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About CADTH: CADTH is an independent, not-for-profit organization responsible for providing Canada's health care decision-makers with objective evidence to help make informed decisions about the optimal use of drugs, medical devices, diagnostics, and procedures in our health care system.

Abbreviations

PDMP	prescription drug monitoring program
OUD	opioid use disorder

Context and Policy Issues

In 2016, there were approximately 2,800 opioid-related deaths in Canada, including those caused by overdose and suicide.[1] Moreover, in the same year, an average of 16 Canadians were hospitalized each day due to opioid-related poisoning.[2] Today, approximately 13% of Canadians use prescription opioids, 2% of whom use it for non-medical purposes.[1] Although all provinces and territories have experienced burden from the "opioid crisis," the greatest burden has been experienced by the Yukon and Northwest Territories.[3]

One factor that has contributed to this crisis has been the practice of "doctor shopping" or "double doctoring" where patients seek opioids from multiple prescribers without making them aware of their prescription history.[4] As a result, individuals with opioid use disorder (OUD) may obtain and use prescription opioids above a safe level, as they have obtained them from a variety of prescribers and dispensers, contributing to an increase in overdose-related deaths.

Prescrption drug monitoring programs (PDMPs) track inappropriate prescribing and dispensing of certain drugs.[4] Originally developed as a surveillance tool for the criminal justice system, prescribers and dispensers in many jurisdictions around the world use them to track controlled drugs, including opioids. PDMPs collect data on patient identity, drug and quantity dispensed, and dispenser and prescriber identity.[5] PDMPs can be used to identify potentially high doses of drugs dispensed to patients, multiple prescriptions given for monitored drugs to a single patient, the locations of pharmacies where an unusual number of controlled drug prescrptions have been filled, and potential risk from combining different drugs.[6] These programs are used not just for monitoring prescription opioids but also for other controlled substances such as benzodiazepines and psychostimulants.[4]

Research has shown that PDMPs are effective in decreasing prescriptions of monitored drugs, eliminating double doctoring, and reducing opioid misuse and abuse.[4,5] PDMPs can also improve patient care by increasing access to essential information.[4] Some research has also found that red flags by PDMPs prompt dispensers to understand and resolve the situation.[6]

PDMPs have existed in Canada since the 1980s.[4] However, there is a need to enhance these programs to ensure they include administrative and design features to help facilitate their potential to reduce the number of deaths related to drug abuse, misuse, and overdose. Given their fundamental role in the success of PDMPs, this review will summarize the perspectives and preferences of healthcare providers (prescribers and dispensers) using PDMPs in providing patients with monitored drugs, with a focus on administrative and design features.

Research Questions

1. How do healthcare providers (prescribers and dispensers) who prescribe monitored drugs use prescription drug monitoring programs?
2. What are their perspectives on and preferences for prescription drug monitoring programs, including specific design and administrative features?

Key Findings

In total, 18 studies were included in this review that described the perspectives and preferences of a variety of medical professionals working across different specialties and settings on the topic of prescription drug monitoring programs. These studies reflected varied methodological reporting quality and the majority of studies could have benefitted from additional methodological detail. While an original focus of this review, no studies were found that described the experiences and perspectives of patients engaging with prescription drug monitoring programs, representing a major gap in this review.

Generally, providers found prescription drug monitoring programs systems useful for their practice, although not all providers used them routinely. For some, prescription drug monitoring program use was prompted by a red flag or concerning interactions with patients about controlled substances (i.e. “subjective use”), while for others use was mandated by institutional policy (i.e. “systematic use”). The ways in which providers engaged with programs appeard to vary based on their personal preconceptions, their institutional circumstances and their professional judgement in terms of who genuinely requires treatment and who may be doctor shopping. The approach also determined what barriers were experienced and which enablers were perceived most relevant to providers.

Prescription drug monitoring program use was delineated into three broad functions. The first is an information function, through which some providers described instances of being surprised with the information from the program, as it conflicted with their preconception of which patients they perceived to be doctor shopping and who genuinely needed controlled drugs. The second is a patient safety function, through which providers described that they perceived the programs to prevent patients from seeking multiple prescriptions from different providers. At the same, providers also described that the programs provided a safety function for their own practice, as the programs allowed them to feel more confident in their prescribing decisions. The third function is an engagement function, through which providers described that programs facilitated ongoing dialogue between them and their patients about drug safety. Here, providers described that programs can be seen to shift responsibility away from them in terms of prescribing decisions, thereby adding legitimacy in particular for decisions to not prescribe controlled substances. The engagement function exemplifies the educational role that prescribers and dispensers play in discussions about substance abuse and awareness. While perhaps not an intended goal of prescription drug monitoring programs, engagement and discussion resulting from program use appears to have become common practice by the majority of providers included in this review.

