Feasibility of Implementing an Opioid Risk Mitigation System in Military Treatment Facilities to Mitigate Drug Use

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FINAL REPORT

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NOTICE AND SIGNATURE PAGE

Feasibility of Implementing an Opioid Risk Mitigation System in Military Treatment Facilities to Mitigate Drug Use

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14. ABSTRACT-
Background: Opioid analgesics are the most misused drug class in the United States, second only to marijuana. Misuse and abuse by military service members is now an urgent concern. Increased use of opioids to treat chronic pain appears to be related to increased opioid misuse and abuse. The 2009 Department of Defense (DoD) Survey of Health Related Behaviors among Active Duty Military Personnel revealed substantial increases in misuse of prescription drugs, attributed overwhelmingly to opioid analgesics. Both overall DoD and Army rates were significantly higher than the civilian rate of prescription drug misuse during the same period. To address similar problems with opioid misuse and abuse, states have initiated electronic prescription monitoring programs (PMP) that track all scheduled medications from pharmacies within the state. Objective: The objective of the project is to utilize PMP technology and innovations to develop and test an opioid-related misuse prevention intervention using surveillance and detection to support clinical care in military settings. We will include standardized population level and individual-user level reports and guidelines to inform utilization of PMP data. This will support future efforts to develop further intervention activities; for example, the development of provider and patient educational activities and brief interventions similar to those that have been developed by state PMPs Study Design: We will use a combination of quantitative and qualitative methods to: (1) develop and test prescription database search algorithms (similar to those used in state PMPs) for identifying potential opioid misuse within the military setting; (2) generate and evaluate standardized reports and guidance documents in preparation for implementing a 'provider-focused' query and reporting system appropriate to the military context; and (3) develop a final set of intervention recommendations suitable for implementation the DOD Military Health System. Quantitative data will be extracted from the DoD Prescription Drug Tracking System (PDTS) and linked with linked patient data from the Military Health System (MHS) Data Repository (MDR).

15. SUBJECT TERMS-

Opioid risk mitigation; Military health system; Clinical Decision Support; Prescription monitoring program; Feasibility

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1.0   EXECUTIVE SUMMARY

Opioid analgesics (OA) are the most misused drug class in the United States (US), second only to marijuana. Misuse and abuse by military service members is now an urgent concern. Increased use of opioids to treat chronic pain appears to be related to increased opioid misuse and abuse. The 2009 Department of Defense (DoD) Survey of Health Related Behaviors among Active Duty Military Personnel revealed substantial increases in misuse of prescription drugs, attributed overwhelmingly to opioid analgesics. Both overall DoD and Army rates were significantly higher than the civilian rate of prescription drug misuse during the same period. To address similar problems with opioid misuse and abuse, states have initiated electronic prescription monitoring programs (PMP) that track all scheduled medications from pharmacies within the state.

2.0   INTRODUCTION

Accompanying this rise in opioid prescriptions is a staggeringly high increase in individuals seeking treatment for opioid addiction and opioid-related deaths. The consequences of opioid misuse include a dramatic increase in opioid-related emergency department visits, poisoning deaths, opioid-related addiction treatment, and suicides.

Unfortunately, the opioid misuse epidemic has not spared the United States (US) military. In the Army, oxycodone and hydrocodone are commonly prescribed. The 2009 Department of Defense (DoD) Survey of Health Related Behaviors among Active Duty Military Personnel reported a substantial increase in opioid misuse, doubling from 2002-2005 and nearly tripling from 2005-2008. In 2008, 10.1% of active duty military personnel misused opioids in the prior month while 17.2% misused in the preceding 12 months. Military leadership and the Institute of Medicine committee on substance use disorders in the military identified improving the surveillance and monitoring of opioid prescribing as a military health priority to prevent opioid misuse and reduce opioid-related morbidity and mortality.

In response to the opioid misuse and problem in the US, there is now increased surveillance and monitoring of prescription drug use and misuse across a variety of domains. This includes the advent of federally-funded, state-implemented prescription drug monitoring programs (PDMPs). Most PDMPs track all controlled substances (Schedules II-V) from all payers dispensed at non-Federal pharmacies within the state. Within the military, a PDMP has a variety of potential disease prevention and health promotion applications including as a resource to monitor individual patient prescribing, to conduct military health surveillance and intervention, to allow detection of illicit behaviors, to improve pharmacy practices, and to track medical and nonmedical use of prescriptions to inform policy on prescribing, medication access, racial disparities and other issues. Prescription monitoring is part of a balanced approach ensuring appropriate access to scheduled medications for those who need them while minimizing risk of abuse and addiction.

Implementing an opioid risk mitigation (ORM) system in the military context is not without challenges. Preliminary research is needed to create intervention materials, evaluate potential barriers and facilitators to implementing the system, and determine the best trial design to test the

system. We conducted preliminary feasibility/proof of concept research of an opioid misuse prevention intervention including the development of provider and patient educational activities and brief interventions similar to those that have been developed by state prescription monitoring programs (PMP) that will support clinical care in military settings with their inherent unique challenges.

This work is a mixed-methods project with a quantitative (project 1) and qualitative component (project 2). This report addresses project 2, the qualitative component.

AIM 1: To develop and examine feasibility issues related to implementing a PMP in the Military Health System (MHS).
   a) Using results from Project 1 (quantitative), develop the PDMP system including population and individual-user reports, and accompanying guidance documents, indicating patients who may be at risk for misuse of opioids or adverse events related to opioid use.
   b) Assess patient-, provider-, and system-level barriers and facilitators to implementing our opioid risk mitigation system in military settings using mixed-method process evaluation to provide important information on factors affecting implementation.

3.0   METHODS, ASSUMPTIONS AND PROCEDURES

3.1   AIM 1: Develop and examine feasibility issues related to implementing a prescription monitoring program in the Military Health System

3.1.1   Sub-aim A.

Using results from Project 1 (quantitative) develop the PMP system including population and individual-user reports, and accompanying guidance documents, indicating patients who may be at risk for misuse of opioids or adverse events related to opioid use.

3.1.2   Sub-aim B.

Assess patient-, provider-, and system-level barriers and facilitators to implementing our opioid risk mitigation system in military settings using mixed-method process evaluation to provide important information on factors affecting implementation.

3.1.3   Methods.

A hybrid of two waves of data collection and analysis were conducted for Sub-aim A and B (A-1 and A-2).

Wave 1 data collection: Identifying barriers and facilitators
We conducted semi-structured qualitative interviews with 26 health care professionals (HCP) practicing within a large tertiary care hospital in the MHS. We focused on providers representing multiple specialties in order to identify a core list of provider knowledge, attitudes and behaviors around opioid prescribing and monitoring that can be further expanded upon and refined in future research.

Participant Recruitment

After securing support of key leadership within the hospital's command structure, we contacted HCPs (table 1) across the facility by using a strategy of snowball sampling. We focused primarily on emergency medicine, primary care, and pain medicine services, but were also directed to other providers and staff within the organization. We contacted potential participants by e-mail or phone and requested their participation in brief (15–20 min) telephone interviews to discuss the potential for implementing an MHS-based PMP.

Table 1. Characteristics of participating health care providers (n=26)

Table 1. Characteristics of participating health care providers (n = 26)

Characteristic	n
Gender	
Male	18
Female	8
Provider Type	
MD	18
DO	3
PA	1
RN	2
PharmD	1
PsyD	1
Branch of Service	
Army	12
Air Force	9
Retired Military	1
Civilian	4
Specialty/Service	
Emergency Medicine	12
Internal Medicine	3
Pain Management	7
Other	4

Interview Strategies

We conducted a comprehensive literature search on the implementation of PMPs and other Clinical Decision Support (CDS) for opioid risk mitigation and factors affecting acceptability and usability. A discussion guide was then developed drawing upon prior study findings and following the Promoting Action on Research Implementation (PARiHS) framework. Questions inquired about professional role and training, knowledge of and behaviors around opioid prescribing and monitoring, prior experiences of PMPs, and potential benefits of and barriers to a military-based PMP or other CDS.

Interviews were conducted by a research team led by a PhD-level anthropologist who engaged in intensive training with other team members to ensure consistency across interviews. The semi structured nature of the discussion guide allowed interviewers to follow relevant topics introduced by interviewees and open new lines of inquiry when appropriate. Interviews were audio-record, due to the sensitivity of discussions around opioid prescribing and in order to ensure anonymity and encourage participants to speak freely. All study procedures were approved by the Institutional Review Board of record, and waivers of written consent were obtained. An information sheet was e-mailed to participants prior to the interview, and verbal consent was provided at the time of the interview. All interviews were conducted by at least 2

individuals, with 1 conducting the interview and another 1 to 2 team members taking notes. Notes were reviewed by both members of the interviewing team at the close of each interview to ensure accuracy and completeness.

<u>Wave 2 data collection: Evaluating opioid risk mitigation tools</u>
We conducted semi-structured panel discussions with HCPs within a DoD, Veterans Affairs (VA), and civilian health system. Six focus groups were conducted via teleconference with 18 experts, 13 of whom participated in two groups occurring on separate days, allowing for in-depth, extended discussion.

Participant Recruitment
We selected experts (table 2) from various specialties such as preventative medicine, family medicine, primary care, emergency medicine and pain medicine, with the goal of eliciting feedback from HCPs whose scope of practice was relevant to opioid prescribing and monitoring. We contacted experts located nationally by sending an invitation letter via email and requesting their participation in two expert panels (90 minutes each) hosted on a web-based platform, Adobe Connect, compatible with DoD and VA installation regulations. Experts consented to participate by responding to the invitation email and were compensated $200 per session. The purpose of the sessions was to discuss the challenges and opportunities of opioid risk mitigation practices across DoD, VA and civilian health systems and to evaluate the individual-user reports (i.e. Provider Report Card and Patient Case Summary), in order to provide feedback regarding feasibility, contextual readiness, barriers and facilitators related to implementation of PDMP reports and/or clinical decision support tools in the MHS.

Table 2. Characteristics of participating health care providers (n=18)

Characteristic	n
Gender	
Male	13
Female	5
Specialty/Service*	
Clinicians	10
Research	10
Policy	8
Location	
Civilian	11
Military	5
VA	5

* Note: participants are not mutually exclusive because provided fall into multiple rolls; VA = Veterans Affair; Specialties include pain medicine, emergency medicine, toxicologist, preventive medicine, professors of psychiatry, preventive medicine, pharmacology

Interview Strategies
We conducted six expert panel discussions via Adobe Connect in May 2017, as well as four individual sessions with those who could not attend group sessions. Eighteen experts participated in the panel discussions held on separate days, with the average number of four participants in each discussion. Building on prior semi-structured interviews conducted with HCPs (Wave 1), interview questions were developed to discuss: (a) challenges in opioid risk mitigation, (b) how best to support providers in safe and appropriate opioid prescribing across DoD, VA, and civilian

health systems, and (c) barriers and facilitators in implementing developed CDS tools (i.e. Provider Report Card and Patient Case Summary) in the MHS. The process used a semi-structured interview guide led by either a PhD-level medical anthropologist or a clinical psychologist to encourage discussion and allow for in-depth exploration of the challenges providers face with opioid risk mitigation, and safe and appropriate opioid prevention, screening and treatment. Due to the sensitivity of discussions around opioid monitoring and prescribing, HCPs provided verbal consent prior to audio and visual recording in order to encourage participants to speak freely and ensure anonymity. In addition, experts were informed that findings from these discussions would be published, and they would be included in the acknowledgments of any resulting manuscript. The institutional review board approved all study procedures and focus groups were recorded for transcription purposes.

3.1.4   Data Analysis.

Wave 1
Completed notes were cleaned of potential identifiers and entered into Dedoose for qualitative analysis. Two different analytic approaches were required to accomplish our research objectives, and therefore we conducted qualitative analysis using an integration of matrix and grounded theory techniques. Members of the research team independently reviewed an initial set of 3 interviews to identify and code for text addressing PARiHS domains. Team members then convened to discuss preliminary coding, make refinements to the coding scheme, and further define the coding manual. A second round of coding was then performed using grounded theory analysis. Members of the research team reviewed all interview notes and met repeatedly to discuss and identify novel themes that emerged in the data, iteratively refining a secondary set of inductively derived codes. Once this coding schema was finalized, all interview notes were independently coded by at least 2 team members, with discrepancies reviewed with a third team member to allow for discussion toward consensus. The final content of thematic codes was reviewed and merged to identify provider knowledge, attitudes and behaviors around opioid prescription and monitoring, as well as their attitude towards PDMP and other CDS tools.

Wave 2
Recoded expert panel discussions were transcribed by GMR Transcription and 2 research team members and uploaded into ATLAS.ti for qualitative analysis. Transcripts were coded using grounded theory, resulting in generation of a summative framework describing the current climate of opioid prescribing, provider's perspective of ORM tools, and suggestions for targeted solutions. Members of the research team reviewed all transcripts and met repeatedly to discuss and identify novel themes that emerged from the data, iteratively refining a secondary set of inductively derived codes. At least two team members independently coded all transcripts, with discrepancies reviewed by a third team member to allow for discussion toward consensus. The content of thematic codes was reviewed and synthesized to identify experts' perspectives on challenges in opioid risk mitigation, implementation of CDS tools in the MHS, and the best way to support providers in safe and appropriate opioid prescribing across DoD, VA, and civilian health systems.

4.0   MAJOR EVENTS/MILESTONES/SUCCESS

- Poster presentation at the 2015 Association of Military Surgeons of the United States (AMSUS)
- Phase 1 data collection completed – September 2016
- Symposium presentation at the 2016 San Antonio Military Health System and Universities Research Forum (SURF)
- Poster presentation at the 2016 College on Problems of Drug Dependence (CPDD)
- Poster and Oral presentation at the 2016 Conference on the Science of Dissemination and Implementation in Health (D&I)
- Poster presentation at the 2017 Behavior, Biology, and Chemistry: Translational Research in Addiction Conference (BBC)
- Poster presentation at the 2017 Institute for Integration of Medicine and Sciences Community Engagement Symposium
- Manuscript on implementation of PDMP/CDS submitted to Journal of Pain – February 2017 (not accepted)
- Phase 2 Expert Reviews completed - June 2017
- Manuscript on implementation of PDMP/CDS accepted to the *Journal of American Medical Informatics Association* – June 2017
- Poster presentation at the 2017 Military Health System Research Symposium (MHSRS)
- Phase 2 Expert Reviews completed - June 2017
- Manuscript on PDMP impact accepted to *BMC Health Services Research* – June 2017

5.0   RISK ASSESSMENT

5.1   Risk Analysis

Delays during the project:
- Due to project consisting of integrated components (i.e. project 1 - quantitative and project 2 – qualitative) delays in project 1 pushed back reaching milestones as scheduled.
- Due to scheduling challenges associated with convening multiple experts located statewide, Wave 2 panel discussions were divided into two sessions on two separate days, and for those who could not attend either, individual interviews were scheduled.

5.2   Technical Challenges

None.

6.0   TRANSITION PLAN

6.1   Military Relevance

Opioid Analgesic (OA) misuse is a health risk for military members and other beneficiaries exposed to opioid analgesics as part of their medical care. It is associated with high rates of military suicides and other adverse events. The impact on service members and their families is significant, particularly when the outcome is progression to a substance use disorder or death. On the other hand, safe and appropriate access to opioids is also important. Thus, a balanced approach is need.

Opioid prescription monitoring systems provide information to HCPs in the MHS to assist them making opioid prescribing decisions and ensuring opioid risk mitigation. Military providers have reported significant need for training and clinical decision support to achieve safe and appropriate opioid monitoring and prescribing. Our research suggests that military HCPs are more likely to value and use PMPs and other CDS tools if they perceive them as valuable to patient-centered care. Therefore, use of PMP must include (1) support for incorporating PMP use into the clinical workflow and (2) training and education in integrating PMP use with Clinical Practice Guidelines as part of safe and appropriate patient-centered care and opioid access (D – 1).

The developed CDS tools, the Provider Report Card and Patient Case Summary, specifically addressed this military health problem and would positively impact MHS providers opioid related monitoring and prescription practices by increasing their PMP use and ultimately preventing opioid-related misuse among military members and beneficiaries.
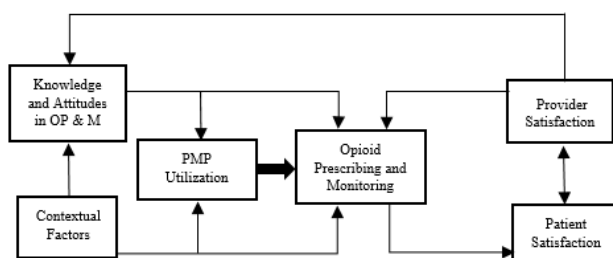
Figure 1. MHS-tailored PMP implementation framework

6.2   Transition Strategy

As a result of this work, we provide MHS leadership with actionable recommendations and concrete CDS tools regarding opioid risk mitigation, such as the Provider Report Card and Patient Case Summary. Using existing data resources within the MHS, it is possible to implement opioid risk mitigation; for example, via the population health portal. However, evaluation is critical to establish effectiveness and minimize unintended adverse consequences on patient care. We propose the transition requires ongoing development of training tools to disseminate best practices, add to the CDS system available to health care providers, and to evaluate their effectiveness.

