 1 presents a summary of the type and quality of the evidence identified for each of the 35 potential best practices identified. As described earlier, while published, peer-reviewed research on PDMP effectiveness exists, the empirical evidence is not extensive, and the research base on PDMP best practices is in an even earlier stage of development. For example, accumulated experience and key stakeholder perceptions predominantly form the basis for more than half (21 out of 35) of potential best practices. Research studies and documented expert opinion still need to be developed for these areas:

1. Collect positive ID on persons picking up prescriptions
2. Collect data on method of payment, including cash transactions
3. Integrate electronic prescribing with PDMP data collection
4. Improve data quality
5. Link records to permit reliable identification of individuals
6. Determine valid criteria for possible questionable activity
7. Conduct periodic analyses of questionable activity
8. Develop expert systems to guide analyses and reports
9. Record data on disciplinary status, patient lock-ins
10. Optimize reporting to fit user needs
11. Integrate PDMP data with health information exchanges, electronic health records
12. Publicize use and impact of PDMP
13. Proactively identify and conduct outreach to potential high-impact users
14. Conduct recruitment campaigns
15. Streamline certification and enrollment processing
16. Mandate enrollment
17. Mandate utilization
18. Institute financial incentives
19. Delegate access
20. Evaluation of PDMPs
21. Funding of PDMPs

This set of promising practices was identified through anecdotal discussions with experts in the field, but no research evidence demonstrating effectiveness or formal written documentation of expert opinions was located.

Documented expert opinions or case studies served as the highest level of evidence for an additional six potential best practices:

1. Adopt a uniform and latest ASAP reporting standard
2. Collect data on nonscheduled drugs implicated in abuse
3. Reduce data collection interval; move toward real-time data collection
4. Enable access to data by appropriate users; encourage innovative applications
5. Enact and implement interstate data sharing among PDMPs
6. Collaborate with other agencies and organizations

Thus, we found *research* evidence (excluding case studies) for approximately one-quarter (eight out of 35) of the potential best practices identified in this paper:

1. Collect data on all schedules of controlled substances
2. Institute serialized prescription forms
3. Conduct epidemiological analyses
4. Provide continuous online access to automated reports
5. Send unsolicited reports and alerts
6. Conduct promotional campaigns
7. Improve data timeliness and access
8. Conduct user education

For these eight practices, the research evidence included only observational studies; to the authors' knowledge, no RCTs or meta-analyses of PDMP best practices have been completed to date. Most of this research is unpublished. We found only three PDMP practices—serialized prescription forms, unsolicited reporting, and education—with published, peer-reviewed papers reporting on the effectiveness of the practice. Although a few analyses examined health outcomes, such as decreased prescription drug use or drug-related mortality, many were focused on intermediate or indirect outcomes (e.g., increased PDMP use).

Even among the eight practices with some type of unpublished or published research evidence, the *quantity* of research studies was minimal. Only a few had more than one source of research evidence. Results were inconsistent for the most studied practice, unsolicited reporting. In one study, unsolicited reporting was associated with lower prescription drug sales (Simeone & Holland, 2006), while case studies on Wyoming's and Nevada's PDMPs describe reduced doctor shopping after unsolicited reporting. However, no effect on drug overdoses or opioid-related mortality was found after unsolicited reporting in another study (Paulozzi et al., 2011).

In summary, this analysis identified and reviewed 35 potential PDMP best practices. Overall, the findings indicate that good research evidence is not available for the vast majority of candidate PDMP best practices, as the research in this area is scarce to nonexistent. All of the studies that have been conducted have employed nonexperimental designs. No systematic reviews, meta-analyses, or RCTs

were identified about any of the PDMP practices in either the published, peer-reviewed literature or other sources. Thus, the reviewed practices appear promising, but major gaps exist in the evidence base that should be addressed in future research. Confirmation of their effectiveness is needed using scientific techniques.

Table 1. PDMP Candidate Best Practices: Summary of Evidence

Best Practice	Evidence Hierarchy	Author(s); (Year)	Number of Research Studies	Consistency of Research Findings	Outcomes Examined	Findings
Data collection and data quality						
Collect data on all schedules of controlled substances	3; 4	PDMP COE unpublished analysis (2011); ASPMP (2010)	1	N/A	Reduced doctor-shopping rates	States collecting all schedules have lower rates of doctor shopping than other states.
Adopt a uniform reporting standard	4	ASPMP (2010)	0	N/A	N/A	N/A
Collect data on nonscheduled drugs implicated in abuse	4	ASPMP (2010)	0	N/A	N/A	N/A
Collect positive ID on person picking up Rxs	5	None	0	N/A	N/A	N/A
Collect data on method of payment	5	None	0	N/A	N/A	N/A
Reduce data collection interval; real-time data collection	4	ASPMP (2010)	0	N/A	N/A	N/A
Institute serialized prescription forms	2	Paulozzi et al. (2011)	1	N/A	N/A	Three PDMP states using serialized forms (TX, NY, CA) had lower increases in opioid overdose death rates than states not using these forms.
Integrate electronic prescribing with PDMP data collection	5	None	0	N/A	N/A	N/A
Improve data quality	5	None	0	N/A	N/A	N/A
Data linking and analysis						
Link records to permit reliable identification of individuals	5	None	0	N/A	N/A	N/A
Determine valid criteria for questionable activity	5	None	0	N/A	N/A	N/A
Conduct periodic analyses of questionable activity	5	None	0	N/A	N/A	N/A
Conduct epidemiological analyses	3	PDMP COE unpublished analysis (2010)	1	N/A	Identification of possible pill mills	Analyses of states neighboring GA allowed identification of possible pill mills in GA.
Develop expert systems to guide analyses	5	None	0	N/A	N/A	N/A
Record data on prescriber disciplinary status and patient lock-ins	5	None	0	N/A	N/A	N/A
User access and report dissemination						
Provide continuous online access to automated reports	3; 4	VA 2010 PDMP data (unpublished analysis, 2010); PDMP COE, NFF 2.6 (2011); ASPMP (2010)	2	Consistent (increased PDMP use)	Increased PDMP utilization; reduced doctor shopping	After this change in VA, the number of data queries increased and the number of individuals meeting doctor-shopping criteria decreased (VA 2010 data); increased use by VA medical examiners (NFF 2.6).
Optimize reporting to fit user needs	5	None	0	N/A	N/A	N/A
Integrate PDMP data with health information exchanges, electronic health records	5	None	0	N/A	N/A	N/A

Table 1. PDMP Candidate Best Practices: Summary of Evidence (continued)

Best Practice	Evidence Hierarchy	Author(s); (Year)	Number of Research Studies	Consistency of Research Findings	Outcomes Examined	Findings
Send unsolicited reports (URs) and alerts	2,3,4	Paulozzi et al. (2011); Simeone & Holland (2006); PDMP COE, NFF 2.5 (2011); PDMP COE, NFF 1.1 (2010); ASPMP (2010)	4	Inconsistent	Reduced Rx sales, drug overdoses, opioid-related mortality, doctor shopping	URs associated with decreased Rx sales (S & H 2006); no effect of URs on drug overdoses or opioid-related mortality but may reduce supply (Paulozzi et al., 2011); in WY, reduced doctor shopping after URs (NFF 1.1); in NV, reduced number prescribers, dispensers, and dosage units for individuals for whom URs were sent (NFF 2.5).
Publicize use and impact of PDMP	5	None	0	N/A	N/A	N/A
PDMP recruitment, utilization, and education						
Enable access to data by appropriate users	4	PDMP COE, NFF 2.2, 2.3, 2.6 (2011); ASPMP (2010)	3	Consistent (increased PDMP use)	Increased utilization	Case studies suggest that enabling access to additional categories of end users increases PDMP utilization (NFF 2.2, 2.3, 2.6).
Outreach and recruitment strategies						
Proactively identify and conduct outreach to potential high end users	5	None	0	N/A	N/A	N/A
Conduct recruitment campaigns	5	None	0	N/A	N/A	N/A
Streamline certification and enrollment processing	5	None	0	N/A	N/A	N/A
Mandate enrollment	5	None	0	N/A	N/A	N/A
Approaches to increasing utilization						
Conduct promotional campaigns	3	VA 2010 PDMP data (unpublished analysis, 2010)	1	N/A	Increased PDMP enrollment and utilization	After promotional campaign in early 2010, the number of registered users and data queries increased (VA 2010 data).
Improve data timeliness and access	3	VA 2010 PDMP data (unpublished analysis, 2010); PDMP COE, NFF 2.6 (2011)	2	Consistent (increased PDMP use)	Increased PDMP utilization; reduced doctor shopping	After this change in VA, the number of data queries increased, and the number of individuals meeting doctor-shopping criteria decreased (VA 2010 data); increased use by VA medical examiners (NFF 2.6).
Conduct user education	3	Cochella & Bateman (2011); Fisher et al. (2011a)	2	N/A	Reduced Rx opioid death rate, improved provider prescribing behaviors; reduced meperidine (MEP) use	Provider detailing associated with reduced Rx opioid death rate and improved provider prescribing behaviors; PDMP prescriber educational intervention associated with reduced MEP use (Fisher, 2011a).
Mandate utilization	5	None	0	N/A	N/A	N/A
Institute financial incentives	5	None	0	N/A	N/A	N/A
Delegate access	5	None	0	N/A	N/A	N/A

Table 1. PDMP Candidate Best Practices: Summary of Evidence (continued)

Best Practice	Evidence Hierarchy	Author(s); (Year)	Number of Research Studies	Consistency of Research Findings	Outcomes Examined	Findings
Interorganizational best practices						
Enact interstate data sharing among PDMPs	4	ASPMP (2010)	0	N/A	N/A	N/A
Collaborate with other agencies/ organizations	4	ASPMP (2010)	0	N/A	N/A	N/A
Evaluation of PDMPs	5	None	0	N/A	N/A	N/A
Funding of PDMPs	5	None	0	N/A	N/A	N/A

The evidence hierarchy focuses on study design, with the following rating scale:

Type 1: Published or formally documented studies or consensus statements:

1=Randomized controlled trial (RCT) or meta-analysis

2=Observational study with comparison groups

3=Observational study without comparison group

4=Case study or written documentation of expert opinion

Type 2: Anecdotally reported experience and perceptions:

5=Accumulated experience and/or key stakeholder perceptions

Number of research studies includes RCT or meta-analyses, observational studies with and without comparison groups, and case studies.
Consistency of findings: for any given practice, the extent to which reported research findings have the same direction of effect (Consistent, Inconsistent, N/A=Unknown or not applicable (e.g., different outcomes, single study, or no studies)

Recommendations for research and development of PDMP best practices

Our review of candidate best practices for PDMPs indicates that several practices, such as collecting prescription information on all schedules of controlled substances, shortening the data collection interval, using the most recent ASAP standard, and providing continuous online access to prescription data, are already widely adopted or constitute long-term program goals for many PDMPs. Having plausible rationales, they will likely become universal or nearly universal among PDMPs, even if documented evidence supporting their effectiveness has not yet been forthcoming. In contrast, many other candidate practices, some with a preliminary evidence base, have not thus far been widely adopted, despite having plausible rationales.