While several benefits to using prescription drug monitoring programs were raised, at the same time some challenges were also noted. For example, due to the sensitive nature of the information, some providers expressed uncertainty as to how patients might respond to learning their providers accessed program information. In some circumstances, providers described concerns about potential conflict and physical altercations, which was raised as a major barrier to initiating conversations about prescription drug monitoring program

information. Another major barrier is the challenge of finding time and dedicated space in a busy pharmacy or medical practice to appropriately engage in discussion with patients. This became particularly problematic when, for one reason or another, prescribers did not use the prescription drug monitoring program and therefore the onus for monitoring and management falls to the dispenser.

Other described barriers appear to stem from perceived challenges in accessing the system, either due to lack of time or challenges with the interface (e.g., losing paswords, finding the website, entering patient data, gaining access approval through in-person authentication). Issues with access were futher complicated by busy work environments that characterize medical practice. For similar reasons, providers also described issues with timely updates of the prescription drug monitoring program system, for example shortly after patients fill their prescription, which can lead to incomplete or inaccurate information.

Specific design features to enhance access and to better integrate programs into clinical workflows were described as means to increase adoption and sustain use of programs over time. These included integrating programs into existing electronic health record systems, which may include real time updating of prescription information and also moving towards a national linked system. In addition, a strong need for a user-friendly display of information was expressed, which includes ensuring the most relevant information is available in an accessible manner to ensure efficient prescribing decisions can be made, and also a desire for a streamlined login process, automatic enrollment, and a map of all dispensers in the area. Finally, training was identified as parituclarly important, and was suggested to include guidance on how to interpet information, strategies to incorporate programs into clinical workflow, and how to approach patients for engagement discussions based on program information.

Methods

Literature Search Methods

A limited literature search was conducted on key resources including PubMed, the Cochrane Library, University of York Centre for Reviews and Dissemination (CRD), Canadian and major international health technology agencies, as well as a focused Internet search. Methodological filters were applied to limit retrieval to health technology assessments, systematic reviews, meta-analyses as well as qualitative studies. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 01, 2009 and March 25, 2019.

Selection Criteria and Methods

One reviewer screened citations and selected studies. In the first level of screening, titles and abstracts were reviewed and potentially relevant articles were retrieved and assessed for inclusion. The final selection of full-text articles was based on the inclusion criteria presented in Table 1.

Table 1: Inclusion Criteria

Population	• Healthcare providers, in particular prescribers, caring for patients receiving, or having received, monitored drugs. • Healthcare providers, in particular prescribers, with experience engaging with prescription drug monitoring programs.
Intervention	Prescription monitoring drug programs with a focus on “real time” programs.
Comparator	Any
Outcomes	Issues emerging from the literature that relate to the research question, including but not limited to perspectives on, expectations of, and experiences with the implementation of prescription drug monitoring programs, including perceived or experienced outcomes (intended or unintended), preferences for any particular design and administrative features, and perspectives on what design features may lead to better outcomes and why.
Study Designs	Primary qualitative studies, the qualitative component of multiple- or mixed-methods studies, and qualitative evidence syntheses

Exclusion Criteria

Articles were excluded if they did not meet the inclusion criteria outlined in Table 1 as well as duplicate publications and those published before 2009. Primary studies that did not use a qualitative or mixed- or multiple-methods research design were also excluded.

The original intent was to retrieve articles describing patients’ and providers’ perspectives on PDMPs. However, screening did not yield any articles on patients’ perspectives. As such, the research questions were modified to better reflect the focus of this report on healthcare providers (prescribers and dispensers) using PDMPs. Studies were excluded if they described the perspectives or experiences of groups other than patients or providers, for example legislators.

Critical Appraisal of Individual Studies

There is no consensus on the merit or most appropriate approach to appraising qualitative research, specifically for rapid qualitative evidence syntheses. The lack of consensus is partly due to the observation that published qualitative manuscripts often omit pertinent methodological details, either because they were not included in the original design or to meet the word count limitations of journals. As such, judging the quality of a qualitative study by using an appraisal tool may actually reflect reporting quality rather than design and conduct. For the context of this rapid review, critical appraisal focused on how methodological details have been reported in the main manuscript. We have detailed our perspectives on critical appraisal in a separate publication.[7]

One researcher appraised all primary qualitative studies and the qualitative component of multiple- or mixed-methods studies using the Quality of Reporting Tool (QuaRT) as a guide.[8] This tool is advantageous because it assesses the reporting quality of four commonly reported methodological characteristics of studies: question and study design, selection of participants, methods of data collection, and methods of data analysis. Summary statistics to describe overall study quality were not calculated for included studies. Rather, a review of strengths and limitations of each study were described

narratively in Appendix 4. The results of this critical appraisal were not used to exclude studies from analysis.