7.0   RESULTS

7.1   Sub-aim A: Using results of Project 1 (quantitative), develop the PMP system including population and individual-user reports, and accompanying guidance documents, indicating patients who may be at risk for misuse of opioids or adverse events related to opioid use.

7.2   Sub-aim B: Assess patient-, provider-, and system-level barriers and facilitators to implementing our opioid risk mitigation system in military settings using mixed-method process evaluation to provide important information on factors affecting implementation.

We conducted interviews with 26 HCPs in the spring of 2016. The majority of them worked in the MHS and 2 had left to practice in the civilian sector. In addition, we conducted focus groups with an expert panel of 18 HCPs practicing within a DoD, VA, and civilian health system in May 2017.

Aim 1 A: Individual-user reports and accompanying guidance documents
Providers made a variety of suggestions for information they would like included in the individual-user reports to increase their use of a PMP or other CDS tools. Examples are mentioned below.

(1) Patient Medication Information. Providers desired a rapid overview of patients' prior medical history (e.g., diagnoses, surgery) and patterns in their receiving and refilling of controlled substances, including trends over time. Providers requested data on medications, including drug names, quantities prescribed, fill dates and locations, and numbers of providers from whom prescriptions were received, for a preferred time span ranging from a few weeks to 5 years.
(2) Patient Visits. Providers were also interested in receiving data on care utilization, including visits to primary and specialty care and emergency medicine.
(3) Alerts/Resources: Multiple providers expressed a desire for resources such as automatic alerts for potential misuse, information regarding clinical practice guidelines, and recommended next steps. Suggestions included a medication inventory available at the touch of a button, a scoring system to signal patients at high risk for opioid misuse, and a metric for comparing opioid medications to understand their equivalence (e.g., morphine milligram equivalents).
(4) Easy Access. Providers also stated the desire of real-time data and a seamless integration with their current EHR that included military and state data in one centralized location. If the data could not be integrated with their EHR system, providers preferred that the report be easily accessed through either a web link or a reliable server via a user-friendly site and login, and presented in a format that would allow for easy cut-and-paste into the EHR.

As a result, we gathered all of their suggestions and developed the provider report card and patient case summary. Both tools were reviewed during the expert panel discussions, allowing HCPs to provide us with feedback regarding feasibility, contextual readiness, barriers and facilitators related to implementation of the CDS tools in the MHS.

Provider Report Card. Providers noted that the provider report card would be helpful at the leadership level and useful for primary care and emergency departments. They found the layout to be visually appeasing and stated it was the cleanest and easiest metric to interpret of all the metric report cards they had seen.

Patient Case Summary: Providers reported the patient case summary to be useful for assessing addiction and opioid risk, as it illustrates a snapshot of a patient's opioid use over time. They viewed the patient case summary as a great asset to use as a conversation piece to speak to their patients about their medications and usage. In addition, providers felt the tools would have a positive impact on their practice and could be used as a back-up when deciding not to prescribe an opioid.

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<u>Barriers</u>. Providers stated that patients differ between clinics, as some HCPs may have more high-risk patients. Another concern is that the tools may be used punitively again them and further contribute to burn out. A significant barrier mentioned is the seamless integration of these tools in the military EHR. Nonetheless, HCPs provided us with numerous valuable suggestions to refine the tools to support clinical decision making and use of PMPs in the MHS.

<u>Aim 1 B: Barriers and facilitators in implementing an ORM system in the MHS</u>
Providers identified various barriers and facilitators to implementing an ORM system in the military setting. Some of the factors affecting implementation include: (1) provider's prior training and experiences with PDMPs, (2) patient population, (3) emphasis on patient satisfaction, (4) leadership support, (5) military provider licensing, (6) time and workload burden, and (7) integration between military PDMP and EHR. Specific examples are highlighted below.

(1) <u>Training:</u> Providers reported receiving different levels of formal training in pain management or substance abuse. Some stated learning "on the job," in "sparse" lectures during residency, or as part of continuing education. Similar variation was reported for knowledge of and use of PDMPs. A few providers noted that, because an in-state medical license is not required to practice in a military health care facility, many military providers do not hold a medical license in their state of practice.

(2) <u>Population</u>. Military facility population consist of not only the active duty service member, but also their dependent spouses and children, and retired military personnel or spouses. Therefore, providers noted that PDMPs would have to account for the diverse patient population and the various challenges in serving this population, including the requirement of ensuring mission readiness, making sure that "they're prepared to [deploy] and well suited for the job," as well as caring for service members with multiple comorbidities, including depression and Post Traumatic Stress Disorder (PTSD), and wounded service members who may have a long prior history with pain medications.

(3) <u>Patient Satisfaction</u>: Some providers, particularly in the emergency care setting, also noted that patient satisfaction can be linked to whether or not patients feel they received adequate pain control. One provider suggested that this could "affect salary," although other providers said that complaints are typically reviewed by providers who are cognizant that "the customer is not always right."

(4) <u>Leadership Support:</u> Provider concerns underscore the importance of leadership structure and chain of command within military health care settings, which has direct implications not only for how patient complaints are handled (and thus the environment of care), but also for how individual commanders choose to handle evidence of substance abuse among their service members. One respondent also noted that "getting through military channels and getting acceptance" was likely to be a significant barrier in PDMP implementation.

(5) <u>Licensing</u>: Another significant challenge is many of those responsible for prescribing and care management are not physicians, making it difficult for clinical team members such as nurses, nurse practitioners, and physician assistants to access PDMP data. Because providers in a military facility typically function in a medical home–like team structure, this also limits the flexibility of team workflow by making the physician the only team member able to conduct PDMP searches.

(6) <u>Time and workload</u>: Military HCPs noted they work under considerable time pressure and have to already check multiple EHR's while treating their patients. They expressed concern in adding on an additional tool which would require more time, contain complex logins, include multiple steps and would need to be seamlessly integrated with existing resources.

(7) <u>Integration:</u> With regard to the interface of potential PDMP reports, most physicians requested streamlined integration of the report with their existing EHR system (i.e., the Armed Forces Health Longitudinal Technology Application, the Composite Health Care System, or Cerner).

8.0   CONCLUSION/DISCUSSION

We utilized a combination of quantitative and qualitative methods to generate and evaluate standardized reports and guidance documents in preparation for implementing a 'provider-focused' query and reporting system appropriate to the military context, and develop a final set of recommendations regarding ORM suitable for implementation in the DoD MHS.

CDS tools around ORM aid providers to making safe and effective opioid prescribing decisions and to monitor their patients. Providers reported complex decision making around opioid prescribing and monitoring. As a result of this work, we are able to provide military leadership with actionable ORM recommendations and tools (i.e. provider report care and patient case summary) military providers may use when treating their diverse patient population in the MHS. Additionally, these recommendations and tools will assist in increasing provider's usage of state PMPs and aid in decreasing opioid use among military service members. Nonetheless, there was a general agreement that CDS tools would benefit both military and civilian HCPs, especially with a seamless integration in both sectors current EHR.

Overall, while evaluation of the tools is critical to establish effectiveness, they offer a potential solution to the opioid epidemic. This benefits active duty service members and other beneficiaries. These tools and recommendations have implications beyond the MHS as they may also aid civilian providers with ORM, particularly if they are easy to access and use, are compatible with existing information technology systems, and supported by initial and ongoing training.

In conclusion, ORM recommendations and tools assist providers in practicing safe and appropriate opioid prescribing and monitoring. Continued refinement of the tools and recommendations will aid providers in visualizing their patient's conditions and prescription over time, and assist with the opioid crisis by reducing potential misuse and addiction among service members and their beneficiaries.

9.0   DELIVERABLES

9.1   **Publications** (A - 1 and A - 2)

1) Evaluating the impact of prescription drug monitoring program implementation: a scoping review (2017)
2) Implementing prescription drug monitoring and other clinical decision support for

opioid risk mitigation in a military health care setting: a qualitative feasibility study (2017)

9.2 Presentations (B - 1 to B - 8)

1) Poster presentation at the 2015 Association of Military Surgeons of the United States (AMSUS)
2) Symposium presentation at the 2016 San Antonio Military Health System and Universities Research Forum (SURF)
3) Poster presentation at the 2016 College on Problems of Drug Dependence (CPDD)
4) Oral presentation at the 2016 Conference on the Science of Dissemination and Implementation in Health (D&I)
5) Poster presentation at the 2016 Conference on the Science of Dissemination and Implementation in Health (D&I)
6) Poster presentation at the 2017 Behavior, Biology, and Chemistry: Translational Research in Addiction Conference (BBC)
7) Poster presentation at the 2017 Institute for Integration of Medicine and Sciences Community Engagement Symposium
8) Poster presentation at the 2017 Military Health System Research Symposium (MHSRS)

9.3 ORM Tools (C - 1 and C - 2)

1) Provider Report Card
2) Patient Case Summary

10.0 COST

This work was funded by the Substance Abuse Working Group (SAWG) of the Joint Program Committee 5 (JPC-5) / Military Operational Medicine Research Program (MOMRP), US Army Medical Research and Materiel Command (USAMRMC). FY15 funding under Project Air Force Research Laboratory FA8650-15-C-6588 P2 of $523,646.00 was received January 2015 and all funds were expended by January 2018.

11.0 TABLES AND FIGURES

11.1 Tables

Table 1. Characteristics of participating health care providers (n=26)
Table 2. Characteristics of participating health care providers (n=18)

11.2 Figures

Figure 1. MHS-tailored PMP implementation framework

A – 1 Evaluating the impact of prescription drug monitoring program implementation: a scoping review (2017)

A – 2 Implementing prescription drug monitoring and other clinical decision support for opioid risk mitigation in a military health care setting: a qualitative feasibility study (2017)

BMC Health Services Research

Evaluating the impact of prescription drug monitoring program implementation: a scoping review

CrossMark

Erin P. Finley[1,2*], Ashley Garcia[1], Kristen Rosen[1], Don McGeary[1], Mary Jo Pugh[1,2] and Jennifer Sharpe Potter[1]

Abstract

Background: Prescription drug monitoring programs (PDMPs) have been implemented in 49 out of 50 states in an effort to reduce opioid-related misuse, abuse, and mortality, yet the literature evaluating the impact of PDMP implementation remains limited. We conducted a scoping review to: (1) describe available evidence regarding impact of PDMPs in the U.S.; and (2) propose a conceptual model to inform future PDMP implementation and evaluation efforts.

Methods: Scoping systematic review following Arksey and O'Malley's (2005) methodology. We identified 11 relevant studies based on inclusion criteria using a PubMed database search of English-language studies published 1/1/2000–5/31/16. Data were extracted and thematic analysis conducted to synthesize results.

Results: Extant evidence for the impact of PDMPs as an opioid risk mitigation tool remains mixed. Thematic analysis revealed four domains of opioid-related outcomes frequently examined in original studies evaluating PDMP implementation: (1) opioid prescribing; (2) opioid diversion and supply; (3) opioid misuse; and (4) opioid-related morbidity and mortality. An evaluation framework incorporating these domains is presented that highlights significant gaps in empirical research across each of these domains.

Conclusions: Evidence for the impact of state-level PDMPs remains mixed. We propose a conceptual model for evaluating PDMP implementation toward the goals of clarifying PDMP mechanisms of impact, identifying characteristics of PDMPs associated with best outcomes, and maximizing the utility of PDMP policy and implementation to reduce opioid-related public health burden.

Keywords: Prescription Monitoring Program, Opioid Risk Mitigation, Scoping Review, Evaluation, Health policy

Background

Misuse of opioid analgesics is an urgent public health concern. Findings from the 2014 National Survey on Drug Use and Health revealed non-medical use of opioid analgesics is second only to marijuana with respect to illicit substance use [1]. Since the early 90's, opioid prescribing and dispensing rates have increased, accompanied by an increase in opioid overdose morbidity and mortality rates [2, 3]. As of 2014, 4.3 million individuals within the U.S. reported non-medical use of opioids within the past month [1], and more deaths from drug overdose were recorded than in any previous year. Of the 47,055 overdose deaths that occurred, 61% were caused by prescription opioids [4].

To address the growing problem of opioid misuse and abuse, 49 of 50 states in the U.S. have implemented electronic prescription drug monitoring programs (PDMPs) that track scheduled medications dispensed from pharmacies in an effort to mitigate prescription misuse and diversion, often with financial support from the U.S. Bureau of Justice Assistance [5]. PDMPs require routine, scheduled reporting by pharmacies of prescription-related data for all medications of interest. Typically such information includes medication data for the past year, date medications were dispensed, and information on patient, prescriber, pharmacy, medicine, and dose. Fulfilling both healthcare and legal functions, PDMPs can be used to generate individual-level reports providing a list of all scheduled

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prescriptions dispensed during a given period of time, or population-level reports identifying broader epidemiologic trends in controlled substance use within and across states. Law enforcement agencies have made use of PDMP data to identify fraudulent prescribing or illegal activity related to diverting controlled substances [6]. Prescribers and pharmacists have access to patients' medication data and, in some states, unsolicited reports may be delivered if embedded algorithms detect patterns indicating potential misuse, abuse, or diversion [5]. These algorithms vary by state, but may, for example, be triggered when a patient receives scheduled medications from five or more prescribers at five or more pharmacies ("5 × 5″), or three or more early refills within a 3 months period ("3 × 3″) [5].

Although PDMP implementation occurred as early as 1939 in California, and in 1972 in Pennsylvania, many states have initiated PDMPs only within the past decade. In 2001, only 16 had passed legislation regarding the implementation of PDMPs, but by 2012, 49 states had passed similar legislation [5]. Because PDMPs have been adopted at the level of individual states, there is considerable variation in state policy regarding such elements as data reporting, how queries are generated, and the responsibilities of prescribers and law enforcement in prescription monitoring [7]. For example, states such as Delaware, North Dakota, and Utah mandate providers query the PDMP based on subjective "judgment of inappropriate use", while Oklahoma requires prescribers to check its PDMP only when prescribing, administering, or dispensing methadone [7]. Perhaps as a result of this diversity, relatively little empirical research has examined the impact of PDMPs on opioid-related outcomes of concern, and PDMPs' effectiveness as an opioid risk mitigation tool remains to be determined. Although selected best practices for PDMPs have been proposed [8], including recommendations that both provider enrollment and utilization be mandated, no standardized model has yet been proposed to facilitate evaluation or comparison of PDMP-related impacts. Defining the desired outcomes of PDMPs and the suspected mechanisms underlying these outcomes is likely to be of value in efforts to improve existing PDMPs and structure those being newly implemented in other systems, particularly in providing a rubric for evaluation that supports valid and reliable assessment of complex PDMP models across diverse settings.

The goals of the current project were therefore to: (1) synthesize the available evidence regarding the impact of PDMP policy and implementation on opioid analgesic misuse within the U.S.; and (2) building upon this literature, to develop a conceptual model in support of future efforts to evaluate PDMP implementation. To these ends, we conducted a scoping review. Scoping reviews are considered preferable to a traditional systematic review when

the aim is to "map rapidly the key concepts underpinning a research area and the main sources and types of evidence available" [9]. Scoping reviews are of particular value in enabling synthesis of research that is complex and makes use of a variety of study designs. Because they allow for summary of studies drawing upon diverse outcome measures, as is the case with the emerging literature on PDMPs [10], they can facilitate rapid dissemination of knowledge where the extant research does not yet support systematic review.

Method
We followed the five steps of the Arksey and O'Malley [9] method for scoping studies (Table 1), which include: 1) identifying one or more research goals; 2) identifying relevant studies; 3) selecting appropriate studies for data extraction; 4) charting the data in selected studies; and 5) collating, summarizing, and reporting results. We began by identifying our primary goal as describing the available evidence regarding impact of PDMPs in the United States. Our secondary objective was to propose a conceptual model for PDMP evaluation to inform implementation and refinement efforts and identify key gaps in existing research.