In this section, we recommend research and development focused on a subset of practices that in our judgment show the most promise in increasing the effectiveness and impact of PDMPs. This judgment incorporates the following considerations: 1) the need to assure the accuracy, completeness, and consistency of PDMP databases as a necessary underpinning for all aspects of PDMP data utilization; 2) the need to optimize all subsequent phases of PDMP operations, including data preparation, analysis, reporting, recruitment of users, and utilization of data; 3) the impact of a practice on enhancing other PDMP capacities and functions, and maximizing PDMP effectiveness, were it widely adopted; 4) the feasibility of implementing the practice; and 5) the extent to which the practice serves to integrate PDMPs into the wider public health and public safety systems.

In addition, we have focused on practices with the potential for research that can produce strong evidence in support of the practices—that is, practices that can be studied by either a randomized controlled trial or an observational study with a comparison group. This is not to suggest that candidate practices surveyed above but unmentioned here are not worthy of research, development, and adoption as best practices, should findings prove positive. We offer this simply as an informed prioritization that may need revision in light of further developments in the field and the research itself.

The recommendations for research and development are:

A. Data collection and data quality

B. Linking records to identify unique individuals

C. Unsolicited reporting and alerts

D. Valid and reliable criteria for questionable activity

E. Medical provider education, enrollment, and use of PDMP data: the question of mandates

F. Extending PDMP linkages to public health and safety

A. Data collection and data quality

The accuracy, completeness, and consistency of PDMP databases are prerequisites for the reliability and effectiveness of PDMP data analysis, reporting, and utilization. All users rely on the data they receive from PDMPs. Prescribers and pharmacists depend on the data to make good clinical care decisions; drug

treatment programs and office-based opioid treatment physicians depend on the data when making treatment decisions; state Medicaid agencies and workers' compensation depend on the data to fill in missing data regarding their enrollees' obtaining of controlled substances; medical examiners depend on the data when determining causes of death; and investigators depend on the data to determine how and what to investigate. All statistical summaries, epidemiological research and evaluation, and geospatial analyses also depend on the data.

As noted previously (see **Data collection and data quality, E. Improve data quality: pharmacy compliance, error, and missing data correction**), best practices need to be identified for all stages of data collection and management. Of necessity, PDMPs will have in place some such systems, but there is no accepted data management gold standard by which they can be assessed. Research is needed to survey current PDMP data management practices in order to determine their common objectives, characteristics, and parameters; develop consensus on achievable data quality goals (e.g., pharmacy reporting compliance rates, target error and completeness rates); determine which data management systems and procedures best achieve those goals; and develop a means to promulgate their adoption.

The results of a PDMP data quality research and development program could be modeled on the development and promulgation of ASAP reporting standards: a specification of systems and procedures that have been proven by research and field testing to produce high-quality PDMP data, as recommended by a recognized expert body. Such an initiative could recruit PDMP administrators and vendors to actively engage in data quality improvement and to collaborate with researchers with the relevant expertise. Convening a meeting of PDMP stakeholders to explore such an initiative would be a first step in the process of identifying best practices in improving and maintaining PDMP data quality. Once clearly defined benchmarks for data quality have been established, as well as the best practices for achieving them, PDMPs will be in a position to measure their effectiveness in this domain.

B. Linking records to identify unique individuals

The capability to link prescription records belonging to an individual, a PDMP data preparation function, is critical to providing accurate prescription information to all users and essential for analyzing the impact of PDMPs, e.g., measuring the level of questionable activity as correlated with program operations. This holds for individual PDMPs, PDMPs that share data, and PDMPs and other organizations that collect or use prescription history information such as IHS, the VA, Medicaid, and private third-party payers. As a discrete data processing capability, optimized record linking seems a feasible objective for most PDMPs.

Research is needed to identify standards for assessing linking algorithms, survey current PDMP practices in linking, and evaluate them in light of accepted standards. For instance, a PDMP's linking methods could be tested on a dummy data set and its output (e.g., number of uniquely identified individuals) compared to the output of a highly rated system. Both SAMHSA and the CDC have developed public domain software—Link Plus and The Link King, respectively—that can be applied for linking records within a PDMP database belonging to the same patient. These have been evaluated with respect to each other and to a basic deterministic algorithm, and both were found superior to the deterministic algorithm (Campbell et al., 2008). However, we are not aware of any PDMPs actually using this software.

Typically, an IT vendor to a PDMP will have developed its own proprietary linking software or purchased such software. To date, no standards have been put forth for comparing such proprietary linking software.

Similarly, research is needed to assess methods of identifying unique individuals across data sets, whether of PDMPs or collaborating agencies. This would permit improved integration of PDMP databases with the wider health care system. Unlike many other kinds of health data, PDMP data do not include a unique numerical patient identifier, such as Social Security number. Linking algorithms needs to incorporate multiple fields such as patient name, street address, birth date, and gender, each of which is subject to various kinds of errors. For this reason, linking algorithms typically incorporates probabilistic matching based on "fuzzy" logic. Considerable research has been done in other fields on probabilistic matching, but research is needed to identify optimal linking algorithms using data fields available in PDMP data and their typical error rates.

Besides testing linking algorithms for relative efficiency, evaluations could assess the impact of better record linking on intermediate measures such as estimates of questionable activity, which themselves depend on actual numbers of uniquely identified individuals in a database. The requirements for optimal linking may suggest which data fields PDMPs should collect and which quality controls they should use to reliably identify individuals, whether patients or prescribers. When generating unsolicited reports, improved linking will increase the identification of individuals currently in a prescriber's practice who may need help, and provide more accurate prescription histories. Better identification of individuals and more accurate prescription histories will also improve the quality of solicited reports. Obtaining end-user feedback on unsolicited and solicited reports, pre- or post- any change in record-linking practices, can help assess the extent to which improved linking on the front end improves PDMP output to end users.

C. Unsolicited reporting and alerts

Findings mentioned above suggest that proactive data analyses and reporting of PDMP data to prescribers and pharmacists serve to inform them of possible questionable activity and patients at risk, increase their awareness and utilization of PDMPs, and contribute to lower rates of questionable activity as measured by the subsequent number of individuals meeting a threshold and prescriptions obtained by suspected doctor shoppers. Proactive analyses and reporting to law enforcement and health professional licensing agencies can identify probable pill mills and doctor shopping rings, and expedite the investigation of possible criminal activity, reducing the supplies of controlled substances for abuse and street trafficking. Some, but not all, PDMPs send unsolicited reports to prescribers and pharmacists, and a smaller number send them to law enforcement investigators, regulatory agencies, and licensing boards. This suggests that unsolicited reporting is well within the capacity of PDMPs, hence a feasible best practice. However, currently, just 40 percent of PDMPs send them to prescribers and pharmacies, and only 20 percent send them to law enforcement and professional licensing agencies.

Expansion of unsolicited reporting appears to be a prudent public health measure given the rapid escalation in prescription drug-related emergency department admissions, overdose deaths, and drug

treatment admissions. The evidence currently available regarding unsolicited reporting, the CDC recommendations, and the requirements for NASPER promulgated by SAMHSA also support its expansion, even while additional scientific evidence is sought. Broader distribution of the existing evidence for the effectiveness of unsolicited reporting and education of state legislatures, agency heads, and other policy makers is needed.

In addition, research is needed to confirm scientifically the hypothesis that unsolicited reporting has the effects suggested by the evidence thus far. For example, published studies of unsolicited reporting have not controlled for possible confounding factors influencing prescription behavior, although there are some under way in Massachusetts (MA PDMP) and Nevada (with Abt Associates). The Massachusetts PDMP is conducting an evaluation of the prescription histories of patients about whom unsolicited reports were sent to prescribers, compared with a matched comparison group about whom reports were not sent. The Schedule II prescription histories of both groups are being tracked for the 12 months prior to the reports (and corresponding period for matching comparison group member) and the 12 months following the reports (MADPH presentation at National Rx Drug Abuse Summit, 2012). The CDC has reportedly funded Abt Associates to conduct a randomized controlled trial of the effects of unsolicited reporting in Nevada on the medical claims of Medicaid patients. Results from this latter study will likely not be available for two years. Further studies are needed to assess the systems and impact of unsolicited reports sent not just to prescribers, but to pharmacists, law enforcement agencies, licensing boards, health departments, diversion programs, collaborating health agencies (e.g., VA, Medicaid) and other PDMP users. Such reporting, were it to become a standard practice, would help integrate PDMPs into other health care and public safety systems.