Data Analysis

Descriptive Analysis

A descriptive data analysis was conducted to describe important study design, methods, and participant (i.e. provider) characteristics. To inform the analysis, one researcher extracted data on author, date and country of publication, research objectives, study design or analytic approach, data collection strategies, study setting, and participant characteristics (i.e., proportion of males, inclusion criteria, specialties of clinicians). Upon completion of descriptive data extraction, the research questions were modified to better reflect available data while respecting the original intent of inquiry. In particular, research questions pertaining to patients' perspectives and experiences with PDMPs were removed because initial screening and data extraction did not retrieve any studies that would answer these questions.

Analytic Approach

Data analysis was informed by the qualitative meta-synthesis approach,[9] which is a type of a qualitative evidence synthesis methodology that enables researchers to aggregate similar findings across multiple studies while retaining the original meaning of results from each study. Findings were extracted, and compared and contrasted to develop an integrative interpretation of the topic. This review also employed a staged-coding approach informed by constructivist grounded theory.[10] A strong emphasis was placed on developing an aggregative interpretation of included studies while maintaining relevance to how findings can inform policy decisions.

One researcher conducted two cycles of coding. In initial coding, the researcher worked through four studies to understand, problematize, breakdown, and reform themes through a line-by-line and section-by-section analysis. This process identified the descriptive and interpretive meanings of data along with its contextual factors and intentions. During this process, the researcher moved quickly through the data to acquire a broad understanding of relevant concepts and themes. The goal of this stage was to develop a preliminary coding schema that would capture the saliency of issues most pertinent to the policy questions. The research questions were also reassessed at this point to determine whether they were congruent with the coding schema and if modifications to the analytic approach or research questions were needed. Also, the possibility of subgroup analyses based on demographic characteristics of participants (e.g., medical specialty) was determined to be not feasible because the majority of included studies did not separate findings based on these characteristics.

The second cycle consisted of focused coding where the researcher used the coding schema to extract relevant data from remaining studies. At this point, findings from new studies either substantiated existing components of the schema or added new concepts and themes. The focused coding process divided the data into two categories that were deemed most relevant to the policy questions. The researcher subsequently extracted findings from relevant themes of each category through multiple, iterative coding cycles towards theoretical saturation between and within each category. The researcher also paid special attention to hidden or conceptually powerful issues that appeared in the data. These ideas were recorded in memos and revisited during report writing.

Eventually, categories become more comprehensible and multiple themes within each category were delineated. The researcher re-analyzed and re-organized all data within categories in a way that would be internally consistent between categories and relevant to the policy issues. A narrative summary was developed that summarized the concepts contained in the themes of each category. After developing these summaries, the researcher collated the summaries to ensure that they contributed to an integrative and holistic interpretation of findings that would enhance policy discussions.

Summary of Evidence

Quantity of Research Available

A total of 89 citations were identified from the literature search. Following screening of titles and abstracts, 62 citations were excluded and 27 potentially relevant reports from the electronic search were retrieved for full-text review. Four potentially relevant publications were also retrieved from the grey literature search for full-text review. Of these potentially relevant articles, 13 publications were excluded for various reasons, and 18 publications met the inclusion criteria and were included in this report. Appendix 1 presents the PRISMA[11] flowchart of the study selection process.

Summary of Study Characteristics

Charateristics of included studies are summarized below and details are available in Appendix 2 and 3.

Study Design or Analytic Approach and Data Collection

Of the 18 studies included in this review, 14 (77.8%) identified a particular study design or analytic approach. An equal number of these studies identified with thematic analysis or adapted approaches (n=7; 38.9%),[12-18] and grounded theory and adapted approaches (n=7; 38.9%).[19-25] Four studies (22.2%) did not specify a particular qualitative methodology or analytic approach.[26-29]

All but one study used either focus groups or semi-structured interviews as the primary data collection strategy. In total 10 (55.6%) studies used semi-structured interviews only,[12,16,17,19,21,23-25,28,29] and five (27.8%) used focus groups only.[14,15,22,26,27] The number of focus groups ranged from one,[22] to five.[26] Two studies (11.1%) used a combination of focus groups and semi-structured interviews[18,20], and one study (5.6%) analyzed the open-ended responses from a survey.[13]

Country of Origin

All studies included in this review were conducted in the United States.[12-29]

Year of Publication

Included studies were published between 2014,[20] and 2019.[12,16,17] The largest jump in the number of published studies was in 2018 when nine (50.0%) studies were published compared to 2017 when two (11.1%) were published.