Search strategy
An initial PubMed database search for English-language peer-reviewed articles was carried out using the key words "prescription drug monitoring program" and "opioid prescription monitoring program". Non-human studies were eliminated through filtering. As noted above, the majority of PDMPs proliferated between 2001 and 2012; to ensure inclusion of relevant studies, we included articles published between 1/1/2000 and 08/18/2015. One hundred twenty-one relevant articles were identified using this approach. An additional 10 studies were identified from review of article references from the initial search. Publications were then reviewed to assess for inclusion criteria defined a priori, specifically: peer-reviewed; presents original research; provides direct assessment of outcomes related to impact or effectiveness of PDMP implementation. Following this process (summarized in Fig. 1), 10 articles remained for review and synthesis. Prior to submission, an updated search for newly published research through 05/31/2016 was conducted by the authors using the same strategy for search and review, resulting in the addition of one article meeting inclusion criteria. The final number of articles included was 11.

Data synthesis and analysis
For the purpose of understanding key concepts and sources of evidence in this literature, thematic analysis was conducted following article review in the course of meetings by the research team, and a data

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Table 1 Overview of Scoping Review (Adapted from Arksey and O'Malley [9])

Step 1. Identify research goal(s)	1) Describe available evidence regarding impact of PDMPs in the United States; 2) Propose a conceptual model for PDMP evaluation to inform future implementation and evaluation efforts.
Step 2. Identify relevant studies	PubMed database search of English-language studies published between 1/1/2000−08/18/2015 using key words "Prescription drug monitoring program" and "Opioid prescription monitoring program". Inclusion criteria: human; English language; original research; peer-reviewed; direct assessment of outcomes related to impact or effectiveness of PDMP implementation. Additional studies were identified using reference lists of relevant articles. Prior to submission, this search was updated to include articles from 8/19/2015−5/31/16.
Step 3. Study selection	Irrelevant and duplicate articles were identified by two reviewers at the abstract and title level. Systematic reviews, commentaries, and non-U.S. studies were excluded. Full text of original studies remaining was examined by two reviewers. A third reviewer provided input as needed to achieve consensus.
Step 4. Charting the data	A data chart collection form was developed to facilitate extraction of findings and key contextual factors from each study. Consistent with scoping methodology, this sheet was updated collectively and iteratively as familiarity with literature increased. Two reviewers independently assessed articles, then met to determine compatibility in approaches. A third reviewer provided input when needed to achieve consensus.
Step 5: Collating, summarizing, and reporting results	The authorship team then independently and collaboratively reviewed summative findings of the data extract, resulting in: identification of distinct domains of opioid-related outcomes hypothesized to be associated with PDMP implementation; conceptualization of an evaluation framework; and synthesis of current PDMP research findings, including recognition of research gaps.

chart developed for extracting findings and key contextual indicators. Each article was reviewed for data extraction by two members of the research team, with discrepancies resolved through discussion and consensus in meetings with a third reviewer and ultimately, with the full authorship team. The authorship team then independently and collaboratively reviewed summative findings of the data extract, resulting in: identification of distinct domains of opioid-related outcomes hypothesized to be associated with PDMP implementation; conceptualization of an evaluation framework building upon these domains; and synthesis of current PDMP research findings, including recognition of research gaps.
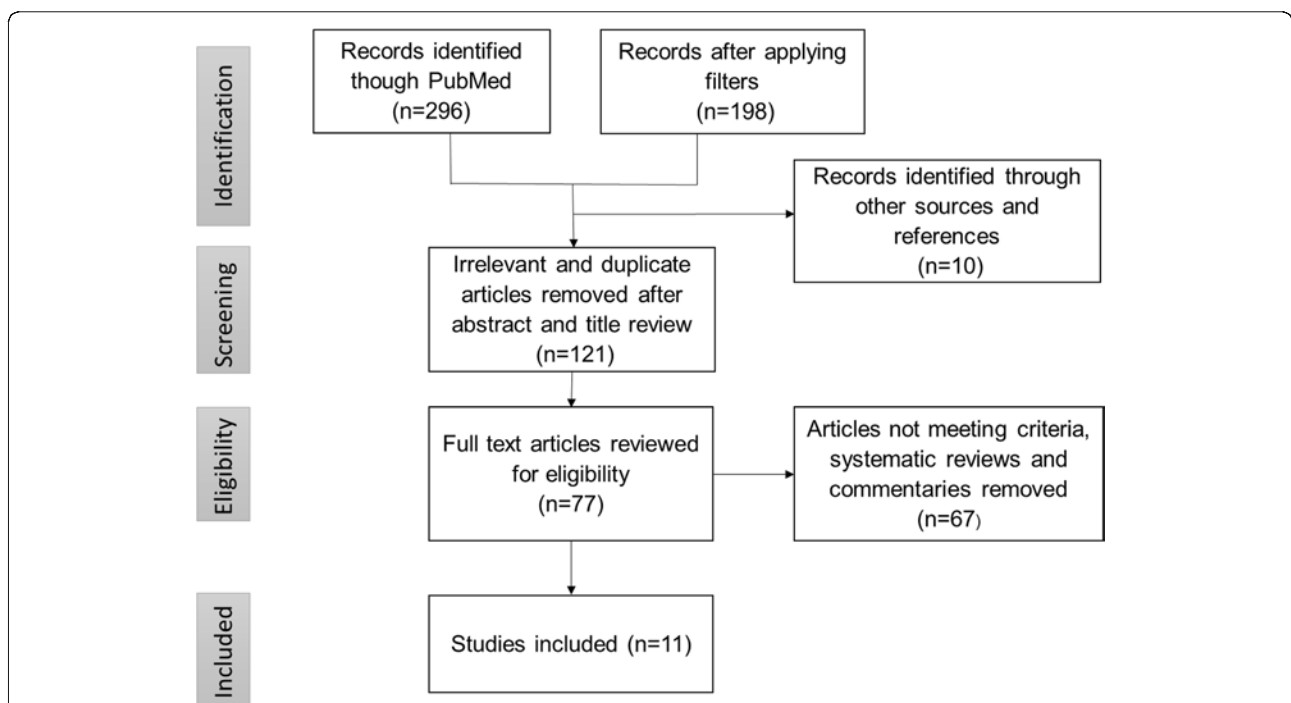
Fig. 1 Article Identification and Selection Process (Adapted from PRISMA (Moher, [24])). *Figure Note: Prior to submission, an updated search for newly published research through 05/31/2016 was conducted by the authors using the same strategy for search and review, resulting in the addition of one article meeting inclusion criteria. The final number of articles included was 11

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Results

Thematic analysis

Thematic analysis revealed that studies of PDMPs generally emphasize an underlying link between opioid prescription monitoring and prescribing, on the one hand, and misuse, diversion, and morbidity/mortality, on the other. Studies anticipate that the increased monitoring and tracking of prescription drugs supported by PDMPs will facilitate reporting in two ways: first, by generating reports for providers that detail a patient's medication history and previous prescriptions; and second, by identifying potential indications of drug abuse or diversion using algorithms or "risk triggers", such as patients with 5 prescribers and 5 pharmacies in a 3 month period [5]. Providers informed in this way regarding a patient's history and likely signs of misuse or diversion are expected to reduce or refine their opioid prescribing, thus decreasing misuse and diversion of prescription opioids and consequently mortality and morbidity rates. The logic of PDMP evaluation studies, therefore, consistently presumes that increased monitoring and reporting of opioid prescriptions will be associated with changes in opioid-related outcomes across one or more domains: 1) opioid prescribing behavior, e.g., a reduction in opioid prescribing; 2) opioid diversion and supply; 3) opioid misuse; e.g., doctor shopping; and 4) opioid-related morbidity/mortality, e.g., substance use disorder or overdose. An additional finding of thematic analysis was that the impacts of PDMP implementation must be considered in terms of both potential benefits and potential harms, particularly related to findings in the domains of prescribing behavior and morbidity/mortality. For example, considerable concern has been expressed about the potential for a "chilling effect" [11, 12] of PDMPs on providers' opioid prescribing that might deprive patients of adequate pain control [13], and unclear long-term unintended consequences [14]. The resulting conceptual framework for PDMP evaluation is depicted in Fig. 2.

Research findings

Table 2 provides a summary of articles addressing the impact of PDMPs. Following scoping methodology [9], data were charted to extract key designs and findings identified in the literature, organized as follows: author and year; study design; outcome measure(s); study findings; and whether the study provides evidence to support beneficial PDMP impact and in which domain(s) (i.e., opioid prescribing behavior, opioid diversion and supply, opioid misuse, and/or opioid-related morbidity/mortality).

As Table 2 makes clear, the extant literature reveals mixed findings about the impact of PDMPs as a tool for reducing misuse and diversion of controlled substances. There is evidence for reduced opioid prescribing following implementation of a PDMP in studies conducted in Florida and New York, but no significant trend emerges in similar studies conducted in North Carolina or combining results from multiple PDMP and non-PDMP states. Studies of opioid diversion and supply found evidence for reduced shipments of oxycodone in PDMP states, but no reduction of opioid shipments overall. A study of diversion in a single state, Florida, found significant reductions in diversion of oxycodone, morphine, and methadone, but not in hydrocodone, fentanyl, or tramadol. The single study identified that examined the association between PDMP implementation and patterns of opioid misuse directly found evidence that the presence of a PDMP helped to slow the increase in rates of misuse, but did not achieve reductions in misuse overall. Studies of opioid-related morbidity and mortality found smaller increases in opioid treatment admissions in PDMP than non-PDMP states [12, 15], but no clear pattern of reduced overdose mortality in PDMP states overall [4, 16]. Mortality rates did appear to be lower in the specific PDMP states of California, Texas, and New York [3], and there was an immediate drop in mortality following PDMP implementation in Florida [17].
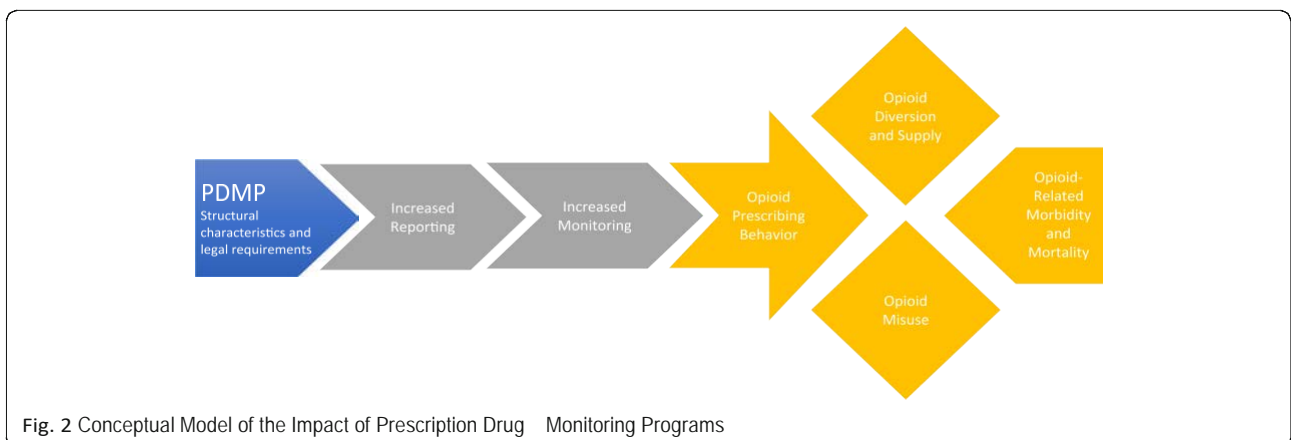
Fig. 2 Conceptual Model of the Impact of Prescription Drug Monitoring Programs

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Table 2 Studies of Prescription Drug Monitoring Program (PDMP) Impact by Domain of Opioid-Related Outcome Measure

Article	State(s)/Years Examined	Outcome measure	Design/Methods	Findings	Evidence for PDMP Benefit
Domain 1: Opioid Prescribing Behavior					
Paulozzi, 2011[a] [3]	PDMP and non-PDMP states; 1995–2005	Mean MME rates	Crude mean MME[b] rates and their standard errors for PDMP and non-PDMP states were calculated by year and across 1999–2005 timespan.	According to results of a regression analysis, the presence of a PDMP was not a significant predictor of MME rates.	No
Brady, 2014 [2]	PDMP and non-PDMP states; 1999–2008	Opioids dispensed per quarter for each state from 1999 to 2008	Multivariable linear regression model with generalized estimating equations assessed the effect of state PDMPs on per-capita dispensing of MMEs.	Overall, implementation of state PDMPs up to 2008 did not show significant impact on per-capita opioids dispensed. Examined state-by-state, authors found PDMP implementation associated with per capita MME decline in 9 states, increase in 8 states, and no effect in 14 states.	No
Rasubala, 2015 [21]	New York; 2012–2014	Frequency and volume of opioid prescriptions by dentists in a dental urgent care center	Cross-sectional survey of a dental urgent care center 3 months before and 6 months after implementation of a PDMP	Total prescribed opioids decreased 78% by dentists in a dental urgent care center after a mandatory PDMP was implemented.	Yes
Ringwalt, 2015 [11]	North Carolina; 2009–2011	Number of filled prescriptions for opioids	Examined associations between total number of providers who used the PDMP, mean number of days providers queried the system, and filled opioid prescriptions.	Strong positive association between increasing use of PDMP and opioid analgesic prescriptions over time.	No
Rutkow, 2015 [25]	Florida; 2010–2012	Opioid volume, per transaction, MME prescribed, MME per transaction, days' supply per transaction, prescriptions dispensed.	Comparative interrupted time-series analysis to assess the effect of PDMP and 'pill mill law' implementation on a closed cohort of prescribers, retail pharmacies, and patients.	Jointly the PDMP and 'pill mill' policies were associated with reductions in total opioid volume, mean MME per transaction, and total number of opioid prescriptions dispensed.	Yes
Domain 2: Opioid Diversion and Supply					
Reisman, 2009[a] [12]	PDMP and non-PDMP states; 1997–2003	State prescription opioid shipments (ARCOS)[b]	Compared state prescription opioid shipments in 14 states with PDMPs (intervention group) and 36 states without PDMPs (control group).	States with PDMPs received fewer oxycodone shipments that non-PDMP states; opioid shipments in all states continued to rise.	Yes
Surratt, 2014 [26]	Florida; 2009–2012	Quarterly prescription opioid diversion rates	Changes in prescription opioid diversion rates identified using quarterly law enforcement data after implementation of PDMP and 'pill mill' laws assessed using hierarchical linear models.	Significant decline in oxycodone diversion; nonsignificant ($p = 0.08$) decline in hydrocodone diversion; no decline in fentanyl, hydromorphone, or tramadol.	Yes
Domain 3: Opioid Misuse					
Reifler, 2012[a] [15]	PDMP and non-PDMP states; 2003–2009	Cases of intentional exposure to opioids (RADARS)[b]	Repeated measures negative binomial regression was applied to quarterly case data to estimate opioid misuse trends. PMP presence was modeled as a time-varying co-variate for each state.	Results suggest PDMPs are associated with a mitigation of increasing opioid misuse over time in both the general population as well as within the population seeking treatment at Opioid Treatment Programs.	Yes
Domain 4: Opioid-related Morbidity/Mortality					
Reisman, 2009[a] [12]	PDMP vs. non-PDMP states; 1997–2003	Inpatient prescription opioid treatment admissions per year	Inpatient admissions for prescription opioid abuse (TEDS)[b] in 14 states with PDMPs (intervention group) and 36 states without PDMPs (control group).	PDMP states reported a smaller increase in opioid treatment admissions per year (p[=0.06). Patients receiving inpatient drug treatment in PDMP states were less likely to have been admitted for prescription opioids.	Yes
Paulozzi, 2011[a] [3]	PDMP and non-PDMP states; 1999–2005	Rates of drug overdose and opioid-related mortality by state	Regression analysis using mortality data by state and year, crude mean mortality and standard error for PDMP and non-PDMP states.	Mortality rates did not differ by a statistically significant margin between PDMP and non-PDMP states.	No

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Table 2 Studies of Prescription Drug Monitoring Program (PDMP) Impact by Domain of Opioid-Related Outcome   Measure *(Continued)*

Reifler, 2012[a] [15]	PDMP and non-PDMP states; 2003–2009	Opioid treatment admissions	Repeated measures negative binomial regression applied to quarterly surveillance data from 2003 to mid-2009 to estimate opioid abuse trends. PDMP presence was modeled as a time-varying covariate for each state.	States with PDMPs appeared to experience smaller increases in drug abuse over time.	Yes
Li, 2014 [16]	PDMP and non-PDMP states; 1999–2008	Drug overdose mortality data for state-quarters	Multivariate negative binomial regression modeling examined drug overdose mortality for states with and without PDMPs during 1999–2008.	PDMP states experienced higher drug overdose mortality overall; PDMP impact on mortality varied by state.	No
Delcher, 2015 [17]	Florida; 2003–2012	Monthly counts of oxycodone-caused deaths	Time-series, quasi-experimental re-search design with ARIMA[b] statistical models examined monthly counts of oxycodone-caused deaths using a binary variable (pre/post-implementation).	Implementation of Florida's Prescription Drug Monitoring Program was associated with a significant decline in oxycodone-caused mortality	Yes
Maughan, 2015 [27]	11 Multi-state metropolitan areas; 2004–2011	Rates of emergency department visits involving opioid analgesics	Using retrospective data (DAWN)[b], generalized estimating equations assessed PDMP implementation and opioid-related morbidity.	PDMP implementation was not associated with change in rates of ED visits involving opioid analgesics.	No

[a]Article findings addressed more than one domain of opioid-related   outcome

[b]*MME* Morphine Milligram Equivalents, *ARCOS* Automation of Reports and Consolidated Orders Systems, *RADARS* Researched, Abuse, Diversion and Addiction-Related Surveillance system, *TEDS* Treatment Episode Data Sets, *ARIMA* Autoregressive Integrated Moving Average models, *DAWN* Drug Abuse Warning Network

Discussion

A critical finding of this synthesis has been that studies of opioid-related outcomes associated with PDMP implementation typically point to a shared logic for how PDMPs are expected to function, namely that: implementation of PDMPs will increase reporting and monitoring of controlled prescriptions, resulting in reduced opioid prescribing by providers, reduced opportunities for opioid diversion and misuse, and lower frequency of negative consequences such as opioid abuse and mortality [18]. Despite this shared logic, however, there is a marked lack of discussion in the literature to date regarding the scope of PDMP-related outcomes that should be examined and assessed in order to evaluate whether, and under what conditions, their implementation is having the intended impact.