Research could examine the criteria used in selecting individuals for reports; the means by which reports or alerts are generated, validated, and delivered; the end-user response to reports, e.g., changes in prescribing and dispensing; and how data are used in investigations. Research is also needed on the effect of reports on health outcomes and diversion, such as rates of questionable activity; individual-level PDMP data on prescription purchases; data on overdoses, drug-related deaths, and hospitalizations; and numbers and disposition of diversion investigations. Studies can be done of states' current unsolicited reporting initiatives, examining doctor shopping rates and prescription behavior in relation to reporting. Isolating the effect of reports from confounding factors will require more sophisticated studies involving collaboration between PDMPs and partners such as government and academic research institutes.

As evidence regarding the efficacy of unsolicited reporting accumulates, further investigation will be necessary to assess the relative efficiency of systems for delivering reports and alerts. For example, automated systems with the capacity to notify prescribers for all individuals in a state meeting a threshold for questionable activity, who can number in the thousands, need to be developed and tested, especially with regard to minimizing false positives. Electronic alerts, while considerably more cost-effective than sending out unsolicited reports via mail, need to be tested for relative efficacy compared to reports. If they are found to be effective, the minimal resources needed would make them feasible for any PDMP. However, electronic alerts depend on providers registering with the PDMP and providing their e-mail addresses.

D. Develop valid and reliable criteria for questionable activity

As noted above, although some published research exists, there is no science-based consensus on valid and reliable criteria for identifying questionable activity or patients at risk of prescription drug abuse. States vary in thresholds and other criteria use to generate unsolicited reports. Although some patient characteristics, diagnoses, and drug classes, especially being prescribed multiple classes (e.g., pain relievers and anti-anxiety medications), seem to be associated with being at risk, these findings are still preliminary. A PDMP best practice would be to use the "gold standard" for questionable activity. The development of such a standard would therefore significantly increase PDMP effectiveness given the importance of accurate identification of such activity for many PDMP functions and uses.[8]

However, it is possible that criteria for questionable activity vary by state or region, just as drugs of choice for abuse vary. Further research to develop valid and reliable criteria, across all states and/or by region, therefore seems indicated. For example, surveys of prescribers could help validate criteria by obtaining patient-level information: What proportion of patients meeting the criteria were judged to actually have drug-related problems in need of intervention? What proportion were "false positives"—those whose prescriptions were medically necessary? What information about the patient, had it been incorporated into the criteria, might have avoided misclassification? Is there a linear or nonlinear relationship between the extent to which individuals exceed a given threshold and the probability of being at risk? Are certain individual characteristics of doctor shoppers, e.g., gender, age, ethnicity, income, education, and urbanicity, differentially associated with different thresholds? Criteria could also be developed by retrospective analysis: What were the prescription histories, characteristics, and diagnoses of individuals judged by prescribers to have drug abuse or diversion problems in advance of consulting a PDMP database?

Research to illuminate patterns of prescription behavior leading up to meeting a threshold for questionable activity—the "natural history" of doctor shopping—could contribute to predictive models that might enable earlier identification of patients at risk. Such patterns—for instance, how long, on average, individuals stay under a given threshold before meeting it, and how long they stay at or above a threshold—may vary by patient characteristics, diagnoses, geographic area, and state policies related to prescribing and diversion, including the use of PDMPs themselves. These questions could be addressed by conducting longitudinal analyses of PDMP databases and other associated health data sets, ideally matched at the individual level but de-identified to protect patient privacy.

These are just a sampling of the questions that research on criteria for problematic prescription behavior could investigate. Consensus on a coordinated, systematic research agenda could be developed by convening a group of investigators tasked with clarifying study objectives and methods, followed by issuing a request for proposals. Since the development of criteria beyond simple thresholds will likely involve non-PDMP health data, the development process will promote relationships and data

[8] For example, when a medical provider downloads a PDMP report, this is usually to help ascertain whether the patient might have a drug-related problem. Research on thresholds and other criteria for patients potentially at risk would help inform this judgment. PDMPs could automatically flag individuals who meet validated criteria for questionable activity; this flag would show up in downloaded reports, proactively informing prescribers and pharmacists about a possible patient at risk.

linking between PDMPs and other health care systems. A similar research agenda could be developed to identify reliable indicators within PDMP data of questionable prescribing on the part of individual providers or practices.

E. Medical provider education, enrollment, and use of PDMP: the question of mandates

As PDMP data and reports become easier to access, become integrated into health care practice, and gain acceptance as a clinical tool, the question of how to increase use of PDMPs by medical providers becomes increasingly salient, including possible actions up to and including mandating prescriber education about, enrollment in, and use of a PDMP. A handful of states now require that prescribers consult the PDMP database in specific circumstances, such as when prescribing controlled substances for the first time for a new patient and periodically thereafter, or when prescribing methadone for treating pain. Other states are considering such requirements. This suggests that instituting a mandate is an attainable policy objective, should a state decide to pursue it via legislative and regulatory reform.

However, whether mandates should become a best practice depends on proving their feasibility and benefits. Many questions need study: How well, compared to voluntary approaches, do mandates increase the actual use of a PDMP? Is the requirement that all prescribers receive education in the prescribing of controlled substances and use the PDMP, whatever their level of prescribing, the most efficient use of a prescriber's time and PDMP resources? Is mandatory use associated with improvements in patient outcomes, such as lower rates of addiction, overdoses, and deaths? Do states with mandates outperform other states in such measures? Do mandates have unintended consequences, such as leading some providers to discontinue or cut back on controlled substance prescribing? If there were reductions in prescribing, are they accompanied by decreased drug-related morbidity and mortality? Can mandates be successfully enforced, and by what kinds of monitoring and penalties for noncompliance? By what legislative and regulatory means were they instituted?

Investigating these and related questions will require descriptive studies of currently existing mandates and their consequences; studies comparing provider behavior with and without mandates, controlling for other factors; studies of how mandates were instituted; and studies of the feasibility and efficacy of enforcement mechanisms, such as monitoring use of the PDMP. Since lack of participation in PDMPs by prescribers is widely cited as a factor limiting their effectiveness, settling the question of whether mandates are better than voluntary approaches to increasing participation has immediate practical significance that should figure in setting a PDMP research agenda. Moreover, obtaining answers to such questions takes on a new sense of urgency with four states enacting mandates in 2012 alone, and other states considering such legislation.

F. Extending PDMP linkages to public health and safety

A potential best practice examined above was for PDMPs to expand their scope of application to include users beyond prescribers, pharmacists, law enforcement agencies, and professional licensure boards. Case studies carried out by the PDMP COE suggest that PDMP data have additional applications that, when implemented, link PDMPs to other public health and safety systems, potentially increasing the

impact and effectiveness of PDMPs in addressing prescription drug abuse. These studies indicate that in some states, PDMP data are being made available to drug courts, medical examiners, drug treatment programs, and criminal diversion programs. Findings suggest that these data are proving valuable in their respective applications.

Case studies could be developed to document other promising uses of PDMP data and the systems supporting such use. For instance, the Washington State PDMP is making its data available to the Workers' Compensation unit in Department of Labor and Industries. Mississippi's PDMP is contacting individuals whose prescription histories suggest questionable activity. Documenting these initiatives and their outcomes would be a first step in developing an evidence base for the utility of PDMP data in these applications. Studies should be undertaken to explore the uses to which PDMP data are applied by state Medicaid agencies and the impact of such use on the quality, safety, and costs of medical care provided to Medicaid enrollees. Another area for exploration is the feasibility of health care institutional peer review organizations using PDMP data to identify and intervene to correct prescribers' deficiencies and problems. Field research is needed to identify other innovative applications of PDMP data being explored by states that could lend themselves to case studies.

Although findings from case studies serve as important preliminary assessments of novel PDMP data applications, more systematic research and evaluation are needed to establish their value, should it exist, in increasing PDMP effectiveness and impact. The case studies conducted thus far could be followed up by formal studies, for example, of how PDMP data are used in substance abuse prevention and treatment programs and the outcomes of such use, or how, in quantitative terms if possible, PDMP reports enhance the work of drug courts, criminal diversion programs, and drug enforcement investigators. Studies could also be conducted comparing different approaches to how PDMP data are used in specific applications. As the evidence base grows in support of particular uses and the practices supporting their use, their adoption will grow. This, in turn, will increase PDMPs' integration with public health and safety systems, helping to maximize their effectiveness in improving the legitimate use of controlled substances, while mitigating the prescription drug abuse epidemic.

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VI. References

Alliance of States with Prescription Monitoring Programs (ASPMP). (2007). An assessment of state prescription monitoring program effectiveness and results. Retrieved Sep. 11, 2012, from www.pmpexcellence.org/pdfs/alliance_pmp_rpt2_1107.pdf

Alliance of States with Prescription Monitoring Programs (ASPMP). (2010). Prescription Monitoring Program Model Act 2010 revision. Retrieved Feb. 26, 2012, from pmpalliance.org/pdf/PMPModelActFinal20100628.pdf

Baehren, D.F., Marco, C.A., Droz, D.E., Sinha, S., Callan, E.M., & Akpunonu P. (2010). A statewide prescription monitoring program affects emergency department prescribing behaviors. *Annals of Emergency Medicine, 56*(1), 19-23.

Barrett, K., & Watson, A. (2005). Physician perspectives on a pilot prescription monitoring program. *Journal of Pain and Palliative Care Pharmacotherapy*, *19*(3), 5-13.

Blumenschein, K., Fink, J.L., Freeman, P.R., Kirsh, K.L., Steinke, D.T., & Talbert, J. (2010). Independent evaluation of the impact and effectiveness of the Kentucky All Schedule Prescription Electronic Reporting Program (KASPER). Lexington, Kentucky: Institute for Pharmaceutical Outcomes and Policy, University of Kentucky. Retrieved Sep. 11, 2012, from chfs.ky.gov/NR/rdonlyres/24493B2E-B1A1-4399-89AD-1625953BAD43/0/KASPEREvaluationFinalReport10152010.pdf

Boeuf, O., & Lapeyre-Mestre, M. (2007). Survey of forged prescriptions to investigate risk of psychoactive medications abuse in France: Results of OSIAP survey. *Drug Safety, 30*(3), 265-276.