Provider Populations

Included studies encompassed the perspectives of providers only, and not patients who use PDMPs. These studies recruited a variety of medical professionals and specialists in

medicine, which often served as the inclusion criteria for studies. With regards to medical professions, physicians were the most common provider population and were included within 13 (72.2%) studies.[13,15-17,20-26,28,29] Pharmacists were the second most common population with eight (44.4%) studies including them as participants.[13-15,18,20,26-28] Other professions included physician assistants (n=5; 27.8%)[13,20,21,23,24]; dentists (n=4; 22.2%)[13,20,21,23]; and nurses and nurse practitioners (n=3; 16.7%).[13,15,21]

With regards to medical specialties, primary care was the most common (n=9; 50.0%),[12,15,16,19,21,23,26,28,29] followed by emergency medicine (n=8; 42.1%),[16,17,19,21-25] pain medicine (n=4; 22.2%),[16,19,21,23] psychiatry (n=2; 11.1%),[21,23] and surgery (n=2; 11.1%).[21,23]

The age range was not reported or could not be ascertained by the information presented in included studies with the exception of one (32 to 80 years).[12] Four (22.2%) studies did not include the proportion of males or females in their study.[14,18,22,27] Among the studies that included this information, the proportion of males ranged from 47.1%,[24] to 77.1%.[20] In total, the perspectives and preferences of 6,694 healthcare providers were captured in this review, from which 5,994 were captured within one study that conducted a content analysis on open-ended survey responses. The median sample of participants included in studies within this review was 34.

Settings of included studies corresponded to the medical professionals and specialties included in each study. The majority of studies were conducted in multiple settings, which made it difficult to analyze the findings based on this study characteristic. The most common setting was primary care clinics (n=8; 44.4%),[12,15,16,20,21,23,26,28] and emergency departments of hospitals (n=7; 38.9%).[17,20-25] Four (22.2%) studies each were conducted in inpatient hospital units, including psychiatry,[13,20,21,23] and community pharmacies.[14,18,27,28] Other settings included: pain clinics (n=3; 16.7%)[20,21,23]; dentist clinics (n=2; 11.1%)[21,23]; surgical units of hospitals (n=2; 11.1%)[21,23]; outpatient hospital clinics (n=1; 5.6%)[13]; hospital pharmacies (n=1; 5.6%)[27]; military hospitals (n=1; 5.6%)[19]; and Veterans Affairs facilities (n=1; 5.6%).[29]

Summary of Critical Appraisal

A summary of strengths and limitations of each study can be found in Appendix 4.

All studies clearly stated the research objectives or questions in the abstract or background sections of the publication. With regards to study design, with the exception of four studies,[26-29] all studies explicitly identified with a qualitative methodology or analytic approach. As such, these two characteristics were subsumed into a single analysis of reporting quality.

With regards to sampling and recruitment process, 11 (61.1%) studies generally included a detailed process,[13-15,18,20,21,23,24,27-29] whereas seven (38.9%) studies were missing crucial detail,[12,16,17,19,22,25,26] for example, avenues used to reach participant populations. For data collection, ten (55.6%) studies described a comprehensive data collection plan,[12-14,16,18,20,21,23,28,29] but eight (44.4%) studies could have benefited from additional information.[15,17,19,22,24-27] Importantly, nine (50.0%) studies did not provide a justification for choosing their primary data collection strategy over other strategies.[12,13,15,18,19,24-26,28] A similar pattern was observed with regards to data analysis. In total, nine (50.0%) studies had a detailed data analysis section,[16,19-21,23-26,28] but eight (44.4%) required elaboration on specific analytic procedures,[12-15,17,18,22,29] and one (5.6%) study did not include a section on data analysis.[27]

A major limitation of included studies was the lack of discussion on strategies to improve rigour, which characterized 11 (61.1%) studies.[12,13,15,17,18,20,21,23,26,27,29] The remainder of studies mentioned it as a passing note but did not elaborate on how the strategies improved their research process.[14,16,19,22,24,25,28]

This analysis indicates that some studies included a comprehensive description of certain sections, while other sections required elaboration. This finding reflects broader observations in the qualitative literature where researchers have had to negotiate between different sections of their methodology and methods to meet the restrictions of peer-reviewed journals. As such, although this analysis provides a snapshot of the strengths and limitations of included studies, it is possible these characteristics should be contextualized to external circumstances and limitations placed on the publication process of qualitative manuscripts.

Summary of Findings

This section describes the perspectives of providers using PDMPs, as they emerged from the reviewed literature. These providers include *prescribers,* referring to physicians and other licensed healthcare providers that prescribe controlled substances, and *dispensers,* most often referring to pharmacists but also others who interact with patients filling prescriptions (e.g., pharmacy technicians). Where possible, findings are reported separately for prescribers and dispensers to contrast their perspectives on and experiences with PDMPs. Results are divided into the following sections: (1) Perceived Goals and Benefits of Prescription Drug Monitoring Programs and (2) Administrative and Design Features.