In conducting this review, therefore, we found it useful to identify four domains of opioid-related outcomes frequently examined in original studies evaluating PDMP impacts: opioid prescribing; opioid diversion and supply; opioid misuse; and opioid-related morbidity and mortality. While these domains are subject to debate and may at times overlap, we believe they provide a useful heuristic for identifying areas of relative strength and weakness in the existing evidence for the impact of PDMPs.

While the literature evaluating PDMPs remains relatively nascent, a complex picture is emerging. Studies examining the association between PDMP implementation and opioid-related outcomes do not indicate a consistent pattern of discernible change. Such variation in results is likely due in part to variation in study-related factors, including study design and methods, use of inconsistent measures of impact, and examination of PDMP impacts in a single state vs. across multiple states. Additionally, the characteristics of PDMPs themselves vary considerably across states in both legislated components and strategies for implementation. Use of PDMPs by providers prior to writing a prescription for opioids may be mandatory or optional, and states vary in the responsibility they place upon providers for any negative outcomes associated with misuse or abuse by their patients [5]. PDMPs also vary in the frequency with which data is reported to them by participating pharmacies, the ease of accessing necessary information, the types of providers allowed to register, the information available, the amount of training providers receive in use of PDMPs, and by which state agencies they are administered [5]. As a result, the timeliness and accuracy of PDMP data varies considerably across states, as does the frequency and consistency of use by providers. It was unsurprising to find two studies examining the impact of PDMP implementation on opioid diversion, given the important role played by the Bureau of Justice Assistance in supporting PDMP implementation [8]. However, reviewing the evidence makes it clear that more nuanced investigation of the impact of specific characteristics of PDMP legislation and implementation will be necessary to firmly establish the policy features and strategies associated with PDMPs that are successful in reducing negative outcomes as intended.

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Even within the limitations of the current evidence, however, it has already become clear that PDMPs may also be associated with impacts beyond those generally hypothesized, both potential benefits and harms. Studies have reported that many clinicians find PDMPs useful as a tool for communication and interaction with patients [19, 20]. With patient prescription history at their disposal, providers can not only verify the patient's current prescriptions to avoid doctor shopping or drug abuse, but can also avoid potentially dangerous non-controlled drug interactions. As noted above, an important concern has been raised regarding the "chilling effect" that PDMPs and other opioid control measures may have on providers' opioid prescribing, leaving patients potentially undertreated for pain or seeking elsewhere for licit or illicit means to manage their pain [11]. What happens when providers re-evaluate their opioid prescribing has proven to be a critical question, although relatively few studies have yet provided data to answer it. Of the studies examined in this review, Rasubula et al. [21] found that dentists reducing their prescriptions of opioid analgesics in a dental urgent care center correspondingly increased their use of non-opioid analgesics, such as acetaminophen, and in this case drew closer to recommended practice guidelines for postoperative management of oral pain. Paulozzi et al. [3]'s findings of increased prescribing of hydrocodone, then a Schedule III drug, in PDMP states may also indicate that some providers have responded to PDMPs and associated shifts in prescribing norms by increasing prescriptions of analgesics from lower schedules. More troublingly, there is also evidence that patients, when faced with reduced ability to access licit opioids, may turn to illicit heroin, morphine, or fentanyl as alternatives, with studies indicating an increase in related mortality in some PDMP states [17, 22, 23].

There are several limitations to this review. Because the PDMP literature remains small and study outcomes and design vary, we were unable to conduct a traditional systematic review or meta-analysis, thus limiting our ability to conduct statistical analysis of the cumulative evidence. Because we described state-administered PDMP programs exclusively, findings may not extend to other prescription monitoring approaches in the U.S. and elsewhere. Nonetheless, this scoping review may inform other monitoring efforts, particularly by underscoring the importance of having clearly defined target outcomes (e.g., reduction in opioid-related morbidity and mortality) and a plan for evaluation. Conclusive evidence regarding impact cannot be determined from observational/cross sectional designs,

and data to support causal relationships between PDMP implementation and opioid-related outcomes remain limited as a result. Drawing upon PubMed as the core search database may have resulted in identifying more literature emphasizing healthcare policy rather than law enforcement impacts of PDMPs. In addition, this review was limited to published data; additional analyses may be available in unpublished reports from state or other sources, and should be considered for inclusion in future systematic reviews.

Conclusions

We believe the conceptual framework and synthesis of findings presented here offer valuable tools for evaluating the body of knowledge around PDMPs as policy and research in this area continue to progress. Establishing a conceptual framework for PDMP evaluation is helpful in clarifying areas of relative strength and weakness in the literature. For example, we identified only a single study examining opioid misuse as an outcome of PDMP implementation [15], a concerning gap given the level of national concern about opioid misuse and its potential consequences for leading to abuse and/or overdose. Moreover, evaluating the literature available along each step of the conceptual framework makes it clear how poorly we yet understand the real-time consequences of PDMP implementation, or the nuances of how specific characteristics of PDMP policy or implementation may impact downstream effects. More sophisticated analysis of specific components of PDMPs will be required to fully understand widely varying impacts across states.

Although PDMP implementation has been initiated across the United States, little consistent evidence has yet emerged to demonstrate PDMPs' impact on outcomes of greatest importance, whether more proximal targets such as prescribing behavior or distal outcomes such as opioid misuse, diversion, morbidity and mortality. We offer a call to action to engage in rigorous examination of PDMP impacts across the range of domains identified here, and particularly with regard to opioid misuse, and to do so with a careful eye to understanding features of PDMP legislation and implementation associated with positive outcomes. This call comes at a time when the field of PDMP evaluation is rapidly maturing and more information is becoming available through data sharing and linking with electronic medical records. The increased analytic capacity enabled by such growth should directly facilitate the examination of algorithms for identifying opioid prescribing, misuse, and abuse that are so much a part of the promise of PDMPs, but which have not yet achieved their full potential in mitigating opioid-related harms for individuals and populations.

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Availability of data and materials
All data generated or analyzed during this study are included in this published article and all sources are cited in the bibliography.

Authors' contributions
All authors contributed to the development of this manuscript. The initial study was conceptualized by JSP, EPF, KR, DM, and MJP. EPF, AG, and KR conducted the literature review and synthesis, incorporating feedback from JSP, DM, and MJP during team meetings. EPF and AG drafted the original manuscript, which was revised in consultation with co-authors. All authors read and approved the final manuscript.

Competing interests
The authors declare that they have no competing interests.

Consent for publication
Not Applicable

Ethics approval and consent to participate
Not Applicable
No human subjects research was conducted as part of this scoping systematic review.

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Implementing prescription drug monitoring and other clinical decision support for opioid risk mitigation in a military health care setting: a qualitative feasibility study

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ABSTRACT

Objective: Chronic noncancer pain is a highly prevalent condition among service members returning from deployment overseas. The US Army has a higher rate of opioid misuse than the civilian population. Although most states and many health care systems have implemented prescription drug monitoring programs (PDMPs) or other clinician decision support (CDS) to aid providers in delivering guideline-recommended opioid therapy, similar tools are lacking in military health settings.

Materials and Methods: We conducted a pre-implementation feasibility and needs assessment guided by the Promoting Action Research in Health Services framework. Twenty-six semistructured interviews were conducted with providers from a large military health system (MHS) to assess baseline knowledge and practices in opioid risk mitigation and providers' preferences and needs for a military-based PDMP or other CDS.

Results: Military health care providers reported complex decision-making around opioid prescribing and monitoring, varied knowledge and use of existing clinical informatics, and concerns about the feasibility of implementing a military-based PDMP in their context. However, providers indicated a need for training and CDS to support opioid risk mitigation for their patients.

Discussion: This article describes providers' knowledge and behaviors around opioid risk mitigation in the MHS, and views on the potential usefulness of a military-based PDMP or other CDS. This pre-implementation study provides a model for using qualitative methods to assess feasibility and inform planning and development of CDS in complex health care settings.

Conclusion: Military providers were skeptical regarding the feasibility of MHS-based PDMP implementation, but provided important recommendations for CDS to support safe and appropriate opioid prescribing in military health care.

Key words: opioid risk mitigation, prescription drug monitoring programs, clinical decision support, feasibility, military health systems

BACKGROUND AND SIGNIFICANCE

Since the American Pain Society first introduced the phrase "pain as the 5th vital sign" in 1996,[1] opioid therapy for chronic noncancer pain has become increasingly common and controversial.[2]

Health care providers who provide pain care routinely find themselves negotiating between ensuring adequate pain control and protecting against risks associated with long-term opioid therapy, which include opioid misuse, abuse, and overdose-related mortality.

1

Pain is a common complaint among returning deployed service members,[3,4] with >25% of recruits likely to experience at least 1 pain-related injury during basic combat training.[5] Back pain is a common complaint associated with the increased physical demands of deployment, including wearing body armor, carrying heavy equipment, and treading uneven ground in harsh conditions.[5] At the same time, studies of prescription opioid misuse and abuse among active duty US military personnel have noted substantial increases in the misuse of prescription drugs since 2005,[6] with misuse of prescription opioids occurring at higher rates than in the civilian population. Military health care providers, moreover, function within a complex environment of care, treating patients who are often highly mobile and for whom information about prior prescription history may be difficult to access. Large military hospitals are frequently staffed by providers and serve patients from multiple branches of service, each of which has unique policies and training standards.

Toward the goal of providing tools to support safe and effective opioid prescribing and monitoring, state-based prescription drug monitoring programs (PDMPs) have been implemented in 49 states,[7] and a number of public and private health care networks maintain computerized clinician decision support (CDS) tools or systems.[8,9] In addition to making searchable information on patient prescriptions available to providers, PDMPs can be used to generate reports to identify potential misuse or diversion at the level of the patient (eg, doctor shopping), provider (eg, overprescribing, "pill mills"), or population (eg, temporal trends), and thus bear similarities to other kinds of CDS proposed for pain management (eg, dashboards).[8] To date, few such opioid prescription monitoring or CDS tools have been made available within US military health care settings, despite elevated rates of both chronic noncancer pain and opioid misuse among military personnel.

In the current study, we undertook pre-implementation qualitative research to assess the feasibility of implementing a PDMP or other CDS for opioid risk mitigation within the military health system (MHS). The study was guided by the Promoting Action on Research Implementation in Health Services (PARiHS) framework. PARiHS is used widely to support implementation of evidence-based practices and postulates that the success of an implementation effort emerges from interactions among providers' perceptions of the evidence supporting use of the intervention, characteristics of the local context, and facilitation efforts.[10,11] Our objectives were to: (1) identify providers' baseline behaviors around opioid prescribing and monitoring; (2) assess providers' knowledge and attitudes regarding the potential utility of a PDMP within the MHS, and their perspectives on characteristics of the military health care context likely to impact PDMP implementation; and (3) understand providers' perceived needs and preferences for a PDMP or other CDS tools to support opioid risk mitigation in their setting.

METHODS

Semistructured qualitative interviews were conducted with health care professionals practicing within a large tertiary care hospital in the MHS. Given the exploratory nature of this work, we elected to focus on providers representing multiple specialties and services across a single, high-complexity site in order to identify a core list of provider knowledge and perspectives around opioid prescribing and monitoring that can be further expanded upon and refined in future research.

Participant recruitment

After securing the support of key leadership within the hospital's command structure, we contacted health care providers across the facility

with the goal of eliciting feedback from those whose scope of practice was relevant to opioid prescribing and monitoring. We used a strategy of snowball sampling, focusing primarily on emergency medicine, primary care, and pain medicine services, but also inviting potential participants to direct us to other providers and staff within the organization as appropriate. We contacted potential participants by e-mail or phone and requested their participation in brief (15–20 min) telephone interviews to discuss the potential for implementing an MHS-based PDMP.

Interview strategies

We conducted a comprehensive literature search on the implementation of PDMPs and other CDS for opioid risk mitigation and factors affecting acceptability and usability. We then developed a discussion guide drawing upon prior study findings[12] and following the PARiHS framework[11,13]; questions inquired about professional role and training, knowledge of and behaviors around opioid prescribing and monitoring, prior experiences of PDMPs, and potential benefits of and barriers to a military-based PDMP or other CDS.

Interviews were conducted by a research team led by a PhD-level anthropologist who engaged in intensive training with other team members to ensure consistency across interviews. The semistructured nature of the discussion guide allowed interviewers to follow relevant topics introduced by interviewees and open new lines of inquiry when appropriate. Due to the sensitivity of discussions around opioid prescribing, we opted not to audio-record interviews, in order to ensure anonymity and encourage participants to speak freely. All study procedures were approved by the Institutional Review Board of record, and waivers of written consent were obtained. An information sheet was e-mailed to participants prior to the interview, and verbal consent was provided at the time of the interview. All interviews were conducted by at least 2 individuals, with 1 conducting the interview and another 1 to 2 team members taking notes. Notes were reviewed by both members of the interviewing team at the close of each interview to ensure accuracy and completeness.

Analysis

Completed notes were cleaned of potential identifiers and entered into Dedoose[14] for qualitative analysis. We determined that 2 different analytic approaches were required to accomplish our research objectives, and therefore conducted qualitative analysis using an integration of matrix and grounded theory techniques.

We first conducted a matrix analysis[15,16] to identify providers' baseline knowledge of and behaviors around opioid prescription and monitoring, as well as their attitudes toward PDMP and other CDS, as these data were primarily descriptive. A preliminary set of analytic domains was defined in order to capture core PARiHS constructs (eg, perceived evidence) and factors associated with PDMP implementation and usability identified in prior research (eg, time burden). Members of the research team independently reviewed an initial set of 3 interviews to identify and code for text addressing these domains. Team members then convened to discuss preliminary coding, make refinements to the coding scheme, and further define the coding manual. Following coding, the content of domains for providers' baseline knowledge, behaviors, and preferences was summarized into matrices; these were reviewed and compared within and across participants.

In a second round of coding, we drew upon grounded theory analysis,[17,18] more appropriate to identifying new or emergent themes, in order to illuminate providers' attitudes regarding PDMPs in the military health care setting, needs and preferences for CDS, and contextual factors likely to impact PDMP/CDS implementation.

Members of the research team reviewed all interview notes and met repeatedly to discuss and identify novel themes that emerged in the data, iteratively refining a secondary set of inductively derived codes. Once this coding schema was finalized, all interview notes were independently coded by at least 2 team members, with discrepancies reviewed with a third team member to allow for discussion toward consensus. The final content of thematic codes was reviewed with constant comparison[18] among participants to identify provider attitudes and perspectives on contextual factors in this unique setting.

RESULTS

Participating providers

We conducted interviews with a total of 26 individuals in the spring of 2016 (Table 1). The majority of participants worked within the military hospital; 2 had left to practice in civilian settings within the prior 2 years. Most participants were male physicians actively serving in the US Army or Air Force and working in emergency medicine, primary care, or pain management settings within the hospital. Nearly all regularly prescribed opioids, although 5 served in a position to identify potential opioid misuse as a nonprescriber, eg, as a case manager or pharmacist.