Bohnert, A.S., Valenstein, M., Bair, M.J., Ganoczy, D., McCarthy, J.F., Ilgen, M.A., & Blow, F.C. (2011). Association between opioid prescribing patterns and opioid overdose-related deaths. *Journal of the American Medical Association, 305*(13), 1315-1321.

Buurma, H., Bouvy, M.L., De Smet, P.A., Floor-Schreudering, A., Leufkens, H.G., & Egberts, A.C. (2008). Prevalence and determinants of pharmacy shopping behaviour. *Journal of Clinical Pharmacy and Therapeutics, 33*, 17–23.

Campbell, K.M., Deck, D., & Krupski, A. (2008). Record linkage software in the public domain: a comparison of Link Plus, The Link King, and a 'basic' deterministic algorithm. *Health Informatics Journal, 14*(1), 5-15.

Carnevale & Associates and Prescription Drug Monitoring Program Center of Excellence. (2010). Prescription monitoring and prevention: recommendations for increased collaboration. Working paper produced for the Substance Abuse and Mental Health Services Administration.

Centers for Disease Control and Prevention. (2010). Unintentional drug poisoning in the United States. Retrieved Feb. 26, 2012, from www.cdc.gov/HomeandRecreationalSafety/pdf/poison-issue-brief.pdf

Coalition Against Insurance Fraud. (2007). Prescription for peril: how insurance fraud finances theft and abuse of addictive prescription drugs. Retrieved Sep. 11, 2012, from www.insurancefraud.org/downloads/drugDiversion.pdf

Cochella, S., & Bateman, K. (2011). Provider detailing: an intervention to decrease prescription opioid deaths in Utah. *Pain Medicine, 12(*Suppl 2), S73-S76. doi: 10.1111/j.1526-4637.2011.01125.x.

Curtis, L.H., Stoddard, J., Radeva, J.I., Hutchison, S., Dans, P.E., Wright, A., Woosley, R.L., & Schulman, K.A. (2006). Geographic variation in the prescription of schedule II opioid analgesics among outpatients in the United States. *Health Services Research, 41*(3 Pt 1), 837-855.

DuBose P., Bender A., & Markman, J.W. (2011, June). Rank-ordering physicians by opioid abuse and diversion risk. Poster presented at the International Narcotics Research Conference, Hollywood, FL.

Dunn, K.M., Saunders, K.W., Rutter, C.M., Banta-Green, C.J., Merrill, J.O., Sullivan, M.D., Weisner, C.M., Silverberg, M.J., Campbell, C.I., Psaty, B.M., & Von Korff, M. (2010). Opioid prescriptions for chronic pain and overdose. *Annals of Internal Medicine, 152*(2), 85-93.

Eadie, J.L. (1990). Policy concerns: benzodiazepine abuse and misuse: New York State's response. In B.B. Wilford (Ed.), *Balancing the Response to Prescription Drug Abuse: Report of a National Symposium on Medicine and Public Policy* (pp. 93-102). Chicago IL: American Medical Association.

Eadie, J.L. (1993). New York State triplicate prescription program. In J.R. Cooper, D.J. Czechowicz, S.P. Molinari, & R.C. Petersen (Eds.), *Impact of Prescription Drug Diversion Control Systems on Medical Practice and Patient Care: NIDA Research Monograph 131* (pp. 176-193). Rockville, MD: U.S. Department of Health and Human Services, National Institute on Drug Abuse.

Eadie, J.L. (2010, May). Prescription monitoring programs and law enforcement: an overview. Presentation made at the PDMP/Law Enforcement meeting, Alliance of States with Prescription Monitoring Programs, San Antonio, TX.

Eadie, J.L. (2011, March). Prescription monitoring program roles. Presentation made at the Surgeon General's Expert Panel on Prescription Drug Abuse in Youth, Washington DC.

Eadie, J.L. (2011, May). Toward the next generation of PMPs: enhancing prescription monitoring programs' ability to address the prescription drug abuse epidemic. Presentation made to the U.S. Senate Sub-Committee on Crime and Terrorism, Washington DC.

Feldman, L., Williams, K.S., Coates, J., & Knox. M. (2011). Awareness and utilization of a prescription monitoring program among physicians. *Journal of Pain and Palliative Care Pharmacotherapy, 25*(4), 313-317.

Fischer, B., Jones, W., Krahn, M., & Rehm, J. (2011). Differences and over-time changes in levels of prescription opioid analgesic dispensing from retail pharmacies in Canada, 2005-2010. *Pharmacoepidemiology and Drug Safety, 20*(12), 1269-1277. doi: 10.1002/pds.2190.

Fisher, J.E., Zhang, Y., Sketris, I., Johnston, G., & Burge, F. (2011). The effect of an educational intervention on meperidine use in Nova Scotia, Canada: a time series analysis. *Pharmacoepidemiology and Drug Safety*, *21*(2), 177-183. doi: 10.1002/pds.2259.

Fisher, J.E., Sanyal, C., Frail, D., & Sketris, I. (2011). The intended and unintended consequences of benzodiazepine monitoring programmes: a review of the literature. *Journal of Clinical Pharmacy and Therapeutics*, 37(1), 7-21. doi: 10.1111/j.1365-2710.2011.01245.x.

Fornili, K., & Simoni-Wastila, L. (2011). Prescription monitoring programs: striking the balance between medical use and diversion. *Journal of Addictions Nursing*, *22*(1-2), 77-82.

Gilson, A.M., Fishman, S.M., Wilsey, B.L., Casamalhuapa, C., & Baxi, H. (2012). Time series analysis of California's prescription monitoring program: impact on prescribing and multiple provider episodes. *Journal of Pain, 13*(2), 103-111.

Gomes, T., Mamdani, M., Dhalla, I., Paterson, M., & Juurlink, D. (2011). Opioid dose and drug-related mortality in patients with nonmalignant pain. *Archives of Internal Medicine,* 171(7), 686-691.

Government Accountability Office (GAO). (2011). Medicare Part D: instances of questionable access to prescription drugs. (GAO-12-104T). Washington, DC. Retrieved Sep. 11, 2012, from www.gao.gov/assets/590/585579.pdf

Government Accountability Office (GAO). (2009). Medicaid: fraud and abuse related to controlled substances identified in selected states (GAO-09-957). Washington, DC. Retrieved Sep. 11, 2012, from www.gao.gov/new.items/d09957.pdf

Hall, A.J., Logan, J.E., Toblin, R.L., Kaplan, J.A., Kraner, J.C., Bixler, D., Crosby, A.E., & Paulozzi, L.J. (2008). Patterns of abuse among unintentional pharmaceutical overdose fatalities. *The Journal of American Medical Association*, 300(22), 2613-20.

Johnson, E.M., Porucznik, C.A., Anderson, J.W., & Rolfs, R.T. (2011). State-level strategies for reducing prescription drug overdose deaths: Utah's prescription safety program. *Pain Medicine*, Suppl 2:S66-72. doi: 10.1111/j.1526-4637.2011.01126.x.

Joranson, D.E. & Dahl, J.L. (1989). Achieving balance in drug policy: the Wisconsin model. In C.S. Hill, Jr. & W.S. Fields, *Advances in Pain Research and Therapy* (pp. 197-204). New York, NY: Raven Press.

Joranson, D.E., Carrow, G.M., Ryan, K.M., Schaefer, L., Gilson, A.M., Good, P., Eadie, J., Peine, S., & Dahl, J.L. (2002). Pain management and prescription monitoring. *The Journal of Pain Symptom Management*, 23(3), 231-8.

Katz, N., Houle, B., Fernandez, K.C., Kreiner, P., Thomas, C.P., Kim, M., Carrow, G.M., Audet, A, & Brushwood, D. (2008). Update on prescription monitoring in clinical practice: a survey study of prescription monitoring program administrators. *Pain Medicine*, 9(5):587-94. Epub 2008 Jun 28.

Katz, N., Panas, L., Kim, M., Audet, A.D., Bilansky, A., Eadie, J., Kreiner, P., Paillard, F.C., Thomas, C., & Carrow, G. (2010). Usefulness of prescription monitoring programs for surveillance: analysis of Schedule II opioid prescription data in Massachusetts, 1996-2006. *Pharmacoepidemiology and Drug Safety,* 19(2), 115-23.

Kentucky Cabinet for Health and Family Services and Kentucky Injury Prevention and Research Center . (2010). 2010 KASPER satisfaction survey: executive summary. Retrieved Sep. 11, 2012, from chfs.ky.gov/NR/rdonlyres/BDC0DFC9-924B-4F11-A10A-5EB17933FDDB/0/2010KASPERSatisfactionSurveyExecutiveSummary.pdf

Kreiner, P. (2011, June). Non-medical prescription drug use and market intervention: prescription drug monitoring program data and law enforcement. Presentation made at the National Institutes of Justice Annual Conference, Washington, DC.

Kreiner, P. (2012, April). Geospatial analyses of opioid overdose rates and rates of questionable activity in Massachusetts. Presentation made at the National Prescription Drug Abuse Summit, Orlando, FL.

Lambert, D. (2007). Impact evaluation of Maine's prescription drug monitoring program. Portland, ME: Muskie School of Public Service, University of Southern Maine. Retrieved Sep. 11, 2012, from webapp.usm.maine.edu/MuskieWebDBfrontend/projectView.action;jsessionid=FAED7067735280FE4FF701970BEF7556?projectId=3230

LeMire, S. (2010). Evaluation of the efficacy of the North Dakota prescription drug monitoring program online training. Grand Forks, ND: Bureau of Educational Services and Applied Research (BESAR), University of North Dakota. Retrieved Sep. 11, 1012, from www.nascsa.org/nascsaPMP/PMPnews/NDPDMPtrainingEvaluation.pdf

LeMire, S., Martner, S., & Rising, C. (2012). Advanced practice nurses' use of prescription drug monitoring program Information. *The Journal for Nurse Practitioners*, 383-405. doi: 10.1016/j.nurpra.2012.02.016

Lipton, B., Laws, C., & Li, L. (2011). Workers compensation prescription drug study: 2011 update, NCCI Research Brief. Boca Raton, FL: National Council on Compensation Insurance Holdings Inc. Retrieved Sep. 11, 2012, from www.ncci.com/documents/2011_ncci_research_rxdrug_study.pdf

Lohr, K.N. (2004). Rating the strength of scientific evidence: relevance for quality improvement programs. *International Journal of Quality Health Care*, 16(1), 9-18.