Perceived Goals and Benefits of Prescription Drug Monitoring Programs

Prescribers and dispensers described a variety of goals and benefits from using PDMPs, which were often conflated in their expressed perspectives and preferences. Three "functions" broadly categorized these goals and benefits: *information*, *patient safety*, and *engagement*.

For the *information function*, prescribers reported that PDMPs provide useful information to support treatment for patients that would not have been available otherwise,[24,25,29] including the location of where prescriptions were written and filled and names and quantities of drugs prescribed. In some cases, this information surprised prescribers as it conflicted with their preconceptions of which patients they thought were doctor shopping, and which genuinely needed controlled drugs to maintain a healthy lifestyle. Prescribers also reported that having additional information from PDMPs introduced more objectivity when deciding whether or not to precribe controlled drugs.[12,16,25,27,29] Importantly, one study reported that PDMP information caused a small number of prescribers to actively remove patients from their practice due to stigma and fear of repercussions on their practice (i.e., other patients may opt to visit another practice due to stigma of treating patients with opioid addictions).[12] In multiple instances, prescribers reported that new information obtained from PDMPs initiated coordination and cooperation between other prescribers and dispensers on how to optimally facilitate care for patients.[16,20,22,27,28] For example, precribers reported valuing dispensers when they provided information about patients' potential misuse and abuse of controlled drugs.[14,15,20] This level of cooperation was perceived as advantageous because it would prompt closer monitoring of patient behaviour and drug safety.

With regards to the *patient safety function*, many participants reported that PDMPs prevented patients from seeking multiple prescriptions from different prescribers and dispensers.[12,13,18,20,25,27,29] Along the same lines, some participants framed this benefit in a way that assisted in optimally managing and monitoring their patients' treatment.[13,14,27-29] Because prescribers can access a wider and more comprehensive range of information (e.g., locations, quantities, and types of prescription drugs) and verify prescription history, prescribers felt that PDMPs led to improved patient safety.[14,16,19,20,28,29] Interestingly, in one study, participants reported that PDMPs protect both them and patients: "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."[19] Other studies also reported that prescribers used PDMPs to confirm what patients said about their prescription history.[14,19,27,28] When these two sources of information did not match, some prescribers used it as an opportunity to have a conversation with their patients about drug safety.

Multiple prescribers and dispensers across nine studies reported using PDMPs as a tool to engage patients in a discussion about drug misuse – referred to as the *engagement function*.[13,14,16,19-21,23,25,28] Similarly, prescribers reported that by using PDMPs as the reason to not prescribe, it shifts responsibility away from them and adds legitimacy to their discussions with patients, and in particular, to their decision not to prescribe controlled substances.[16,21] Although the engagement function was not the intended goal of PDMPs, it appears to have become common practice by prescribers and dispensers participating in the studies included in this review. Engagement and discussion were often reported to occur when PDMP information showed that patients are doctor shopping or if patients' verbally stated information did not match PDMP data. Overall, prescribers and dispensers described four ways of engaging with patients in response to concerning PDMP data: non-judgemental open dialogue, avoid discussion and do not prescribe, confront the patient, or serve as a detective in order to understand the situation.[16,20,21,23] Two studies reported that different approaches to communicating with patients may lead to different responses, for example, denial or physical conflict.[20,25]

Prescribers and dispensers reported many advantages and disadvantages of using information from PDMPs to engage with patients patients. In particular, participants reported that PDMPs provided essential opportunities for them to engage in discussions with patients about potential addiction issues and medication safety.[12,16,19,20,23,25,27,28] These discussions exemplify the educational role that prescribers and dispensers may have to play in raising patients' understanding and awareness of substance abuse through PDMPs. These discussions also appear to contribute to trust, and improved communication and rapport between providers and patients.[25] In some cases, discussions were reported to encourage patients to admit that they have a substance abuse problem, which subsequently prompted them to engage in treatment options such as counseling to address abuse issues.[12,14,20,21,25] In these situations, patients responded positively to prescribers' decisions not to prescribe controlled drugs, particularly if the discussion included information about alternative treatment options.[21,25,28]