Baseline practice in opioid prescribing and monitoring

Providers reported complex clinical decision-making around prescribing and monitoring of opiates for pain, describing typical steps in determining whether or not to initiate a prescription for opioid therapy (Figure 1). These included assessing: (1) the patient's diagnosis or condition; (2) the patient's need for pain meds based on that condition and/or patient report; (3) the patient's prior medication history, using review of available electronic health records (EHRs) and/or discussion with the patient; and (4) whether the patient's affect or behavior raised red flags regarding potential for misuse, abuse, or diversion. If the decision to prescribe medication was made, providers also described determining whether to prescribe a narcotic or non-narcotic, what amount of medication to prescribe, and whether to initiate a consult or other follow-up.

Providers reported variation in how they preferred to sequence the 4 assessments, which appeared to vary in relation to the weight they assigned to key factors in their decision-making. Providers placed more or less emphasis on a variety of factors, including: acuity or chronicity of pain; conditions for which short-term opioids were felt to be appropriate, such as fractures or recent surgery; degree of pain severity and impact on function; history of prior medications, including current use of narcotics; prior history of substance abuse; psychological comorbidity; and the subjective "gestalt" of the patient as assessed during the clinical encounter, including whether the provider felt the patient was telling the truth or whether the reported medication history was consistent with available records. Providers frequently described having a general approach to opioid prescribing, typically predicated on a stated dislike of opioids for chronic pain. Some providers described rarely prescribing beyond a narrow range of pain medications (eg, Tylenol 3, Ultram, Norco), while others described prescribing opioids only for acute conditions. A few providers indicated a somewhat softer stance, describing themselves as "patient-centric" in treating pain or saying "I believe in treating pain." Providers described policies instituted by the facility to assist with opioid monitoring, including a sole provider program, pain contracts for individuals treated at the pain clinic, and protocols for routine urine testing.

Table 1. Characteristics of participating health care providers (n¼26)

Characteristic	n
Gender	
Male	18
Female	8
Provider Type	
MD	18
DO	3
PA	1
RN	2
PharmD	1
PsyD	1
Branch of Service	
Army	12
Air Force	9
Retired Military	1
Civilian	4
Specialty/Service	
Emergency Medicine	12
Internal Medicine	3
Pain Management	7
Other	4

Notably, it was when providers described uncertainty related to their assessment or monitoring of patients that they reported calling upon additional resources to determine next steps. In the handful of cases where providers spoke of checking the state PDMP, it was consistently described as an extra step taken in response to a particular concern rather than a standard component of opioid prescribing or monitoring.

Knowledge and attitudes regarding PDMPs

Prior training and experiences of PDMPs

Providers reported widely varying exposure to formal training in pain management or substance abuse (Table 2). While providers who specialized in pain management might have been board certified or completed a fellowship in this area, providers who operated in other clinical settings frequently described their training in pain or substance abuse as having occurred largely "on the job," in "sparse" lectures during residency, or as part of continuing education. Similar variation emerged in providers' knowledge of what a PDMP is or how to access and make use of PDMP data. In some cases, providers, particularly those who had made prior use of a state-based PDMP, could provide a detailed assessment of the pros and cons of those programs; others were unfamiliar with PDMPs or had no prior experience with their use. A few providers noted that, because an in-state medical license is not required to practice in a military health care facility, many military providers do not hold a medical license in their state of practice; as a result, a number of the providers at this facility were licensed in other states and had never used the local state PDMP.

Awareness of research/guidelines and climate of practice

Providers also reported varying levels of knowledge regarding the broader research and published guidelines on opioid risk mitigation, with some reflecting on the recent release of updated guidelines or referring to studies on the effectiveness of opioid therapy for chronic vs acute pain. In making clinical judgments, providers appeared to be responding more directly to what 1 respondent called the "provider tightrope," ie, the everyday challenge of determining how to achieve pain control for individual patients that is both safe and
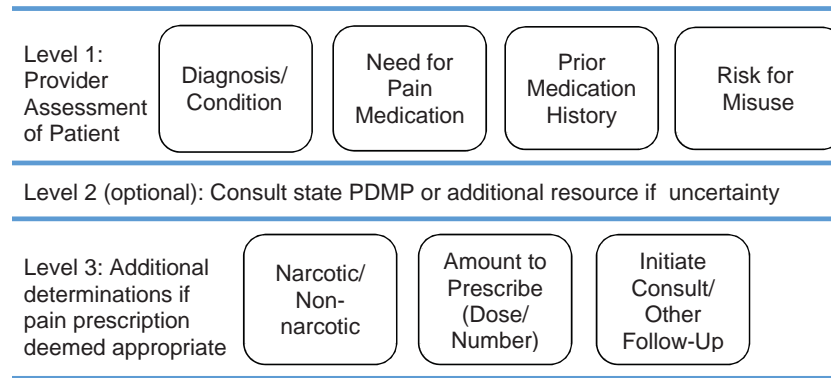
Figure 1. Common elements of provider decision-making in opioid prescription

Table 2. Knowledge of and attitudes toward opioid prescription drug monitoring programs or other clinical decision support in a military hospital setting

Key Themes	Sample Quotes
Prior Training	"We had lectures in medical school, but I don't have a formal certification or fellowship in [substance abuse]. In pain management, same thing. I did a palliative care rotation in residency and that's about it. Most of it's on the job training."
Prior Experience of PDMPs	"[The State PDMP has] been really helpful. It's objective. You can have a conversation with the patient, and if they say they haven't been prescribed a drug, you can go look and see it there."
	"I know [PDMPs] exist, but I don't know a lot about them."
	"Yes I have worked with one – they're horrible. Basically, if you design a system so that no doctor will access it, think of a PDMP. There's so many checks, it's not clear, and it's painful to get into.... [State] PDMP is awful. You're lucky if you even find the right button to find the information."
Awareness of Relevant Research and Published Guidelines	"There are new opioid prescribing guidelines from the CDC, no? I haven't read it yet."
	"I rely on palliative medicine training, knowing WHO pain management guidelines, and the tier system."
Climate of Practice	"I think for a long time people would equate a pain score with needing opioids and felt [they were] letting patients suffer by not prescribing the opioids. ... When I first started out in 2010 they were always self-escalating medication from primary care providers. They were taking short acting opioids around the clock! My impression is now it's a rarity to see that but not then, it was commonplace then, and that's over a period of six years. It is a carry-over from the '90s to prescribe opioids with nonmalignant pain."
Perceived Risks of PDMP	"With any of these things, my concern is that a patient would be inappropriately labeled. I would be concerned with something that would be setting the bar too high so that everyone looks like they're at risk for abuse and no one gets narcotics. And then no one gets appropriate treatment. It needs to take into account there are patients with different needs."
Perceived Benefits of PDMP	"If I want to prescribe something and can see [in the PDMP] that they have not been abusing it, then I feel safe prescribing it. I protect myself if I prescribe it. It's to be able to feel safe prescribing and not prescribing. The PDMP protects the patients as well. To detect the abusing and the non-abusing, both. If I break my leg, I would like a Vicodin vs an Ultram."
Relative Advantage of PDMP to Current EHR	"It would be helpful and overdue. Most states have a system like that in place. Most hospitals have ways of flagging people as high risk. It is overdue in military hospitals."
	"Yes, there are multiple systems we use to track [patient data]. It can be difficult to determine if it's complete or up to date. It would be helpful to have one place to have access to this data."
	"We have our own EHR. I don't think [other providers] would use anything else. We already have our own and it's pretty comprehensive."
	"We don't need it in the military. No one will use it."

effective. Notably, providers described operating within a climate of practice where the standard of care has evolved rapidly to rely less on opioid therapy for noncancer or long-term care. Even providers who had been in practice for only a few years described observing a "swing" toward "less medication" and "more management."

Perceived risks and benefits of a military PDMP
Provider perspectives on the perceived need for a military-based PDMP were generally weighed in relation to concerns about likely implications for patients and providers. Potential concerns included whether implementation of a military PDMP would prevent patients with "legitimate need" from getting appropriate medications, create undue burden for patients at low risk (eg, by requiring routine drug testing of elderly patients), result in "inappropriate labeling" of patients as drug abusers, increase the risk of violating patient confidentiality by facilitating access to patient data, or create unnecessary barriers for prescribers in getting patients the medications they need. Perceived positives of a military-based PDMP emphasized potential gains for patient safety by allowing providers access to more comprehensive information on medications from both military and civilian providers, making it easier to assess whether patients were taking medications as prescribed and ensuring that those who were received continued access.

Relevant advantage of PDMP to current EHRs

Unsurprisingly, provider attitudes toward PDMP implementation within the military setting varied according to the perceived value of PDMPs; these perceptions were often based on prior experience with PDMPs, including anecdotal reports from other providers. A few providers reported finding PDMPs helpful in establishing whether a patient was accurately reporting any medications received outside of the MHS or TRICARE (eg, purchased with cash), and appreciated being able to use the "documentation" to facilitate discussions about potential misuse with patients. Likewise, a few reported strongly negative reactions to PDMPs, noting that they can be difficult to access and time-consuming to use, and lack reliable data (eg, by failing to include prescriptions obtained in nearby states). Most providers relied primarily on the existing military EHR and used the state PDMP infrequently or not at all. Providers varied in whether they thought a military-based PDMP would have a relative advantage over the current system, depending on whether they felt the information available in current military EHR systems was adequate or incomplete. Opinions from providers ranged from those who felt it was "needed" and "useful" to those who felt it merely replicated resources already available and that "no one will use it."

Contextual factors in the military health care setting

Patient populations

Providers noted a variety of factors likely to impact the utility of PDMPs or other decision supports within the military health care context (Table 3). Among the most important were the widely varying needs of their diverse patient populations. Functioning across specialties within a large and complex health care facility, providers care for active duty service members, their dependent spouses and children, and retired military personnel or spouses. This facility also offers Level 1 trauma care for the broader metropolitan area in which it is located. As a result, providers noted that any system intended to capture medication history or flag patients at risk must account for the diverse needs of a young service member with comorbid posttraumatic stress disorder (PTSD) and back pain and an elderly cancer patient facing the end of life. A few providers who saw primarily active duty service members noted unique challenges in serving this population, including the requirement of ensuring mission readiness, making sure that "they're prepared to [deploy] and well suited for the job," as well as caring for service members with multiple comorbidities, including depression and PTSD, and wounded service members who may have a long prior history with pain medications.

Time and work burden, provider licensing, and complexity of integration

Military health care providers also noted that they work under considerable time pressure and already make use of multiple record systems, including a facility-based outpatient EHR, a local inpatient EHR, and a military-wide EHR, in addition to some setting-specific templates and forms (eg, in the emergency department and pain clinics). As a result, they expressed a concern that additional tools should not require time, multiple steps, or complex logins, and stipulated that any new tools must be seamlessly integrated with existing resources. One provider noted that every military facility is likely to have a different system, raising significant challenges for efforts to implement new data systems across the armed forces. They also noted, as mentioned above, that only physicians with an in-state medical license can access the state PDMP. Many of those responsible for prescribing and care management in this health care

facility are not physicians, making it difficult for clinical team members such as nurses, nurse practitioners, and physician assistants to access PDMP data. Because providers at this facility typically function in a medical home–like team structure, this also limits the flexibility of team workflow by making the physician the only team member able to conduct PDMP searches.

Emphasis on patient satisfaction, leadership support, and chain of command

Some providers, particularly in the emergency care setting, also noted that patient satisfaction can be linked to whether or not patients feel they received adequate pain control. Providers reported that they were likely to hear about patient complaints or poor satisfaction ratings from their supervisors, although experiences of this varied. In some cases, providers reported getting "bad reviews," and 1 provider suggested that this could "affect salary," although other providers said that complaints are typically reviewed by providers who are cognizant that "the customer is not always right." Provider concerns underscore the importance of leadership structure and chain of command within military health care settings, which has direct implications not only for how patient complaints are handled (and thus the environment of care), but also for how individual commanders choose to handle evidence of substance abuse among their service members. One respondent also noted that "getting through military channels and getting acceptance" was likely to be a significant barrier in PDMP implementation.

Preferences for PDMP usability and reports

Information to include, suggested alerts, and report content and presentation

Providers made a variety of suggestions for increasing the usability of a PDMP or other CDS in the MHS (Table 4). Generally, providers desired a rapid overview of patients' prior medical history (eg, diagnoses, surgery) and patterns in their receiving and refilling of controlled substances, including trends over time. Providers requested data on medications, including drug names, quantities prescribed, fill dates and locations, and numbers of providers from whom prescriptions were received, for a preferred time span ranging from a few weeks to 5 years. Providers were also interested in receiving data on care utilization, including visits to primary and specialty care and emergency medicine. Multiple providers expressed a desire for resources such as automatic alerts for potential misuse, information regarding clinical practice guidelines, and recommended next steps. Suggestions included a medication inventory available at the touch of a button, a scoring system to signal patients at high risk for opioid misuse, and a metric for comparing opioid medications to understand their equivalence (eg, morphine milligram equivalents). Providers noted that the utility of any report or information system would, in part, be dependent on how often data were updated, with some providers desiring real-time updates.

With regard to the interface of potential PDMP reports, most physicians requested streamlined integration of the report with their existing EHR system (ie, the Armed Forces Health Longitudinal Technology Application, the Composite Health Care System, or Cerner). If the data could not be integrated with their EHR system, physicians preferred that the report be easily accessed through either a web link or a reliable server via a user-friendly site and login, and presented in a format that would allow for easy cut-and-paste into the EHR.

Table 3. Contextual factors likely to affect PDMP implementation in the military health context

Key Themes	Sample Quotes
Patient Populations	"It's not just active duty. We also see 80-year-old women with cancer. We don't see Peds, but mostly young, healthy warriors. Most of them are active duty, somewhat healthy. We also see older active duty ready to retire."
	"I'm treating a different population than the 18-year-olds coming into the ER for their back pain. I'm treating end-of-life patients who have good reasons to have pain. It would be useful for other people, but a pain for me."
Emphasis on Patient Satisfaction	"It's a very patient-centered culture. I'm worried about patient complaints or satisfaction scores."
	"There are [providers] that give out all the meds that patients ask for. … It depends on the setting. It also depends on recent ratings. .. . Patient satisfaction is usually based on if they get what they want. You're aware that your score increases or decreases depending on that. We typically take criticism from our supervisor or whoever reviews the complaints, but there are competing interests in the way the system works."
Leadership Support and Chain of Command	"If a patient files a complaint … my colonel might come to me or the person right below him. They'll say to me 'This person made a complaint, what is your side of the story?'"
Military Provider Licensing	"For me to get access to the [State] PDMP, I need to have a [State] license but I don't have a [State] license. ... I can practice here in [State] with my [Other State] license."
Time and Workload Burden	"No one has 10 or 15 minutes to waste on a stupid computer system."
	"My understanding about the PDMP system in [State] is only physicians can log in and there is a delay … to access information. Now that is 2 to 3 minutes wasted! We don't have that time to waste – I'd rather be spending that time talking to my patients."
Complexity of Integration between State PDMP and Military EHR	"In my experience .. . there are two things I can think of that would be difficult. There's a lot of care within military system and a lot of care within the community. I don't know how easy it is to reconcile those 2 systems in terms of prescriptions."
	"One of the biggest things physicians are called upon to do is work through several different electronic medical programs. I have to provide documentation through five different programs. … My point is, we check a lot of things, okay, if we have to open a program to check something there is going to be a problem with compliance."
	"There's already a system [in the military] called CHCS, which is a harsh system. It interacts with the other EHR systems we have. It is not user-friendly. Ideally, it would be something that needs to be integrated into the current system or workflow. If there's some way to monitor what meds are getting to some people. The only ones we can see is from military providers. If you want to see what nonmilitary providers are prescribing, you have to really dig for it. It's not an intuitive method to find it. You have to really know how to do it. There's so many steps to go through. It's just not an intuitive system. It needs to be robust in the sense that it needs to be comprehensive and can access easily. It needs to be integrated."

Personnel access to PDMP reports

Most providers also recommended opening PDMP access to all members engaged in patient care (eg, nurses, residents, medical assistants, nurse practitioners, and physician assistants) in order to facilitate patient care and reduce the time burden for physicians associated with patient triage, chart preparation, and reporting/debriefing/presentation. A few providers suggested that primary care providers should receive patients' PDMP reports and hold the responsibility of regularly checking the PDMP.