Massachusetts Department of Public Health. (2010, August). Request to Public Health Council for final promulgation of amendments to regulations implementing the Controlled Substances Act, 105 CMR 700.000, concerning the Prescription Monitoring Program. Public Health Advisory Council Meeting, Boston, MA.

Massachusetts Department of Public Health. (2012, February). PDMP Advisory Council presentation. Public Health Advisory Council Meeting, Boston, MA.

Massachusetts Department of Public Health. (2012, April). Presentation made at National Rx Drug Abuse Summit, Washington, DC.

McDonald, D., Hurd, D., Lloyd-Kolkin, S., Hamilton, C., Reddy, P., & Adedokun, L. (2004). Prescription monitoring programs: current practices and suggestions for further research on their effectiveness. Cambridge, MA: Abt Associates.

National Alliance for Model State Drug Laws. (2011a). Interstate sharing of prescription monitoring database information. Retrieved June 28, 2012, from namsdl.org/documents/InterstateSharingofPMPInformation10.14.2011.pdf

National Alliance for Model State Drug Laws. (2011b). States that allow practitioners to designate an authorized agent to access the PMP database. Retrieved June 28, 2012, from www.namsdl.org/documents/StatesthatAllowPractitionerstoDesignateanAuthorizedAgenttoAccesthePMPDatabaseMapFebruary201.pdf

National Alliance for Model State Drug Laws. (2012a). States that require practitioners to register for PMP database. Retrieved June 28, 2012, from www.namsdl.org/documents/StatesthatRequirePractitionerstoRegisterforPMP.pdf

National Alliance for Model State Drug Laws. (2011b). States that require prescribers and/or dispensers to access PMP database in certain circumstances. Retrieved June 28, 2012, from www.namsdl.org/documents/RequirementtoAccess_000.pdf

National Alliance for Model State Drug Laws. (2012c). States that require certain authorized users to undergo training and/or completion of educational courses before accessing PDMP data. Retrieved Sep. 11, 2012, from www.namsdl.org/documents/StatesthatRequireAuthUserstoReceiveTrainingPriortoAccessingPMP07232012.pdf

Office of National Drug Control Policy. (2011). Epidemic: responding to America's prescription drug abuse crisis. Washington, DC: Executive Office of the President of the United States. Retrieved Feb. 26, 2012, from www.whitehouse.gov/sites/default/files/ondcp/issues-content/prescription-drugs/rx_abuse_plan_0.pdf

Owens, D.K., Lohr, K.N., Atkins, D., Treadwell, J.R., Reston, J.T., Bass, E.B., Chang, S., & Helfand, M. (2010). AHRQ series paper 5: grading the strength of a body of evidence when comparing medical interventions—agency for healthcare research and quality and the effective health-care program. *The Journal of Clinical Epidemiology,* 63(5), 513-23.

Paulozzi, L.J., & Stier, D.D. (2010). Prescription drug laws, drug overdoses, and drug sales in New York and Pennsylvania. *The Journal of Public Health Policy*, 31(4), 422-32.

Paulozzi, L.J., Kilbourne, E.M., & Desai, H.A. (2011). Prescription drug monitoring programs and death rates from drug overdose. *Pain Medicine*, 12(5), 747-54. doi: 10.1111/j.1526-4637.2011.01062.x. Epub 2011 Feb 18.

Paulozzi, L.J. (2011, June). High-decile prescribers: all gain, no pain? Presentation made at the 2011 Harold Rogers Prescription Drug Monitoring Program National Meeting, Washington DC.

Paulozzi, L.J., Kilbourne, E.M., Shah, N.G., Nolte, K.B., Desai, H.A., Landen, M.G., Harvey, W., & Loring, L.D. (2012). A history of being prescribed controlled substances and risk of drug overdose death. *Pain Medicine*, 13, 87-95.

Pauly, V., Frauger, E., Pradel, V., Rouby, F., Berbis, J., Natali, F., Reggio, P., Coudert, H., Micallef, J., & Thirion, X. (2011). Which indicators can public health authorities use to monitor prescription drug abuse and evaluate the impact of regulatory measures? Controlling High Dosage Buprenorphine abuse. *Drug and Alcohol Dependence,* 113(1), 29-36. Epub 2010 Aug 8.

Payne, S., & Thayer, D. (2009). Epidemiological analysis of the Maine prescription monitoring program (PMP) data. Portland, ME: Muskie School of Public Service, University of Southern Maine. Retrieved Sep. 11, 2012, from muskie.usm.maine.edu/Publications/Maine-PMP.pdf

Pearson, S., Soumerai, S., Mah, C., Zhang, F., Simoni-Wastilla, L., Salzman, C., Cosler, L., Fanning, T., Gallagher, P., & Ross-Degnan, D. (2006). Racial disparities in access after regulatory surveillance of benzodiazepines. *Archives of Internal Medicine,* 166, 572-579.

Peirce, G.L., Smith, M.J., Abate, M.A., & Halverson, J. (2012). Doctor and pharmacy shopping for controlled substances. *Medical Care*, 50(6), 494-500.

Perrone, J., & Nelson, L. (2012). Medication reconciliation for controlled Substances: an "ideal" prescription drug monitoring program. *The New England Journal of Medicine*, 10.1056/NEJMp1204493.

Pradel, V., Frauger, E., Thirion, X., Ronfle, E., Lapierre, V., Masut, A., Coudert, C., Blin, O., & Micallef, J. (2009). Impact of a prescription monitoring program on doctor-shopping for high dosage buprenorphine. *Pharmacoepidemiology and Drug Safety,* 18(1), 36-43.

Prescription Drug Monitoring Program Center of Excellence. (2010). Positive customer identification. Unpublished analysis of state prescription monitoring data.

Prescription Drug Monitoring Program Center of Excellence. (2010). Unpublished analysis of PDMP performance measure data collected by the Bureau of Justice Assistance.

Prescription Drug Monitoring Program Center of Excellence. (2010). Trends in Wyoming PDMP prescription history reporting: evidence for a decrease in doctor shopping? NFF 1.1. Heller School, Brandeis University. Waltham, MA.

Prescription Drug Monitoring Program Center of Excellence. (2011). Unpublished analysis of the Second State PDMP Profiles Survey conducted for the Bureau of Justice Assistance.

Prescription Drug Monitoring Program Center of Excellence. (2011). Staying clear of the law and addiction: Nevada's Pre-Criminal Intervention Program. NFF 2.1. Heller School, Brandeis University. Waltham, MA.

Prescription Drug Monitoring Program Center of Excellence. (2011). Briefing on PDMP effectiveness: PDMPs—an effective tool in curbing the prescription drug abuse epidemic. Heller School, Brandeis University. Waltham, MA.

Prescription Drug Monitoring Program Center of Excellence. (2011). Keeping patients safe: a case study on using prescription monitoring program data in an outpatient addictions treatment setting. NFF 2.2. Heller School, Brandeis University, Waltham, MA.

Prescription Drug Monitoring Program Center of Excellence. (2001).Perspective from Kentucky: using PDMP data in drug diversion investigations. Notes from the Field 2.3. Heller School, Brandeis University. Waltham, MA.

Prescription Drug Monitoring Program Center of Excellence. (2011). Monitoring and changing behavior: the role of PDMP data in Kentucky drug courts. NFF 2.4. Heller School, Brandeis University. Waltham, MA.

Prescription Drug Monitoring Program Center of Excellence. (2011). Nevada's proactive PDMP: the impact of unsolicited reports. NFF 2.5. Heller School, Brandeis University. Waltham, MA.

Prescription Drug Monitoring Program Center of Excellence. (2011). Drug-related deaths in Virginia: medical examiner use of PDMP data. NFF 2.6. Heller School, Brandeis University. Waltham, MA.

Prescription Drug Monitoring Program Center of Excellence. (2012). Real-time reporting: Oklahoma's pioneering PDMP. NFF 3.1. Heller School, Brandeis University. Waltham, MA.

Prescription Drug Monitoring Program Center of Excellence. (2012). Project Lazarus: using PDMP data to mobilize and measure community drug abuse prevention. NFF 3.2. Heller School, Brandeis University. Waltham, MA.

Reifler, L.M., Droz, D., Bartelson, B.B., Bailey, J.E., Schnoll, S., & Dart, R.C. (2012). Do prescription monitoring programs impact state trends in opioid abuse/misuse? *Pain Medicine* 2012:13, 434–442.

Reisman, R.M., Shenoy, P.J., Atherly, A.J., & Flowers, C.R. (2009). Prescription opioid usage and abuse relationships: an evaluation of state prescription drug monitoring efficacy. *Substance Abuse: Research and Treatment*. 2009:3, 41-51.

Rigg, K.K., March, S.J., & Inciardi, J.A. (2010). Prescription drug abuse and diversion: role of the pain clinic. *Journal of Drug Issues*. 40(3), 681-702.

Rosenblatt, N. (2007). Reducing the diversion of scheduled prescription medications in the Commonwealth of Kentucky: 2006 KASPER Satisfaction Survey: Executive summary. Kentucky Cabinet for Health and Family Services: Frankfort, KY.