Providers also reported disadvantages to discussing PDMP information with patients.[12-14,20,21,23,25,28] For example, due to the sensitive nature of the information, some providers were uncertain how patients would respond if they mentioned that they accessed the PDMP system.[21,25] At the same time, providers reported that typically patients felt guilt or

embarrassment,[20,21,28] or denied the validity of PDMP information.[20,21,23,28] Some providers used these situations to address patients' concerns and orient them towards treatment-seeking behaviour. In rare circumstances, a discussion with patients led to conflict or physical altercations that placed providers' safety at-risk.[14,20,21,23,25] In one study, the potential for compromised personal safety of dispensers was raised as a major barrier to initiating conversations with patients about PDMP information: "I've heard of people getting their tires slashed, or actually getting hurt. I've heard of some walking to the parking lot and something happened because of something that happened in the store."[14] Ultimately, while rare, it is possible that discussions with patients will lead to confrontations that may also harm the patient-provider relationship, and which may also lead to patients not returning to a practice. Consequences of losing patients in this way were cited as "bad for business", which was also noted as another barrier to using PDMPs because it may discourage providers' use of PDMPs to maintain their relationships with patients.[12,14,20,28]

While common, engagement was not a ubiquitous practice among providers in included studies. A few dispensers reported finding it difficult to engage patients in a conversation because of the lack of time, dedicated space, or practicality in a busy pharmacy environment.[14] For these dispensers, these barriers were bolstered by the perception that engaging patients in such conversations about drug misuse may prompt conflicts with prescribers,[14] which can cause a breakdown in professional relationships that ultimately affects patients.[13,22] This finding contrasts with a previous observation that PDMP use prompts regular communication between prescribers and dispensers, and so it must be noted that experiences are not uniform, but varied. In the cases where prescribers did not use PDMPs for one reason or another, the onus for monitoring and management falls on the dispenser, which has been noted to have an adverse effect on busy pharmacy workflows.[28] In these circumstances, it was common for dispensers to suggest enhancing the working relationships with prescribers.[13,14,27]

Administrative and Design Features

Providers identified multiple barriers to PDMP use that stemmed from access-related issues and emerged when treating their patients.[12-14,16-20,22-26,28,29] Two broad approaches to using PDMPs were identified. For some providers, accessing PDMP was prompted by a red flag in a patient's history.[19,20,22-25,28,29] Red flags included asking for early refills, reporting that prescribed medications were lost or stolen, or asking for a particular medication by its name.[28] Radomski (2018) refers to this as the *subjective approach* to using PDMPs, which often relied on prescribers' preconceptions of patients' circumstances.[29] On the other hand, providers may routlinely use PDMP in their practice – as an integrated aspect of their workflow.[20,22,23,25,28,29] This type of use is what Radomski (2018) refers to as the *systematic approach* primarily because it is mandated by institutional policies.[29] In other instances prescribers may follow a middle ground between subjective and systematic approaches; PDMPs will be accessed for patients with substance abuse problems who are on a fixed schedule to attend consultations or for new patients who request controlled substances.[20,22,23,25,28,29] Perhaps understandably, there is diversity in the reasons why prescribers may choose subjective versus systematic, or blended, approaches:

> Any existing patient, it really will sort of depend on the situation. If I see them frequently wanting medications, maybe after the first or second time, I'll be checking them. It really depends on what they're asking for. It really depends on the feel that I'm getting from the patient. I don't have a really good—I don't have a thing I do for every patient.[23]

This quote shows that some prescribers resort to their personal preconceptions and professional judgement regarding which of their patients are genuine, and which patients may be doctor shopping. The use of heuristics to make prescription decisions is problematic because PDMP use often causes surprise and shift in preconceptions. Therefore, personal heuristics can serve as a barrier to using PDMPs as provider confidence in the veracity of patient sincerity may preclude the perceived need to use PDMPs, regardless of whether or not these preconceptions are accurate.[12,16,25,27,29]

Barriers to Using Prescription Drug Monitoring Programs

A commonly reported barrier of using PDMPs is that some systems are perceived as difficult to access and time-consuming to use.[12,14,16-20,22,24,25,28,29] This barrier often emerged as a consequence of specific administrative or design features. For example, multiple prescribers and dispensers reported that a different program and login procedure than other systems they use regularly made it difficult to use in a time-constrained environment.[24-26,28,29] For these providers, logging into the system,[24,25,28,29] losing passwords,[24-26] finding the website,[24] entering patient data,[28] and logging in for trainees,[26] were aspects of PDMP use that they believed should be modified. Similarly, another barrier was obtaining approval to access PDMP systems, which was perceived as a demanding process because it required multiple, in-person authentication steps by their Information Technology departments.[24,25,29] This experience, combined with poor infrastructure, support, and design of the system were reported as strong disincentives to initiate use [19,24,28]: "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."[19]

Other identified reasons for lack of routine use in prescribers include: older age, low computer literacy, and a belief that drug monitoring is the responsibility of dispensers.[28] These served as strong barriers for initiating and sustaining use of PDMPs.