Other recommendations

Providers made other recommendations regarding their preferences for PDMP reports or other opioid-related CDS, with the preferred option being integrating state and military data into 1 centralized system in order to address current gaps, such as prescriptions received outside of the MHS. Other suggestions included further educating providers, faculty, and staff on guidelines related to proper opioid prescribing.

DISCUSSION

In the current study, we found that military health care providers reported widely varying perspectives on whether a military-based PDMP would be advantageous in addressing recognized problems of opioid misuse and abuse among their patients. Providers reported complex clinical decision-making around opioid prescription and

monitoring, and differing levels of prior training in substance abuse and/or pain management. Relatively few providers reported being aware of, having access to, or making use of the state PDMP, and respondents raised significant concerns regarding the feasibility and utility of a military-based PDMP.

Nonetheless, there was general agreement that it would be valuable to create a more seamless record of prescriptions from across military and civilian health care systems, and to create CDS to aid providers in opioid risk mitigation, eg, by flagging patients at risk for opioid misuse or abuse. To ensure acceptability and functionality within the military health care system, providers suggested that any PDMP or CDS be easy to access and use, compatible with existing IT systems and workflows, supported by initial and ongoing training that accounts for variation in providers' baseline knowledge, and accessible by multiple members of the care team (ie, not solely physicians). These findings are consistent with those identified in the Moxey et al.[19] systematic review of factors affecting utilization of CDS. MHS providers also reported military-specific challenges related to licensing providers, integrating military and civilian informatics, and treating an active duty population facing potential deployment.

This study reflects a growing move toward use of preimplementation research to assess the feasibility of interventions such as CDS products and tailor them prior to rollout.[9,20] As increasing access to big data revolutionizes our ability to assist decision-making and tailor the delivery of guideline-based care, there may be significant value in approaches that integrate qualitative assessments of baseline provider behaviors and attitudes, training

Table 4. Provider recommendations for opioid prescription drug monitoring program and clinical decision support tools in the military hospital setting

Domain	Specific Examples
Information to Include	*Prescription*
	Drug names (controlled and noncontrolled)
	Number of prescriptions
	Dates of prescriptions
	Prescription doses
	Number of tablets/quantity
	Indications
	Prescribing provider(s)
	Name
	Specialty
	Service/clinic (eg, primary care, emergency)
	Location
	Date of visit
	Sole provider contact information
	Number of providers being seen
	Prescription filled
	Yes/no
	Date
	Location
	Form of payment (eg, cash, insurance)
	Refills
	Number of refills
	Refill attempts
	Dates
	Location(s)
	Early refills
	Form of payment (eg, cash, insurance)
	Patient history
	Reported reason for visit(s)
	Prior overdose
	Prior hospitalization for opioid misuse
	Chronic pain
	Doctor shopping
	Urine drug screens
	Involvement in a sole provider program
	Patient summary
	Prior controlled medications
	Trends in opioid and pain therapy over time
	Age
	Provider visits
	Dates
	Service/clinic (eg, primary care, emergency)
Suggested Alerts	When patient fills medication
	When patient fills early
	When patient fills medication from another provider
	Patient is high risk
	Develop threshold for average prescriptions/ year (for this type of patient/case) and alert if patient is higher than average
	When another medication might be more appropriate (eg, "consider using something less potent")
	Alerts delivered by e-mail

(continued)

Table 4. continued

Domain	Specific Examples
Report Content and Presentation	Real-time data reporting
	Easily accessible (eg, 1 button to open from main chart, desktop login)
	Easy login (eg, 1 step, user-friendly)
	Easy to use (eg, requires minimal patient information)
	Populated by data from both military and civilian providers
	Integrated with existing military EHRs
	Automated to minimize provider burden
	Automated reports easy to copy and paste into EHRs
	Report should facilitate pattern recognition for the provider
	Report should/should not be presented as a popup
	Report should be in a different color to make easily visible
	Report should trigger creation of accompanying face sheet to include basic patient data (vitals, chief complaint, recent medications)
Personnel with Access to PDMP or Reports	Physicians
	Nurses
	Any prescriber (eg, residents, physician assistants, nurse practitioners)
	Pharmacists
	Everyone on patient's care team
	Sole provider
	Medical review committee
	Group cost manager
	Nursing or administrative assistants
	No nonproviders (including command, administration)
Other Recommendations	Create easily visible red flags for patients at high risk
	Receive alerts in e-mail
	Provide information on recommended next steps for flagged patients
	Develop threshold for average prescriptions/ year
	Include information on requirements for prescribing
	Develop tracking program to categorize risk based on medications prescribed within specific time span
	Develop standardized risk score to describe risk
	"It would be helpful to have some sort of pattern recognition"
	Alert triggers a pain provider consult
	Alert should trigger review by pharmacist
	Provide information on opioid equivalence to facilitate comparison between medications
	Definitely establish a diagnosis of opioid misuse to provide a synthesis for busy providers
	Make it easy to see patient medications and refills globally

(continued)

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Table 4. continued

Domain	Specific Examples
	Create provider-level opioid prescribing reports
	Have social worker assigned to every emergency department to support patients who need additional resources
	Offer additional education and ongoing training for providers
	Develop hospital-level committees to review at-risk patients
	Provide medication return program for patients who find no benefit from initial medication prescribed
	Double facility's pain management capacity

needs, and context factors with expectations for feasibility and uptake. We found the revised PARiHS framework[11] to be of value in guiding data collection and analysis; consistent with the framework, providers' perspectives on the potential value of a PDMP or other CDS were primarily informed by their clinical experience and perceived patient needs, while their views on feasibility and the relative advantage of implementing PDMP/CDS were informed by their perspectives on the receptive context and local culture within the MHS.

Generalizability of these findings is limited by a small sample size reflecting a single site. It is worth noting, however, that these providers were nearly all active duty service members and had typically served at multiple military health care sites; they frequently spoke of practice variations they had observed across sites and offered reflections on the implications of these variations for efforts to implement CDS across the broader MHS.

The findings presented here have been used to refine planned CDS products and plan for future implementation and evaluation. Given concerns about the feasibility of integrating PDMP effectively into existing and incoming EHRs, and also given providers' statements that they would value additional support in identifying and responding to potential opioid misuse among their patients, we have worked with our stakeholders to modify an initial plan to implement a military-based PDMP and are now developing CDSs to aid providers in visualizing patients' conditions and prescription use over time. The resulting CDSs are in line with provider recommendations and are currently being refined through a process of expert panel review.

COMPETING INTERESTS

There are no competing interests

CONTRIBUTORS

All of the authors contributed to the manuscript and read and approved of the submission

ACKNOWLEDGMENTS

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APPENDIX B – Abstracts

B – 1 Poster presentation at the 2015 Association of Military Surgeons of the United States (AMSUS)

B – 2 Symposium presentation at the 2016 San Antonio Military Health System and Universities Research Forum (SURF)

B – 3 Poster presentation at the 2016 College on Problems of Drug Dependence (CPDD)

B – 4 Oral presentation at the 2016 Conference on the Science of Dissemination and Implementation in Health (D&I)

B – 5 Poster presentation at the 2016 Conference on the Science of Dissemination and Implementation in Health (D&I)

B – 6 Poster presentation at the 2017 Behavior, Biology, and Chemistry: Translational Research in Addiction Conference (BBC)

B – 7 Poster presentation at the 2017 IIMS Community Engagement Symposium

B – 8 Poster presentation at the 2017 Military Health System Research Symposium (MHSRS)

B – 1
Meeting: 2015 Association of Military Surgeons of the United States (AMSUS)

A Systematic Review of Barriers and Facilitators to Implementing a Prescription Drug Monitoring Program

Garcia, Ashley; Finley, Erin; Bebarta,Vikhyat; Song, Kangwon; Rosen, Kristen; Valtier, Sandra; Potter, Jennifer S., University of Texas Health Science Center, San Antonio, TX

Background: The 2009 Department of Defense (DoD) Survey of Health Related Behaviors among Active Duty Military Personnel revealed substantial increases in misuse of prescription drugs, attributed overwhelmingly to opioid analgesics. DoD rates were significantly higher than civilian rates of prescription drug misuse during the same period. Electronic prescription drug monitoring programs (PDMP) are state-run systems used to track scheduled medications dispensed from pharmacies and mitigate misuse and diversion.

Objective: In support of a DoD-funded study evaluating the feasibility of implementing a PDMP in the Military Health System (MHS), we conducted a systematic review of the literature to examine PDMP effectiveness as opioid risk mitigation tools.

Methods: 167 English-language studies published between January 2000 and December 2014 were identified through a PubMed database search using the key words "Prescription drug monitoring program". An additional 15 were identified from relevant articles' reference lists. Articles met inclusion criteria based on applicability to one of three elements (as defined through group consensus): "effectiveness", "implementation", and "utilization".

Conclusion: The current literature suggests that when utilized by providers, PDMPs impact opioid prescribing practices; however, the extent to which they impact opioid misuse and diversion is equivocal. Their limited impact on misuse and diversion may be due, in part, to variations in implementation approaches that impact utilization of PDMP data. Barrier to use include lack of knowledge regarding PDMPs, lack of access, time burden, technology platforms, timeliness of information, attitude towards PDMPs, and user interface complexity. Although there is some evidence PDMPs can be an effective tool in the civilian population, it is unknown whether PDMPs are feasible in the DoD.

Learning Objectives:
1. Explain the purpose and rationale of PDMPs
2. Describe the evidence supporting the effectiveness of PDMPs.
3. Summarize the barriers and facilitators associated with PDMP utilization.

CHRONIC PAIN AND SUBSTANCE ABUSE: WHAT'S THE CONNECTION?

Moderator: Jennifer Sharpe Potter, PhD, MPH, Associate Professor in the Departments of Psychiatry and Anesthesiology and Assistant Dean for Research and Student Programs in the School of Medicine at the University of Texas Health Science Center at San Antonio. Her primary research interest is substance use disorders. Her current research focuses on the prevention and treatment of opioid use disorders and chronic pain utilizing combined behavioral and medication-based approaches.

Moderator: Sandra Valtier, PhD, Clinical Research Division 59th Medical Wing, Wilford Hall Medical Center, Lackland AFB, Dr. Valtier directs the Substance Abuse Task Area for the US Air Force and serves on the Army Substance Abuse Research Program advisory board. In this capacity show

Speaker 1: Mary Jo Pugh, RN, PhD, Associate Professor of Epidemiology and Biostatistics, University of Texas Health Science Center at San Antonio and Veterans Evidence-based Research, Dissemination, and Implementation Center (VERDICT), South Texas Veterans Health Care System. Her research interests and background includes exploration of quality of care and health care system factors associated with patients with complex comorbidity clusters, especially older veterans and younger veterans from Afghanistan and Iraq Wars (OEF-OIF). She has used methods from pharmacoepidemiology and health services research to examine quality of care issues related to medication treatment approaches, comparative effectiveness, epilepsy care, and chronic disease management in older patients and my current work uses similar methods to understand OEF-OIF veterans and their healthcare needs.

Speaker 2: Erin Finley, PhD, MPH, Assistant Professor of Medicine and Psychiatry, Division of Clinical Epidemiology. Dr. Finley is also an Investigator with the Veterans Evidence-based Research Dissemination and Implementation Center (VERDICT) at the South Texas Veterans Health Care System, and an Adjunct Assistant Professor with the Division of Clinical Epidemiology, Department of Medicine, at the University of Texas Health Science Center at San Antonio. Her primary research interests include PTSD and the implementation of evidence-based treatments for Veterans, interventions promoting resilience for individuals and families, and the role of social relationships in shaping health behaviors and outcomes.

Speaker 3: Donald McGeary, PhD, ABPP, Associate Professor of Psychiatry, University of Texas Health Science Center San Antonio. Dr. McGeary is board certified in Clinical Health Psychology, American Board of Professional Psychology. His primary interests include interdisciplinary chronic pain intervention and military trauma. The majority of his experience and expertise has been focused on chronic pain rehabilitation research and clinical work in multi- and interdisciplinary environments.

Objectives of the session:

Using results from an ongoing DoD and NIH studies as a backdrop, the objectives of the session are to:

- Describe the prevalence of co-occurring chronic pain and substance use disorder, specifically prescription-related opioid use disorder, among active duty service members

- Identify challenges and opportunities for implementing systems-level prevention and intervention initiatives in the Military Health System

- Explore treatment options for co-management of chronic pain and opioid misuse/abuse/addiction

- Provide a vehicle for discussion of research priorities in this area including a discussion of the Substance Abuse Task Area and current military research priorities in this area

The United States is experiencing a major public health crisis as a result of the dramatic rise in opioid prescriptions for chronic pain management during the last two decades. This includes a dramatic increase in opioid-related emergency department visits, poisoning deaths, opioid-related addiction treatment, and suicides.

The military is not immune increased opioid prescribing and potential adverse consequences. The 2009 Department of Defense (DoD) Survey of Health Related Behaviors among Active Duty Military Personnel revealed substantial increases in misuse of prescription drugs, attributed overwhelmingly to opioid analgesics. DoD rates were significantly higher than civilian rates of prescription drug misuse during the same period. In the Army, oxycodone and hydrocodone are the second and third most commonly prescribed analgesics.

Given the high prevalence of musculoskeletal pain, posttraumatic stress disorder, and depression in Iraq and Afghanistan military personnel post deployment, this cohort may be at increased risk for opioid misuse. In 2008, 10.1% of active duty military personnel reported misusing opioids in the prior month while 17.2% misused in the preceding 12 months. More recent survey data from a large MHS, supports these estimates. In an anonymous survey of patients presenting at an MHS emergency department (ED) and a Level 1 trauma center with an annual volume of 75,000 pts/year, 31% of active duty respondents reported opioid misuse (use of an opioid for reasons other than pain, use of an old opioid prescription for a new reason, or use of more medication than prescribed).

The session will be a combination of didactics, case study presentation, and facilitated group discussion. All didactics will draw from the peer-review literature and the presenters' own research data. During the session, we will be distributing index cards and using social media (e.g., live Tweeting) to solicit questions from the audience for use as discussion prompts. Each presentation will be followed by a Q&A session.

Presentations:

1. Jennifer S Potter, PhD: (co-moderator) Chronic pain and opioid use risk mitigation

Present summary of the current literature oh co-occurring chronic pain and opioid use disorder and an introduction to learning objectives

2. Sandra Valtier, PhD: (co-moderator) DoD Substance Abuse Task

Discuss the current priorities of substance abuse task area research portfolio

3. Mary Jo Pugh, PhD: Opioid prescribing patterns in the US military: 2006-2014

Report on patterns of opioid prescribing in the MHS using data from the DoD UT Health Science Center Opioid Risk Mitigation Project

4. Erin Finley, PhD: Systems level approaches to opioid risk mitigation in the MHS

Present qualitative research findings on barriers and facilitators to implementing an opioid risk mitigation program in the MHS based on results from the DoD UT Health Science Center Opioid Risk Mitigation project

5. Donald McGeary, PhD: Behavioral pain management and reducing opioid misuse

Describe nonpharmacological approaches to pain management that may reduce overall opioid misuse and, potentially, opioid misuse and abuse.

Funding provided by US Air Force #FA8650-15-C-658 10/2014–10/2017

500 word abstract:

Using results from an ongoing DoD and NIH studies as a backdrop, the objectives of the session are to:

- Describe the prevalence of co-occurring chronic pain and substance use disorder, specifically prescription-related opioid use disorder, among active duty service members

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Given the high prevalence of musculoskeletal pain, posttraumatic stress disorder, and depression in Iraq and Afghanistan military personnel post deployment, this cohort may be at increased risk for opioid misuse. In 2008, 10.1% of active duty military personnel reported misusing opioids in the prior month while 17.2% misused in the preceding 12 months. More recent survey data from a large MHS, supports these estimates. In an anonymous survey of patients presenting at an MHS emergency department (ED) and a Level 1 trauma center with an annual volume of 75,000 pts/year, 31% of active duty respondents reported opioid misuse (use of an opioid for reasons other than pain, use of an old opioid prescription for a new reason, or use of more medication than prescribed).

The session will be a combination of didactics, case study presentation, and facilitated group discussion. All didactics will draw from the peer-review literature and the presenters' own research data. During the session, we will be distributing index cards and using social media (e.g., live Tweeting) to solicit questions from the audience for use as discussion prompts. Each presentation will be followed by a Q&A session.