Simeone, R. & Holland, L. (2006). An evaluation of prescription drug monitoring programs. Simeone Associates, Inc. Albany, NY. Retrieved on September 11, 2012 from www.simeoneassociates.com/simeone3.pdf

Sorg, M., Labrie, S., & Parker, W. (2009). Analysis and evaluation of participation by prescribers and dispensers in the Maine state prescription monitoring program. Margaret Chase Smith Policy Center, University of Maine. Retrieved on September 11, 2012 from mcspolicycenter.umaine.edu/files/pdf/PMP%20Report%20Final%20Nov09.pdf

Substance Abuse and Mental Health Services Administration, National All Schedules Prescription Electronic Reporting Act Program Grants. (2005). Request for Applications (RFA) No. TI-11-F1, Catalogue of Federal Domestic Assistance (CFDA) No.: 93.975. p. 10.

Substance Abuse and Mental Health Services Administration, Drug Abuse Warning Network. (2010). Highlights of the 2009 Drug Abuse Warning Network (DAWN) findings on drug-related emergency department visits. The DAWN Report. DAWN10-1228. Retrieved on September 11, 2012, from store.samhsa.gov/product/Highlights-of-the-2009-Drug-Abuse-Warning-Network-DAWN-Findings-on-Drug-Related-Emergency-Department-Visits/DAWN10-1228

Substance Abuse and Mental Health Services Administration, Treatment Episode Data Set. (2011) Substance abuse treatment admissions for abuse of benzodiazepines. The TEDS Report. TEDS11-0602. Retrieved on September 11, 2012, from store.samhsa.gov/product/Substance-Abuse-Treatment-Admissions-for-Abuse-of-Benzodiazepines/TEDS11-0602

Tufts Health Care Institute Program on Opioid Risk Management. (2011). Advancing safe opioid prescribing through prescriber training and behavior change. Retrieved on September 11, 2012, from www.thci.org/opioid/mar11docs/Prescriber%20Education%20Executive%20Summary%20final.pdf

Twillman, R. (2006). Impact of prescription monitoring programs on prescription patterns and indicators of opioid abuse. *Journal of Pain*, Supplement. 7(4), S6.

Ulbrich, T.R., Dula, C.A., Green, C.G., Porter, K., & Bennett, M.S. (2010). Factors influencing community pharmacists' enrollment in a state prescription monitoring program. *Journal of the American Pharmacists Association.* 50(5), 588-94.

United States Government Accountability Office (GAO). (2002). Prescription drugs: state monitoring programs provide useful tool to reduce diversion. Washington, D.C. GAO Report GAO-02-634.

Virginia Department of Health Professions and Virginia State Police. (2004). Prescription monitoring program. Richmond, VA. Retrieved September 11, 2012, from www.dhp.virginia.gov/dhp_programs/pmp/docs/REPORT%20OF%20THE%20PMP.pdf

Virginia Prescription Monitoring Program. (2010). 2010 Statistics. Retrieved September 11, 2012, from www.dhp.virginia.gov/dhp_programs/pmp/docs/ProgramStats/2010PMPStatsDec2010.pdf

Wang, J., & Christo, P.J. (2009). The influence of prescription monitoring programs on chronic pain management. *Pain Physician*. 12(3), 507-515.

White, A.G., Birnbaum, H.G., Schiller, M., Tang, J., & Katz, N.P. (2009). Analytic models to identify patients at risk for prescription opioid abuse. *American Journal of Managed Care*. 15(12), 897-906.

Whitely, M. (2012, January) Opioids pose major concern for comp stakeholders. W*orkcompcentral* available by subscription at ww3.workcompcentral.com/news/story/id/96a7f1d3df648d6ee72730515354e37em#.UE91-K71GSo

Wilsey, B.L., Fishman, S.M., Gilson, A.M., Casamalhuapa, C., Baxi., H, Zhang, H., & Li, C.S. (2010). Profiling multiple provider prescribing of opioids, benzodiazepines, stimulants, and anorectics. *Drug and Alcohol Dependence*. 112(1-2), 99-106.

Wilsey, B.L., Fishman, S.M., Gilson, A.M., Casamalhuapa, C., Baxi., H, Lin, T.C., & Li, C.S. (2011). An analysis of the number of multiple prescribers for opioids utilizing data from the California Prescription Monitoring Program. *Pharmacoepidemiology and Drug Safety.* 20(12), 1262-8. doi: 10.1002/pds.2129.

Appendix A. Published Empirical Studies on PDMP Effectiveness and Candidate Best Practices

Citation	Study Topic	Study Population and Data Source	Study Design	Outcome(s)	Findings
Joranson et al., 2002	Assess perspectives on the effects of PDMPs	Qualitative data from regulatory and pain management reps on PDMP from two meetings in 1998	Qualitative	Multiple	Cooperation and information between PDMPs and pain management groups and education of medical community about PDMPs are needed.
Barrett & Watson, 2005	Physician perspectives on usefulness and effectiveness of pilot PDMP in Virginia	Survey of physicians (n=275, 41 percent response rate)	Descriptive, cross-sectional study	Knowledge of and attitudes toward PDMP	Nearly 60 percent believed their prescribing was being more closely monitored due to PDMP; of these, 23 percent reported it had a negative impact on their ability to manage patients' pain; 68 percent believed PDMP useful for monitoring and decreasing doctor shopping, but only 11 percent had requested PDMP data.
Curtis et al., 2006	Assess geographic variation in opioid use in the U.S. outpatient population	Outpatient Rx drug claims database for 7.8 million subjects with one or more Rx drug claims in 2000	Quasi-experimental: controlled—states or counties with PDMPs vs. those without	Claim rates for opioid analgesics and controlled-release oxycodone	Presence of Statewide Schedule II PDMP associated with lower claim rates at county level.
Hall et al., 2008	Evaluate risk characteristics of West Virginia unintentional Rx overdoses	Medical examiner data, PDMP data and opiate treatment program records on West Virginia residents who died of unintentional Rx overdoses in 2006	Population-based, observational study	Death involving Rx diversion, doctor shopping indicators	63 percent and 21 percent, respectively, of overdose deaths were associated with diversion of Rxs and doctor shopping.
Boeuf et al., 2007	Describe patterns of drug diversion and define profiles of forged prescriptions	National cross-sectional survey on community pharmacies in France, 2001-2004	Cross-sectional study	Profiles of forged prescriptions	Two profiles were developed for suspicious prescriptions.
Katz et al., 2008	Assess current status of PDMPs re: goals, data, data sharing, training, and evaluation efforts	Web survey of PDMP directors with telephone follow-up, 2006 (n=18)	Descriptive, cross-sectional study	Multiple	State PDMPs vary greatly; development of provider guidelines, education, and training are essential.
Pradel et al., 2009	Effect of PDMP implemented in 2004 on doctor shopping for high-dose buprenorphine (HDB)	PDMP records in a French region from 2000 to 2005	Pre-post; no control group	Doctor-shopping ratio: percentage of HDB obtained from doctor shopping; doctor-shopping quantity	After four years of increases in doctor-shopping indicators, the period after PDMP started showed a decrease in indicators and no marked effect on treatment access.
Reisman et al., 2009	Effect of state PDMPs on prescription opioid drug shipments and abuse admissions	Automation of Reports and Consolidated Orders System (ARCOS) data on state prescription opioid shipments and TEDS data on inpatient admissions, 1997-2003	Retrospective ecological cohort study; PDMP states vs. non-PDMP states	Prescription opioid shipments and admissions	PDMPs appear to decrease the amount of opioid shipments and prescription opioid admission rates in states with these programs.

Appendix A. Published Empirical Studies on PDMP Effectiveness and Candidate Best Practices (continued)

Citation	Study Objective(s)	Study Population and Data Source	Study Design	Outcome(s)	Findings
Wang & Christo, 2009	Impact of PDMPs on pain management and controlled substance prescribing	Data on PDMP structure, operations, and evaluations	Comparative analysis of PDMP operations and evaluations	Investigation times, supply of prescription medications, prescribing patterns	PDMPs may reduce abuse of controlled substances.
White et al., 2009	Assess feasibility of using claims data to create models that identify patients at risk for Rx opioid use or misuse	Rx and medical claims for 632,000 privately insured patients in Maine, 2005-2006	Modeling study	Factors predicting prescription opioid abuse	Patient characteristics can be used to predict Rx abuse and misuse (e.g., number of opioid Rxs, early refills, escalating dosages, pharmacy shopping, doctor shopping).
Baehren et al., 2010	Effect of Ohio PDMP (e.g., online access to database) on emergency department prescribing	Clinical management data on 179 ED patients with painful conditions, June/July 2008	Prospective quasi-experimental study	Change in planned opioid prescribing after review of PDMP data	After review of PDMP data, providers changed their prescribing behavior for 41 percent of cases; 61 percent of these resulted in fewer or no opioids prescribed than originally planned.
Katz et al., 2010	Evaluate trends in opioid prescribing, dispensing, and use	Massachusetts PDMP Schedule II opioids Rx records, 1996-2006		Number of Rxs, doses prescribed and individuals receiving Schedule II opioids; questionable activity (QA) measures	Outcome measures all increased from 1996 to 2006; questionable activity estimated as ≥ 4 prescribers and ≥ 4 pharmacies; the percentage of outcome measures associated with QA is small and similar to that in Maine; explores threshold criteria for doctor shopping.
Paulozzi & Stier, 2010	Comparison of drug overdose death rates in New York and Pennsylvania	National Center for Health Statistics data, 2006	Observational study	Rates and rate ratios for non-suicidal drug overdose deaths	Drug overdose death rate 1.6 times higher in Pennsylvania than New York; both states had PDMPs but New York had greater funding and required tamperproof Rx forms.
Rigg et al., 2010	Role of pain clinics in Rx drug abuse and diversion	In-depth interviews with Rx drug abusers in South Florida who use pain clinics as primary source of drugs (n=30)	Qualitative	Characteristics of pain clinics	Pain clinic pill mills only accept cash as payment; method of payment, especially cash, can be indicator of questionable activity (e.g., doctor shopping).
Ulbrich et al., 2010	Factors influencing pharmacists' enrollment in Ohio's PDMP	Online survey of pharmacists in Ohio (n=2,511)	Descriptive cross-sectional study	Factors influencing enrollment	Non-PDMP pharmacists noted time available to access the PDMP report as top factor affecting decision not to enroll in PDMP.
Wilsey et al., 2010	Profiles multiple provider prescribing of opioids, benzodiazepines, stimulants, and anorectics	California PDMP data, 2007	Modeling study	Predictors of multiple provider episodes (MPEs)	MPEs associated with being prescribed different controlled substances simultaneously.