Issues related to challenges in access were further influenced by busy work environments that characterized providers' medical practice. Prescribers generally reported that a lack of time during medical appointments with patients made it difficult to access PDMPs and obtain the correct information about prescription history.[12,13,19,20,25] As a result, these prescribers reported often resorting to using their heuristics developed from previous interactions with patients to prescribe controlled substances. In some cases prescribers described realying on dispensers to access PDMPTs, and identify and act on any converns. In these cases, dispensers reported that prescribers who relegate responsibility to them add strain to their practice, which affects pharmacy workflow and as previously mentioned, may cause a breakdown in professional relationships that ultimately affects patient care.[28] For dispensers, accessing PDMPs, especially as a routine practice, reduced the time available to continue patient workflow and address other important tasks.[12,14,20,25,29] As such, there were delays in attending to other patients' requests, and in some cases, updating PDMP systems was ignored in order to address other priorities.

Not updating the PDMP system was echoed throughout reviewed studies and stemmed from providers' challenges interacting with multiple administrative and design features. Specifically, providers found that delays in the PDMP system was a strong barrier to use,[13,19,20,23-25,29] that may even contradict the perceived goals and benefits that the system offers. Prescribers in four studies specifically mentioned that delays stemmed from

pharmacies, for example dispensers not updating the system shortly after a patient fills their prescription.[20,24,25,29] These delays prevented prescribers from adequately judging whether or not a particular patient was doctor shopping.[13] Providers also reported that information in PDMP systems was sometimes incomplete or incorrect.[12,14,19,20,22,26,28,29] Information was reported to occassionaly be found to be placed under the wrong prescribers' account, or under the attending physician rather than residents.[22,26] A similar situation arose when prescribers and dispensers did not have access to relevant information from all clinics and pharmacies in the area.[13,19,20,23,25,26,28] Further, prescribers also mentioned that PDMP access for other members of their healthcare team was not permissible, which limited the extent to which an integrated healthcare system can be achieved, and also added unnecessary time constraints on providers.

Strategies to Improve Prescription Drug Monitoring Programs

Having expressed issues with and preferences for PDMP systems, providers also mentioned a variety of strategies to improve access. Providers asserted that their use of PDMPs would be low if it required additional steps in the care process.[17-19,22,24,25,28,29] As such, making access easier and integrated into clinical workflows was seen to increase usage.[13,17,20,25,26] A common suggestion was to integrate PDMPs in existing electronic heath record systems that would make formatting and data entry easier.[13,16,19,23,24,26,28,29] If integration was not possible, providers in one study reported preferring a user-friendly login and information presented in a format that would allow easy transfer of information between electronic health records and PDMPs.[19] Importantly, some providers believed that PDMPs were redundant because existing electronic health record systems were comprehensive.[19] Alongside integration between these systems, prescribers and dispensers expressed a need to incorporate a real-time mechanism for updating information,[13,19,20,23,29] that would address delays in updating PDMPs. Similarly, prescribers and especially dispensers expressed the need to link PDMPs across practice locations in all jurisdictions. A national PDMP system was proposed as a way to help providers determine whether or not their patients were traveling across jurisdictional boundaries to obtain prescriptions.[13,19,20,23,25,26,28] Finally, some providers suggested allowing access to PDMPs to other members of the healthcare team so they could offload some of their workload to other providers, for example, physician assistants,[19,25,29] and initial and ongoing training on how to use PDMPs.[12,16,19,20] The training portion was perceived as imperative and was suggested to consist of guidance on interpreting findings, strategies to integrate PDMPs into workflow, and how to approach patients with PDMP information (i.e., the engagement function).[12,16,19,20]

One of the most commonly expressed strategies to improve PDMPs related to the types and organization of information presented in PDMP systems.[13-17,19,24,26,28] In general, prescribers and dispensers reported a preference for a comprehensive range of the types of information available in PDMPs.[13] This preference stemmed from the experience that PDMPs often lacked complete or contained unreliable information. This preference also related to the belief that a national system of PDMPs should be implemented that connects all healthcare institutions and dispenseries.

Some providers mentioned that PDMPs have too much information and colours, making it difficult to find the most relevant information.[16] These providers desired for the most critical information to be more visible in the PDMP display,[16,24] and also related to a reported preference for better organization of prescription history data.[24,28] Some prescribers and dispensers expressed the need for a rapid overview or summary of relevant information

that they need to make the decision whether or not to prescribe or dispense to a patient with suspected substance abuse.[16,17,19,24] Providers mentioned a variety of information that they desired in such a rapid overview including drug names;[19] quantities and locations of prescriptions;[16,19] number of providers from whom prescriptions were obtained;[16,19] data on care utilization, for example, number of visits to primary, specialty, and emergency care;[16,19] information about clinical practice guidelines on treating opioid use disorder;[19] a list of recommended next steps when a red flag was reported for a particular patient;[16,19] and information for all controlled substances in a visual format.[16] Some prescribers mentioned that more information could aid them in making decisions regarding whether or not to prescribe more efficiently, this was however not the case for all prescribers, especially those who experienced issues with PDMP access.[16] Providers suggested that more information may be particulary useful if it captures the diverse needs, circumstances, and contexts of patient populations.[19] To some, an idiographic characteristic of PDMPs was crucial to its usefulness as it would allow prescribers to delineate whether patient requests for controlled substances were genuine or not.