B - 3
Meeting: College on Problems of Drug Dependence

Submission Category: Literature Review

A Systematic Review of Barriers and Facilitators to Implementing a Prescription Drug Monitoring Program

Ashley Garcia, BA
Erin Finley, PhD, MPH
Kristen Rosen, PhD, MPH
Jennifer S. Potter, PhD, MPH

Aims: Prescription drug monitoring programs (PDMPs) are state-run systems used to mitigate misuse and diversion by tracking scheduled medications e.g., opioid analgesics. We conducted a systematic literature review in an effort to better understand the current state of PDMP effectiveness and factors influencing their utilization.

Methods: 198 English-language studies published between January 2000 and August 2015 were identified through a PubMed database search. After removing irrelevant articles and applying inclusion criteria, ("effectiveness", "barriers", "facilitators, "perception & awareness", and "utilization") the number of original studies left for qualitative analysis was 35. We categorized findings regarding implementation by applying PARIHS Implementation Framework containing three elements of successful evidence-based practices: Evidence, Context, and Facilitation.

Results: The literature reveals mixed findings about the efficacy of PDMPs. This may be due to variations in implementation approaches, inconsistent measures of effectiveness, and weak evidence limited by study design. Barriers of use cited by providers include interface complexity, time burden, data delay, limited staff access, lack of awareness, and training on how to use PDMP reports. Facilitators indicate providers use PDMPs as a clinical tool, upon suspicion of abuse or diversion, after receiving PDMP training or education, or per workplace requirement.

Conclusion: The success of a PDMP relies heavily on the extent to which it can be supported and perceived as useful by its users. The gaps in the literature illustrate a lack of evidence, resources, and best practices for adoption of PDMPs. In order to promote PDMP uptake, there is a need for more implementation research.

B – 4
Meeting: 9th Annual Conference on the Science of Dissemination and Implementation in Health (2016)

Track: Health Policy Dissemination and Implementation

A scoping review to evaluate the impact of prescription drug monitoring program implementation

Erin P. Finley, PhD, MPH
Ashley Garcia, BA
Kristen Rosen, PhD, MPH
Claudina Tami, BS
Don McGeary, PhD
Mary Jo Pugh, PhD RN
Jennifer Sharpe Potter, PhD MPH

Background: Prescription drug monitoring programs (PDMPs) have been implemented in 49 out of 50 states in an effort to mitigate opioid-related misuse, abuse, and mortality, yet the literature evaluating the impact of PDMP policy implementation remains limited. We conducted a scoping review to: (1) describe available evidence regarding impact of PDMPs in the United States; and (2) propose a conceptual model to inform future PDMP implementation and evaluation efforts.

Methods: Scoping review following Arksey and O'Malley's (2005)'s methodology. Of the 121 articles identified from the initial PubMed database search of English•language studies published between 1/1/2000•5/31/16, eleven articles were identified as relevant based on the inclusion criteria defined a priori, specifically: peer•reviewed; presents original research; provides direct assessment of outcomes related to impact or effectiveness of PDMP implementation. We extracted data from each article following a structured template, then conducted thematic analysis to synthesize results.

Findings: Thematic analysis revealed studies of opioid-related outcomes associated with PDMPs typically point to a shared logic for how PDMPs are expected to function: i.e., implementation of PDMPs will increase reporting and monitoring of controlled prescriptions, leading to reduced opioid prescribing, opportunities for opioid diversion and misuse, and opioid abuse and mortality. However, extant evidence for the impact of PDMPs as an opioid risk mitigation tool remains mixed, with studies reporting evidence that both supports and contradicts their efficacy. We identified four domains of opioid-related outcomes frequently examined in original studies evaluating PDMP implementation: (1) opioid prescribing; (2) opioid diversion and supply; (3) opioid misuse; and (4) opioid-related morbidity and mortality. These domains inform a proposed evaluation framework that highlights significant gaps in empirical research across each of these domains.

Implications for D/I Research: There is currently no standard of best practices or guidelines regarding implementation or use of PDMPs for their intended purpose, and evidence for their

impact remains mixed. We propose a conceptual model for evaluating the complexities of PDMP implementation with the goals of clarifying PDMP mechanisms of impact, identifying characteristics of PDMP implementation associated with best outcomes, and maximizing the utility of PDMP policy to reduce opioid-related public health burden.

B – 5
Meeting: 9th Annual Conference on the Science of Dissemination and Implementation in Health (2016)

The Role of Small Ns in Implementing Big Data: Using Qualitative Methods to Refine Clinical Decision Support for Opioid Risk Mitigation in Military Health Settings

Erin P. Finley, PhD, MPH[1, 2] (finleye@uthscsa.edu)
Ashley Garcia, BA
Samantha Paniagua, BA
Suyen Warzinski, MA
Claudina Tami, BS
Don McGeary, PhD
Mary Jo Pugh, PhD RN
Jennifer Sharpe Potter, PhD MPH

Background: While big data opens up unprecedented new opportunities for implementing clinical decision support (CDS) tools in real time, successful implementation is likely to benefit from integration of qualitative methods in tool development and implementation planning. We conducted predictive analytics to identify individuals at risk for prescription-opioid-related morbidity and mortality using military health records, with the goal of developing CDS to assist in opioid prescribing and monitoring in military health settings; we also conducted qualitative interviews with military providers to assess how best to ensure CDS compatibility with providers' existing patterns of workflow and decision-making.

Methods: We conducted 26 semi-structured telephone interviews with providers from a large military health facility to assess (a) knowledge, attitudes, and behaviors regarding opioid prescribing management and monitoring; and (b) barriers and facilitators to integration of opioid-related CDS in their environment. Interview schedules were developed to assess key domains of the Promoting Action Research in Health Services (PARIHS) framework; interviews were coded for PARIHS constructs as well as emergent themes in providers' responses.

Findings: Twenty-six providers representing emergency medicine, pain medicine, behavioral health, pharmacy, and primary care participated. Providers reported complex decision-making around opioid prescribing and monitoring, as well as little knowledge or use of existing clinical informatics (e.g., the state-based prescription drug monitoring program). Providers also reported treating diverse patients (including active duty service members, retirees, and dependents), negotiating a delicate balancing act between ethical practice and patient satisfaction, and concerns about the feasibility of implementing new clinical tools in their context. Interview findings were used to refine planned CDS products and plan for implementation and evaluation.

Implications for D&I Research: As big data revolutionizes our ability to assist decision-making and tailor delivery of guideline-based care in complex settings like the military health system, mixed method approaches integrating qualitative assessments of baseline provider behaviors and attitudes, training needs, and context factors with implications for feasibility and uptake offer significant value. Implications for integrating qualitative and big data in evaluation of CDS implementation will also be discussed.

Include Table 1.
Include 3 Tables at the end with a sample quote
Poster discussion outline for paper discussion

Disclaimer: The views expressed are those of the author(s) and do not reflect the official views or policy of the Department of Defense, Department of Veterans Affairs, or its Components. The voluntary, fully informed consent of the subjects used in this research was obtained as required by 32 CFR 219 and DODI 3216.02_AFI40-402.

B - 6
Meeting: Behavior, Biology, and Chemistry: Translational Research in Addiction Conference (2017)

Utilizing Provider Feedback to Develop Opioid Risk Mitigation Tools for the Military Health System

Warzinski, Suyen S[1]; Tami, Claudina[1]; Finley, Erin P.[1,2]; Garcia, Ashley[1]; Paniagua, Samantha[1]; Potter, Jennifer S[1]

[1]University of Texas Health Science Center San Antonio; [2]South Texas Veterans Healthcare System.

Background: Clinical Decision Support (CDS) tools provide healthcare providers with helpful knowledge and detailed information to enhance patient healthcare and decision-making in the clinical workflow. Successful implementation of opioid risk mitigation tools will likely benefit from the integration of provider feedback during development and implementation planning.

Methods: We conducted 26 semi-structured telephone interviews with providers from a large military health facility to assess (a) knowledge, attitudes, and behaviors regarding opioid prescribing management and monitoring; and (b) barriers and facilitators to integration of opioid-related CDS in their environment. Interview schedules were developed to assess key domains of the Promoting Action Research in Health Services (PARIHS) framework; interviews were coded for PARIHS constructs as well as emergent themes in providers' responses.

Findings: Twenty-six providers representing emergency medicine, pain medicine, behavioral health, pharmacy, and primary care participated. Providers noted a variety of factors (e.g. time and workload constraints and integration with electronic health records) likely to affect the design, utility and integration of these opioid risk mitigation tools in Military Health Facilities. Providers' recommendations including ensuring rapid access to patient-specific information such as a list of medications and quantity of dose. Providers also made recommendations regarding report content and presentation, e.g., noting the importance of real-time data and easy login access.

Conclusion: Findings were used to develop opioid risk mitigation tools and plan for implementation and evaluation. As a result of this pre-implementation feasibility assessment, we modified our strategy to focus on opioid risk mitigation tools that support providers in recognizing patterns for patients' pain and opioid use over time, as well as linking them with key recommendations for safe opioid prescribing and follow-up care. In preparation for a pilot, next steps include a secondary expert review process.

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Utilizing Provider Feedback to Develop Opioid Risk Mitigation Tools for the Military Health System

Suyen Schneegans Warzinski, M.A.[1];
Claudina Tami, B.S.[1];
Erin P. Finley, M.P.H., Ph.D[1,2];
Mary Jo Pugh, Ph.D [1,2]
Don McGeary, Ph.D[1]
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Jennifer Sharpe Potter, M.P.H, Ph.D[1]

[1]University of Texas Health Science Center San Antonio; [2]South Texas Veterans Healthcare System; [3]University of Colorado School of Medicine; [4]Colorado National Guard; [5]Emergency Department, Brooke Army Medical Center; [6]59th Medical Wing Science & Technology Cell; [7]San Antonio Uniformed Services Health Education Consortium

Background: Clinical Decision Support (CDS) tools provide healthcare providers with knowledge and detailed information to enhance decision-making in the clinical workflow and patient healthcare. For example, CDS tools may help lower costs, improve healthcare efficiency and reduce the risk of medication errors and misdiagnoses. Due to the lack of tools to support opioid risk mitigation in the Military Health System (MHS), we explored the preferred characteristics of opioid risk mitigation tools by involving user engagement during the development of CDS feasible to implement within the Military Health System.

Methods: We conducted 26 semi-structured telephone interviews with providers from a large military health facility to assess (a) knowledge, attitudes, and behaviors regarding opioid monitoring and safe prescribing; and (b) barriers and facilitators to integration of opioid-related CDS in their environment. Interview schedules were developed to assess key domains of the Promoting Action Research in Health Services (PARIHS) framework; interviews were coded for PARIHS constructs as well as emergent themes in providers' responses.

Results: Twenty-six providers representing emergency medicine, pain medicine, behavioral health, pharmacy, and primary care participated. Providers reported key factors in clinical decision-making (e.g. time burden and patient medication information) likely to affect the design, utility and integration of these opioid risk mitigation tools in Military Health Facilities. Providers' noted recommendations regarding report content and presentation, e.g., noting the importance of real-time data and easy login access. Recommendations were incorporated in the development of CDS tools feasible in the MHS.

Discussion: The results of this project demonstrate the feasibility of implementing provider engagement in the development of CDS tools. As a result, we modified our strategy to focus   on

opioid risk mitigation tools that support providers in recognizing patterns for patients' pain and opioid use over time, as well as linking them with key recommendations for safe opioid prescribing and follow-up care. Next steps include a secondary expert review process of the resulting opioid risk mitigation tools.

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B - 8
Meeting: Military Health System Research Symposium (MHSRS)

Utilizing Provider Feedback to Develop Opioid Risk Mitigation Tools for the Military Health System

Suyen Schneegans Warzinski, M.A.[1];
Claudina Tami, B.S.[1];
Erin P. Finley, M.P.H., Ph.D[1,2];
Mary Jo Pugh, Ph.D [1,2]
Don McGeary, Ph.D[1]
Col (S) Vik S. Bebarta, M.D.[3,4]
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Jennifer Sharpe Potter, M.P.H, Ph.D[1]

[1]University of Texas Health Science Center San Antonio; [2]South Texas Veterans Healthcare System; [3]University of Colorado School of Medicine; [4]Colorado National Guard; [5]Emergency Department, Brooke Army Medical Center; [6]59th Medical Wing Science & Technology Cell; [7]San Antonio Uniformed Services Health Education Consortium

Background: Clinical Decision Support (CDS) tools provide healthcare providers with knowledge and detailed information to enhance decision-making in the clinical workflow and patient healthcare. For example, CDS tools may help lower costs, improve healthcare efficiency and reduce the risk of medication errors and misdiagnoses. Due to the lack of tools to support opioid risk mitigation in the Military Health System (MHS), we explored the preferred characteristics of opioid risk mitigation tools by involving user engagement during the development of CDS feasible to implement within the Military Health System.

Methods: We conducted 26 semi-structured telephone interviews with providers from a large military health facility to assess (a) knowledge, attitudes, and behaviors regarding opioid monitoring and safe prescribing; and (b) barriers and facilitators to integration of opioid-related CDS in their environment. Interview schedules were developed to assess key domains of the Promoting Action Research in Health Services (PARIHS) framework; interviews were coded for PARIHS constructs as well as emergent themes in providers' responses.

Results: Twenty-six providers representing emergency medicine, pain medicine, behavioral health, pharmacy, and primary care participated. Providers reported key factors in clinical decision-making (e.g. time burden and patient medication information) likely to affect the design, utility and integration of these opioid risk mitigation tools in Military Health Facilities. Providers' noted recommendations regarding report content and presentation, e.g., noting the importance of real-time data and easy login access. Recommendations were incorporated in the development of CDS tools feasible in the MHS.

Discussion: The results of this project demonstrate the feasibility of implementing provider engagement in the development of CDS tools. As a result, we modified our strategy to focus on opioid risk mitigation tools that support providers in recognizing patterns for patients' pain and

opioid use over time, as well as linking them with key recommendations for safe opioid prescribing and follow-up care. Next steps include a secondary expert review process of the resulting opioid risk mitigation tools.

Research Topic:
Health Services Research Across DoD

Learning Objectives:
1. Define the importance and need of CDS tools in the Military Health System.
2. Define key factors likely to affect the design, utility and integration of CDS tools in the MHS.
3. Demonstrate the clear role and need for provider engagement in development and implementation of CDS tools.

Disclaimer: The views expressed are those of the author(s) and do not reflect the official views or policy of the Department of Defense, Department of Veterans Affairs, or its Components. The voluntary, fully informed consent of the subjects used in this research was obtained as required by 32 CFR 219 and DODI 3216.02_AFI40-402.

APPENDIX C – Opioid Risk Mitigation Tools

C – 1 Provider Report Card

C – 2 Patient Case Summary
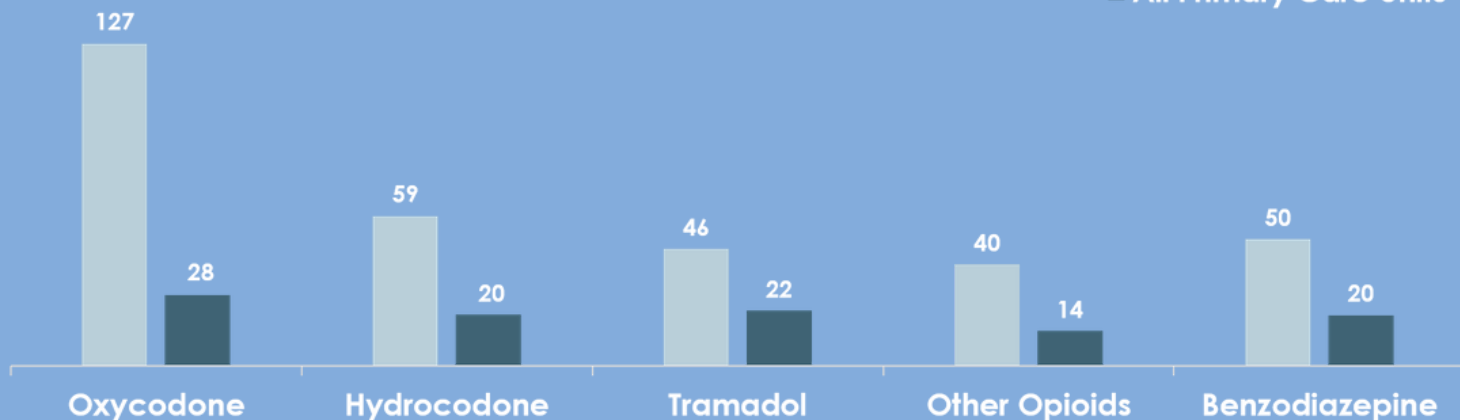
SPECIALTY PRESCRIBING TRENDS PRIMARY CARE

QUARTERLY REPORT: JAN 2011- MAR 2011

Please note: Draft only. Not for distribution.