Appendix A. Published Empirical Studies on PDMP Effectiveness and Candidate Best Practices (continued)

Citation	Study Objective(s)	Study Population and Data Source	Study Design	Outcome(s)	Findings
Bohnert et al., 2011	Association between opioid prescribing patterns and opioid overdose-related deaths	Veteran's Health Administration pharmacy data and National Death Index data, 2004-2008, unintentional opioid overdose decedents (n=750) and random sample of patients who received opioid therapy for pain	Case-cohort design	Opioid dose and schedule and risk of overdose deaths	Higher maximum daily opioid doses associated with risk of overdose deaths.
Feldman et al., 2011	Awareness and use of state PDMP by physicians in Ohio	Survey of physicians (n=95, 61 percent response rate)	Cross-sectional survey	PDMP use rates	Awareness was high (84 percent), but less than 59 percent of respondents had used PDMP; medical specialty had effect on awareness and use of PDMP.
Fischer et al., 2011;	Examine impact of PDMPs on opioid use	Opioid dispensing data from representative sample of 2,700 pharmacies in 10 Canadian provinces, 2005-2010	Longitudinal; controlled (PDMP vs. non-PDMP provinces)	Changes in opioid dispensing rates (ODR) between provinces with and without PDMPs	No significant differences in changes in ODRs between PDMP provinces and non-PDMP provinces.
Fisher et al., 2011a	Effect of PDMP prescriber educational intervention on MEP use	Nova Scotia PDMP records on meperidine use, July 2005 to December 2009	Time series	Number of individuals with at least one MEP Rx filled, number of Rxs, and number of tablets dispensed	Intervention was associated with reduced MEP use, after adjusting for long-term trends in use.
Fisher et al., 2011b	Reviews literature on PDMP impact on benzodiazepine (BZD) use	32 articles on the impact of a New York PDMP for BZDs in early 1990s	Review	Use of BZDs	Suggests PDMP decreases BZD use and may help reduce doctor or pharmacy shopping or BZD diversion, though may have unintended consequences for certain subgroups.
Gilson et al., 2011	Impact of 2005 changes to California's PDMP on opioid Rx rates and associated multiple prescriber episodes (MPEs)	California's PDMP data, 2000-2006	Time series	Changes in Schedule II opioid Rx rates and MPEs associated with these drugs	Change to security form from triplicate Rx form led to rise in MPEs involving all opioids and increased prescribing of some short-acting opioids.
Gomes et al., 2011	Assess relationship between opioid dose and risk of death among nonmalignant chronic pain patients	Ontario residents, Ontario Public Drug Benefit Program (PDMP) database; death data from Office of the Chief Coroner of Ontario	Case control study	Deaths from drug exposures	Higher daily dose of opioids associated with increases in opioid-related mortality; daily doses of 200 mg or more of morphine (or equivalent) associated with very high risk.
Cochella & Bateman, 2011; Johnson et al., 2011	Effect of state-funded media/education program and physician detailing about safe opioid prescribing on overdose deaths in Utah	Medical examiner data on prescription drug-related deaths in Utah, 2007-2009	Pre-post; no control group	Opioid-related prescription drug deaths in Utah	14 percent reduction in opioid-related drug deaths in 2008 and 2009 from 2007.

Appendix A. Published Empirical Studies on PDMP Effectiveness and Candidate Best Practices (continued)

Citation	Study Objective(s)	Study Population and Data Source	Study Design	Outcome(s)	Findings
Paulozzi et al., 2011	Effect of PDMPs on death rates from drug overdose	U.S. mortality data (CDC) by state and year (1999-2005)	Observational study	Rates of drug overdose mortality, opioid mortality, opioid use by state	PDMPs not associated with lower rates of overdose, opioid mortality, or opioid use; PDMP states used more Schedule III hydrocodone, while use rates for Schedule II opioids were not significantly lower; three states (California, New York, Texas) that use special Rx forms showed lower increases in mortality rates and use rates.
Pauly et al., 2011	Compare two types of indicators to monitor Rx drug abuse among users of high-dosage buprenorphine (HDB)	French drug reimbursement database, 2006	Cluster analysis	Doctor-shopping indicator; clustering method of deviant behavior	73 percent of HDB patients had no doctor-shopping behavior, but doctor shopping was higher in patients with deviant profiles.
Wilsey et al., 2011	Analysis of number of multiple prescribers for opioids	California's PDMP data, 1997-2007	Modeling study	Predictors of use of two to five prescribers of opioids in one-year period	Individuals who used two to five providers differed from those using one provider per year, but were not more prone to opioid abuse.
Peirce et al., 2012	Assess association of doctor/pharmacy shopping and risk of drug-related death	Doctor and pharmacy shoppers from West Virginia PDMP database, decedents from drug-related death data.	Case control study	Deaths from drug exposures	Doctor and pharmacy shopping was associated with drug-related death; prescription monitoring programs may be useful in identifying potential shoppers at the point of care.

Appendix B. Unpublished Studies on PDMP Effectiveness and Candidate Best Practices

Citation	Study Objective(s)	Study Population and Data Source	Study Design	Outcome(s)	Findings
United States GAO, 2002	Examine characteristics and effectiveness of 15 state PDMPs	Review of information from DEA and National Alliance for Model State Drug Laws data; interviews with PDMP administrators and stakeholders in Kentucky, Nevada, Utah, and other national experts, 2001-2002	Review, qualitative	Time to investigate drug diversion cases, number of Rxs for controlled substances	States with PDMPs (e.g., Kentucky, Nevada) have reduced the time to investigate drug diversion cases; PDMP states had lower number of Rxs for controlled substances (e.g., OxyContin); border states showed increased Rx rates.
VA Department of Health Professions and VA State Police, 2004	Evaluation of Virginia's PDMP after first year of operation	Virginia PDMP data, 2003 and 2004; survey of physicians, state police drug diversion unit data, 2003-2004	Cross-sectional survey data; pre-post analysis of drug diversion unit data	Physician perception of impact on prescribing Schedule II drugs; time to investigate drug diversion cases	PDMP did not show a chilling effect on Schedule II substances; 36 percent of physicians reported prescribing fewer Schedule II drugs; most of these reported no impact on patient pain management; shorter investigation time for drug diversion cases from 2003 to 2004.
Simeone & Holland, 2006	Effect of PDMPs on supply and abuse of prescription drugs	Integrated data from ARCOS (drug supply) and Treatment Episode Data Set (treatment admissions) with focus on Schedule II drugs, 1997-2003	Modeling study; comparison of states with and without PDMPs	Rx drug sales for Schedule II pain relievers and stimulant drugs	Suggests PDMPs reduce supply and thus probability of abuse of these drugs; proactive Rx monitoring and dissemination of this data to doctors and pharmacists led to 10 percent decrease in Rx sales, which may result in reduced drug abuse, compared to states that did not have PDMPs; proactive states appear to reduce per capita supply of Rx pain relievers and stimulants compared to reactive states.
Twillman, 2006	Evaluate impact of PDMPs on prescribing and on substance abuse	2003 ARCOS data; 2003 TEDS and National Survey on Drug Use and Health data	Observational; controlled (PDMP states vs. non-PDMP states)	Retail distribution of Rx opioids; substance abuse treatment admissions; nonmedical use of Rx opioids in past year	PDMPs appear to result in increases in Schedule III Rxs; PDMP states have higher rates of Rx opioid abuse.
ASPMP, 2007	Assessment of state PDMPs effectiveness and results	Summary of state PDMP reports, surveys, and comments	Cross-sectional survey data	Perceptions of change in prescribing behavior and PDMP effectiveness	74 percent of California physician respondents had changed prescribing behavior due to PDMP; 91 percent rated PDMP effectiveness good to excellent.

Appendix B. Unpublished Studies on PDMP Effectiveness and Candidate Best Practices (continued)

Citation	Study Objective(s)	Study Population and Data Source	Study Design	Outcome(s)	Findings
Lambert, 2007	Impact evaluation of Maine's PDMP. Online Web portal available in 3/2006.	2006 survey of 354 prescribers and 34 pharmacies in Maine's PDMP; stakeholder interviews and PDMP data queries	Cross-sectional	Perceptions of PDMP's usefulness in reducing diversion and doctor shopping	41 percent of prescribers receiving unsolicited reports said their patient had been misusing prescriptions; more than 97 percent of prescribers and pharmacies found the PDMP useful in monitoring Rxs and controlling doctor shopping; no chilling effect; patient confidentiality maintained.
Reifler et al., 2012	Association between PDMPs and state abuse/misuse trends over time	RADARS System Poison Center Program data, 2003-2009	Observational data, controlled (PDMP states vs. non-PDMP states)	Poison center intentional exposure calls as measure of opioid abuse/misuse cases	PDMP states had higher rate of intentional exposures than non-PDMP states, but annual rate of increase in exposures was lower in PDMP states.
Blumenschein et al., 2010	Impact of KASPER on Rx drug abuse and diversion. In 2006, eKASPER created to allow online access to data and real-time receipt of reports	Surveys of prescribers, pharmacists, and law enforcement officials (2009); analysis of national datasets (ARCOS; TEDS) on distribution of controlled substances in Kentucky and nearby states, 1998-2006	Cross-sectional survey data	Perceptions of KASPER's impact on reducing abuse, diversion, and doctor shopping; rates of controlled substance diversion	KASPER users perceive KASPER PDMP as effective in reducing abuse, diversion; KASPER doesn't appear to have chilling effect; states without PDMPs are more likely to have higher rates of controlled substance diversion.
Rosenblatt, 2007	2006 KASPER Satisfaction survey to evaluate satisfaction with new eKASPER system	Survey of prescribers, dispensers, and law enforcement officials, 2006	Cross-sectional survey data	Perceptions of KASPER's usefulness and impact on identifying doctor shopping	After 2006 eKASPER change, there was increase in user belief that KASPER was useful and effective in identifying doctor shopping.
Kentucky Cabinet for Health and Family Services, 2010	2010 KASPER Satisfaction survey to evaluate opinions about the PDMP's usefulness and effectiveness	Survey of prescribers, dispensers, and law enforcement officials, 2010			
Cross-sectional survey data	Perceptions of KASPER's usefulness and impact on identifying doctor shopping	Compared to 2006 survey, KASPER user satisfaction increased and increase in opinion that KASPER was useful and effective in identifying doctor shopping and controlling substance abuse and diversion			
PDMP COE, NFF 1.1, September 2010	Trends in Wyoming PDMP prescription history reporting	Wyoming PDMP data, October 2008-2009	Case study	Number of solicited and unsolicited prescription histories per month, doctor shopping indicators	Reductions in patient doctor shopping reported after proactive reporting.

Appendix B. Unpublished Studies on PDMP Effectiveness and Candidate Best Practices (continued)

Citation	Study Objective(s)	Study Population and Data Source	Study Design	Outcome(s)	Findings
LeMire, 2010	Evaluation of efficacy of North Dakota's PDMP Online Training	Interviews with random sample of prescribers and dispensers who completed training (n=30)	Qualitative	Satisfaction with online training	High level of satisfaction with the training.
DuBose et al., 2011	Develop model for predicting prescriber questionable activity	Physician and patient prescription data	Predictive modeling	Probability of questionable prescribing	Model correctly classified 83 percent of prescribers with disciplinary actions.
PDMP COE, 2011	Briefing on PDMP effectiveness	Published articles, unpublished reports, PDMP COE Notes from the Field, personal communication	Review of published and unpublished literature	Diversion, clinical decision making, doctor shopping, others	Accumulating evidence that PDMPs reduce diversion of controlled substances and improve clinical decision-making.
PDMP COE, NFF 2.1, January 2011	Description of Nevada PDMP's Pre-Criminal Intervention Program (PCIP)	11 closed cases from PCIP	Case study	Number of prescribers, dispensers, and prescriptions post-PCIP	Post-PCIP, the average number of prescribers, dispensers, and prescriptions fell to 4, 4.5, and 34, from 13, 13, and 56 pre-PCIP, respectively.
PDMP COE, NFF 2.2, March, 2011	Using PDMP data in outpatient methadone clinic	Clinic medical director's report on PDMP prescription history data of patients in treatment setting	Case study	Percentage of patients prescribed controlled substances outside of clinic	23 percent of patients were prescribed controlled substances outside of clinic unbeknownst to clinic; anecdotal evidence that use of this data reduced diversion and illicit sale of controlled drugs.
PDMP COE, NFF 2.4, August, 2011	Role of PDMP data in Kentucky drug courts	Interview with Regional Circuit Judge for one drug court in Kentucky	Case study	Drug court participants' diversion or nonmedical use of controlled substances	PDMP data considered a valuable addition to court's monitoring capabilities.
PDMP COE, NFF 2.5, October 2011	Impact of unsolicited reports in Nevada's PDMP	Nevada PDMP data, 1997-2002	Case study	Number of prescribers, dispensers, and dosage units	The average number of prescribers, dispensers, and dosage units decreased for individuals for whom unsolicited reports were sent.
PDMP COE, NFF 2.6, December 2011	Drug-related deaths in Virginia; medical examiner (ME) use of PDMP data	Interview with one Virginia medical examiner	Case study	Impact of PDMP data on ME practice and forensic investigations	Since continuous online access to PDMP data became available in 2009, Virginia medical examiners use PDMP data in their routine practice.
PDMP COE, NFF 3.1, January 2012	Real-time reporting: Oklahoma's pioneering PDMP	Interview with PDMP administrator	Case study	Process and impact of instituting real-time reporting	Oklahoma's PDMP demonstrates the feasibility of real-time reporting, improvements in data quality, and timeliness.

Appendix C. Demonstration Checklist of Candidate PDMP Best Practices

To be used by states to track progress in adopting best practices

Practice	Adoption Status		
	Planned	In progress	Achieved
Data Collection and Data Quality			
Collect data on all schedules of controlled substances			
Adopt latest ASAP reporting standard			
Collect data on nonscheduled drugs implicated in abuse			
Collect positive identification for the person picking up prescriptions			
Collect data on method of payment, including cash transactions			
Reduce data collection interval; move toward real-time data collection			
Institute serialized prescription forms			
Integrate electronic prescribing with PDMP data collection			
Improve data quality:			
Target pharmacy reporting compliance rate			
Target initial data error rate			
Target corrected data error rate			
Target missing data rate			
Data Linking and Analysis			
Link records to permit reliable identification of individuals			
Determine valid criteria for questionable activity:			
Patients			
Prescribers			
Conduct periodic analyses of questionable activity			
Conduct epidemiological analyses for use in surveillance, early warning, evaluation, and prevention			
Develop automated expert systems to expedite analyses and reports			
Record data on disciplinary status and patient lock-ins			
User Access and Report Dissemination			
Provide continuous online access and automated reports to authorized users			
Optimize reporting to fit user needs:			
Batch reporting			
Customized reports			
Integrate PDMP reports:			
Health information exchanges			
Electronic health records			
Pharmacy dispensing systems			
Send unsolicited reports and alerts to appropriate users:			
Prescribers			
Dispensers			
Law enforcement agencies			
Licensure boards			
Patients			
Publicize use and impact of PDMP via websites, presentations, and reports			

Appendix C. Demonstration Checklist of Candidate PDMP Best Practices (continued)

To be used by states to track progress in adopting best practices

Practice	Adoption Status		
	Planned	In progress	Achieved
PDMP Recruitment, Utilization and Education			
Enable access to PDMP data by all appropriate users, encourage innovative applications:			
Prescribers, including monitoring of prescriptions attributed to their own DEA numbers			
Dispensers			
Law enforcement agencies			
Licensure boards			
Patients			
Medicare and Medicaid			
Private third-party payers			
Workers' compensation programs			
Substance abuse treatment clinicians			
Medical examiners			
Drug courts			
Proactively identify and conduct outreach to potential high impact users			
Conduct recruitment campaigns			
Streamline certification and enrollment processing			
Mandate enrollment			
Conduct promotional campaigns			
Improve data timeliness and access			
Conduct user education			
Mandate utilization			
Institute financial incentives			
Delegate access			
Inter-organization Best Practices for PDMPs			
Enact interstate data sharing:			
Model memoranda of understanding			
Standardize data collection fields, formats and transmissions standards			
Identify individuals in multistate data			
Standardize measures for identifying questionable activity			
Data encryption and de-identification			
Collaborate with other health agencies/organizations in applying and linking PDMP data:			
Veterans Affairs			
Indian Health Service			
Department of Defense			
Medicare and Medicaid			
Private third-party payers			

Appendix C. Demonstration Checklist of Candidate PDMP Best Practices (continued)

To be used by states to track progress in adopting best practices

Practice	Adoption Status		
	Planned	In progress	Achieved
Evaluation of PDMPs			
Conduct satisfaction and utilization surveys of end users			
Conduct audits of PDMP system utilization for appropriateness and extent of use			
Use PDMP data as outcome measures in evaluating program and policy changes			
Analyze other outcome data (e.g., overdoses, deaths, hospitalizations, ER visits) to evaluate the PDMP's impact			
Funding PDMPs			
Secure funding that is independent of economic downturns, conflicts of interest, and changes in PDMP policies			
Enact legislation to maintain sufficient funding over time			
Conduct periodic review of PDMP performance to ensure efficient operations and identify opportunities for improvement			

Appendix D: List of Abbreviations

ASAP — American Society for Automation in Pharmacy

ASPMP — Alliance of States with Prescription Monitoring Program

BJA — Bureau of Justice Assistance

BZD — Benzodiazepine

CDC — Centers for Disease Control and Prevention

CMS — Centers for Medicare and Medicaid Services

DAWN — Drug Abuse Warning Network

DEA — Drug Enforcement Administration

DoD —Department of Defense

DSM — Diagnostic and Statistical Manual of Mental Disorders

EHR — Electronic health record

EPCS — Electronic prescribing of controlled substances

FDA — Food and Drug Administration

GAO — Government Accountability Office

HDB — High-dose buprenorphine

HID — Health Information Designs

HIE — Health information exchange

IHS — Indian Health Service, U.S. Department of Health and Human Services

MADPH — Massachusetts Department of Public Health

ME — Medical examiner

MEP — Meperidine

MOU — Memorandum of understanding

MPE — Multiple-provider episodes (being prescribed controlled substances by multiple providers as identified in PDMP data)

NAMSDL — National Association of Model State Drug Laws

NASCSA — National Association of State Controlled Substance Authorities

NASPER — National All Schedules Prescription Electronic Reporting Act

NFF — Notes from the Field

OBOT — Office-based opioid treatment

ODR — Opioid dispensing rate

ONC — Office of the National Coordinator for Health Information Technology

ONDCP — Office of National Drug Control Policy

PDMP — Prescription drug monitoring program

PDMP COE — Prescription Drug Monitoring Program Center of Excellence

PDMP TTAC — Prescription Drug Monitoring Program Training and Technical Assistance Center

PMIX — Prescription Monitoring Information Xchange (RxCheck)

RCT — Randomized controlled trial

SAMHSA — Substance Abuse and Mental Health Services Administration

SBIRT — Screening, brief Intervention, and referral to treatment

TEDS — Treatment episode data set (data collected by SAMHSA on substance abuse treatment admissions)

UR — Unsolicited Reports

VA — Department of Veterans Affairs