PRESCRIPTIONS WRITTEN

Total number of prescriptions written by your facility compared to average number of prescriptions written by all facilities.

- Your Primary Care Unit
- All Primary Care Units

	Oxycodone	Hydrocodone	Tramadol	Other Opioids	Benzodiazepine
Your Primary Care Unit	127	59	46	40	50
All Primary Care Units	28	20	22	14	20

AVERAGE DOSE PER PRESCRIPTION (e.g. pills, injections, etc.)

Average dose prescribed by your facility compared to average dose prescribed by all facilities.

- Your Primary Care Unit
- All Primary Care Units

	Oxycodone	Hydrocodone	Tramadol	Other Opioids	Benzodiazepine
Your Primary Care Unit	56	41	40	57	61
All Primary Care Units	41	37	69	36	36
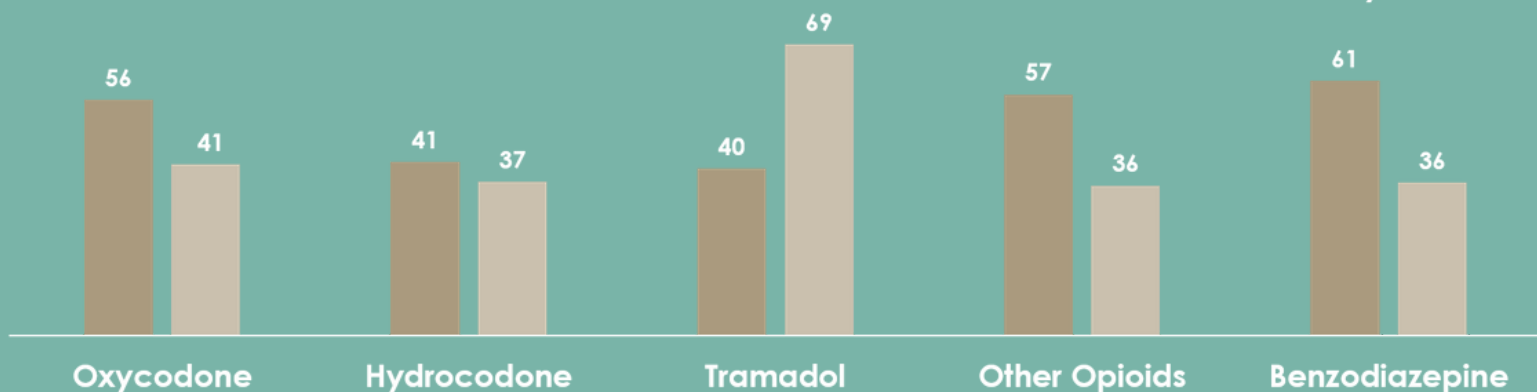
AVERAGE DAILY MME

Average daily MME prescribed by your facility compared to average daily MME prescribed by all facilities.

- Your Primary Care Unit
- All Primary Care Units

	Oxycodone	Hydrocodone	Tramadol	Other Opioids
Your Primary Care Unit	70	38	8	127
All Primary Care Units	48	32	27	41
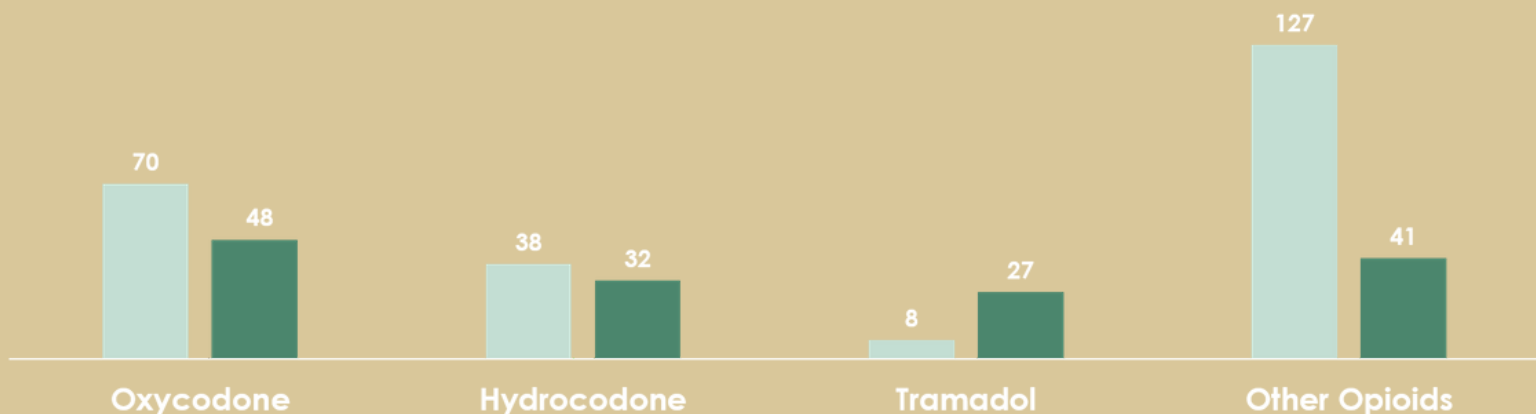
115 patients received Opioids from your clinic

13 patients are receiving a combination of Opioids and Benzos from your clinic

10 patients are receiving Opioids from your clinic and Benzos from other sources

3 patients received 100 or more MMEs from your clinic

7 patients received 50 or more MMEs from your clinic

9 patients received 30 or more MMEs from your clinic

0 of your patients received opioids* from 47 five or more doctors

7 of your patients received opioids* from five or more sites

*includes tramadol

PATIENT A:
MALE ACTIVE DUTY MARINE CORPS BETWEEN THE AGE OF 18 - 25

Note: Text in this color identifies diagnoses that continued for more than one year.

Significant Events in 2010:
1 Emergency Visit
2 Outpatient Visits
Musculoskeletal signs and symptoms
Acquired foot deformities
Head injury

Significant Events in 2011:
1 Inpatient Hospitalization
1 Emergency Visit
21 Outpatient Visits
2 Unique & 2 Specialty Providers
Musculoskeletal signs and symptoms
Acquired foot deformities
Musculoskeletal disorders, other
Non-fungal infections of skin and subcutaneous tissue
Infections, other
Chronic ulcer of the skin

Significant Events in 2012:
2 Emergency Visit
18 Outpatient Visits
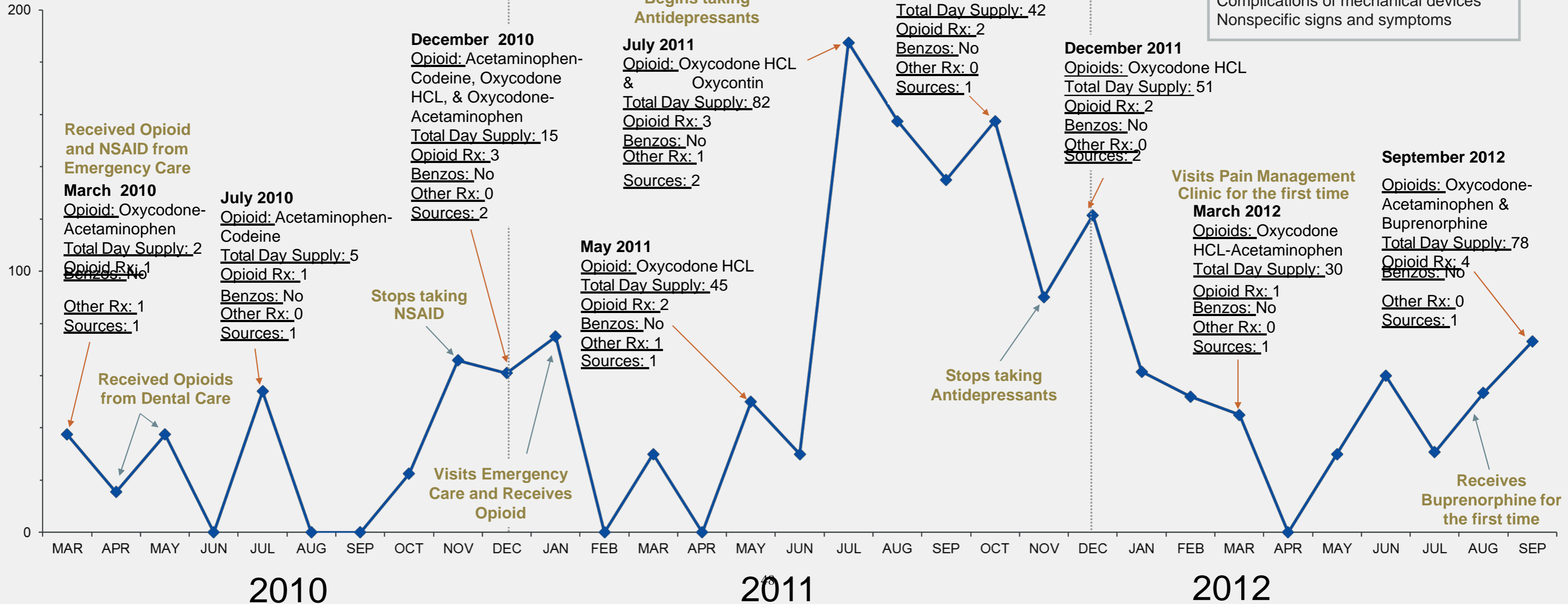1 Unique & 1 Specialty provider
Low Back Pain
Musculoskeletal signs and symptoms
Acquired foot deformities
Acute sprains and strains
Musculoskeletal disorders, other
Bursitis, synovitis, tenosynovitis
Lacerations
Contusions and abrasions
Complications of mechanical devices
Nonspecific signs and symptoms

Average Daily MME

200

100

0

Received Opioid and NSAID from Emergency Care

March 2010
Opioid: Oxycodone-Acetaminophen
Total Day Supply: 2
Opioid Rx: 1
Benzos: No
Other Rx: 1
Sources: 1

Received Opioids from Dental Care

July 2010
Opioid: Acetaminophen-Codeine
Total Day Supply: 5
Opioid Rx: 1
Benzos: No
Other Rx: 0
Sources: 1

Stops taking NSAID

December 2010
Opioid: Acetaminophen-Codeine, Oxycodone HCL, & Oxycodone-Acetaminophen
Total Day Supply: 15
Opioid Rx: 3
Benzos: No
Other Rx: 0
Sources: 2

Visits Emergency Care and Receives Opioid

May 2011
Opioid: Oxycodone HCL
Total Day Supply: 45
Opioid Rx: 2
Benzos: No
Other Rx: 1
Sources: 1

Begins taking Antidepressants

July 2011
Opioid: Oxycodone HCL & Oxycontin
Total Day Supply: 82
Opioid Rx: 3
Benzos: No
Other Rx: 1
Sources: 2

October 2011
Opioids: Oxycodone HCL
Total Day Supply: 42
Opioid Rx: 2
Benzos: No
Other Rx: 0
Sources: 1

December 2011
Opioids: Oxycodone HCL
Total Day Supply: 51
Opioid Rx: 2
Benzos: No
Other Rx: 0
Sources: 2

Stops taking Antidepressants

Visits Pain Management Clinic for the first time

March 2012
Opioids: Oxycodone HCL-Acetaminophen
Total Day Supply: 30
Opioid Rx: 1
Benzos: No
Other Rx: 0
Sources: 1

September 2012
Opioids: Oxycodone-Acetaminophen & Buprenorphine
Total Day Supply: 78
Opioid Rx: 4
Benzos: No
Other Rx: 0
Sources: 1

Receives Buprenorphine for the first time

MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP

2010   2011   2012

APPENDIX D – Executive Summary

D – 1 Feasibility of Implementing an Opioid Prescription Monitoring Program in the Military Health System

<div align="center">

Executive Summary
FEASIBILITY OF IMPLEMENTING AN OPIOID PRESCRIPTION MONITORING
PROGRAM IN THE MILITARY HEALTH SYSTEM

</div>

Contract # Air Force Research Laboratory FA8650-15-C-6588 P1; Air Force Research Laboratory FA8650-15-C-6588 P2
Substance Abuse Working Group (SAWG) of the Joint Program Committee 5 (JPC-5)/ Military Operational Medicine Research Program (MOMRP), US Army Medical Research and Materiel Command (USAMRMC)

PURPOSE
This 2-year project addressed opioid risk mitigation and prescription monitoring implementation in the MHS by 1) examining opioid prescribing trends and patterns; 2) identifying military-specific algorithms to alert clinicians of potential OA misuse; and 3) developing standardized reports and guidelines for opioid prescription monitoring suitable for use in Military Treatment Facilities (MTFs).

COLLABORATORS
- Extramural PI - Jennifer Sharpe Potter, Ph.D., M.P.H., UT Health San Antonio
- Intramural PI – Maj Joseph Maddry, M.D., Director, USAF En route Care Research Center, 59 MDW
- Past Intramural PI (current CO-I) – Col Vikhyat Bebarta, M.D., USAF Reserve IMA, 59MDW, JBSA
- Co-I - Erin P. Finley, Ph.D., M.P.H. and Don McGeary, Ph.D., UT Health San Antonio
- JPC-5 Substance Use Task Area - Project Manager, Lt Col Mikel Merritt, Ph.D., 59MDW

AIMS
1. Develop and test prescription database algorithms, utilizing a model developed and implemented successfully with civilian prescription monitoring programs (PMP), for identifying non-medical use of scheduled medication and/or 'questionable' activity.
2. Develop and examine feasibility issues related to implementing a PMP in the Military Health System (MHS).
3. Based on aims 1 and 2, develop an optimal study and trial protocol for a randomized effectiveness-implementation hybrid study to be testes in a subsequent study.

ACCOMPLISHMENTS
- Quantitatively <u>examined trends</u> in MHS opioid prescribing
- Qualitatively <u>evaluated the impact</u> of using these algorithms to identify aberrant drug-taking behavior among individuals prescribed opioids in the MHS

DELIVERABLES (see supplemental attachments)
- Developed two opioid risk mitigation tools: Provider Report Card & Patient Case Summary
- Three published manuscripts:
-- Evaluating the impact of prescription drug monitoring program implementation: a scoping review (2017)
-- Implementing prescription drug monitoring and other clinical decision support for opioid risk mitigation in a military health care setting: a qualitative feasibility study (2017)
-- Opioid Use Patterns Among Active Duty Service Members and Civilians: 2006 – 2014 (2017)
- Five poster presentations presented at military and civilian conferences

IMPACT STATEMENT
As a result of this work, we are able to provide MHS leadership with actionable recommendation regarding opioid risk mitigation. Using existing data resources within MHS, it is possible to implement opioid risk mitigation; for example, the population health portal. However, evaluation is critical to establish effectiveness and minimize unintended adverse consequences on patient care. Below, we propose our next steps to continue our PMP activities.

NEXT STEPS – We have submitted the following proposal and is under review at: JPC-5 WG: EARLY ASSESSMENT & INTERVENTIONS TO SUPPORT SERVICE MEMBER PSYCHOLOGICAL HEALTH
- Pending review of JPC-5 SAWG – FY19 Research Call on proposal "A non-randomized controlled stepped wedge trial to evaluate the effectiveness of a multi-level intervention to support clinical decision making and use of prescription monitoring programs in the Military Health System" with the following aims:
1. Develop the **Achieving Risk Mitigation and Opioid Risk Reduction (ARMORR)** toolkit to inform clinical decision making and PMP integration into clinical practice.
2. Evaluate the ARMORR toolkit in MTF's using a non-randomized controlled stepped wedge cluster trial design in 3 MHS sites, all of whom have agreed to participate: 460th Medical Group Buckley AFB, 140th Medical Group, Colorado Air National Guard AFB and Brooke Army Medical (Departments of Emergency Medicine, Internal Medicine and Orthopedic Surgery)

LIST OF SYMBOLS, ABBREVIATIONS AND ACRONYMS (alphabetical order)

AMSUS	Association of Military Surgeons of the United States
BBC	Behavior, Biology, and Chemistry: Translations Research in Addiction Conference
CDS	Clinical Decision Support
CPDD	College on Problems of Drug Dependence
D&I	Conference on the Science of Dissemination and Implementation in Health
DoD	Department of Defense
EHR	Electronic Health Record
HCP	Health Care Provider
MHS	Military Health System
MHSRS	Military Health System Research Symposium
OA	Opioid Analgesics
ORM	Opioid Risk Mitigation
PARiHS	Promoting Action on Research Implementation
PDMP	Prescription Drug Monitoring Program
PMP	Prescription Monitoring Program
PTSD	Post Traumatic Stress Disorder
SURF	San Antonio Military Health System and Universities Research Forum
US	United States
VA	Veterans Affairs