Providers also recommended several features to include in PDMP systems to augment the information within. In general, providers preferred a user-friendly system that clearly displayed most pertinent details for making prescription decisions.[16,24,28] Other features providers mentioned as ideal for a PDMP include: automatic enrollment for all licensed prescribers[24]; a streamlined login and access process;[24,28] inclusion of a map of dispensers in the area;[16] medical inventory available through the touch of a button;[19] a scoring system that signals prescribers of patients who are at a high-risk for opioid misuse; and a metric for comparing opioid medications to understand their equivalence and to apply to patients' treatment plans.[16,19] For providers who reported routine use of PDMPs, there were additional preferences such as a pre-designed note template within existing electronic health record systems;[29] automatic alerts in the event of potential substance misuse;[19,28] and automatic initiation of a PDMP search when controlled substances are being prescribed.[24,28] If a pre-designed note template was not feasible, then some providers desired automatic transfer of patient demographic information between electronic health record and PDMP systems, or at the minimum administrative provisions that ease the process of inputting patient information into PDMPs.[24,28]

Many of these reportedly ideal features related to a strong desire for a user-friendly interface of PDMPs. User-friendliness appeared to be a combination of intuitiveness, interactiveness, and appeal. Intuitive PDMP design was viewed as advantageous to make prescription decisions in a fast-paced environment.[24,28,29] An example provided by one participant was to include colour-coded bar graphs that differentiate each prescription given to a patient by provider and type of drug.[16] Interactiveness of the PDMP system included flexibility in sorting information by columns, relevance, time, and demographic characteristics.[16,24]

Limitations

The body of evidence presented in this review has a number of limitations arising from the quality and scope of included studies. Perhaps most importantly, the literature search and screening process did not retrieve any studies that described the perspectives and experiences of patients with PDMPs. As such, this review focused on describing the perspectives of providers (prescribers and dispensers) who use PDMPs. While the perspectives of providers provides some insight into how patients may experience or react to PDMPs, it is the case that patients do not access PDMP systems themselves, but

instead interact with PDMPs indirectly through providers. This connection between patients' experiences and providers' usage of PDMPs is related to the engagement function that many providers cited as an important benefit of PDMPs. However, this review is unable to contrast how patients interact and experience providers' PDMP use with provider perspectives described in this review. This contrast would be advantageous because it may reveal additional tensions or conflicts that may inform how and in what contexts PDMPs enhance patient safety. This contrast would also be helpful to inform the development of training programs and guidance that providers receive with regards to PDMP use. Future research should explore how patients experience and interact with providers who use PDMPs, and their perspectives of using these systems to make prescription decisions.

Another limitation of this review is that all included studies were conducted in the United States. Although a somewhat comparable system to Canada, there are important distinctions that may emphasize or de-emphasize certain barriers and enablers to PDMP use. With regards to similarities, both nations have a similar division of jurisdictional responsibility over healthcare between national and subnational governments (i.e., states and provinces). The responsibility for deciding whether or not and how to monitor controlled substances falls upon subnational governments in both systems. As such, issues concerning building a national system that monitors potential doctor shopping across jurisdictional boundaries identified in this review may be highly relevant to the Canadian context. On the other hand, a limitation may concern the highly privatized characteristic of the United States' system, which increases competition between primary and secondary care practices. This level of competition does not exist in the Canadian context and renders more choice on patients with regards to which providers they choose to visit for prescriptions. It may be conjectured that this characteristic may contribute to a higher prevalence of doctor shopping behaviour compared to systems where there are a greater number of restrictions in care provision. This characteristic can also contribute to fear in healthcare providers around the potential adverse consequences of not prescribing, which includes the loss of patients that would reduce their annual income, and accordingly their ability to provide care for other patients. Moreover, differences in accessibility and availability of drugs between the United States and Canada adds another layer of complexity. Access-related issues may be problematic in some jurisdictions and not others depending on policies and institutional mandates. These differences affect the extent to which the barriers and enablers mentioned in this review are experienced by providers.

Conclusions and Implications for Decision or Policy Making

While PDMPs have been in place for several decades, there is a need to enhance these programs to ensure they include administrative and design features to help facilitate their potential to reduce the number of deaths related to drug abuse, misuse, and overdose. To address this challenge, this rapid qualitative review summarizes the results of 18 studies that discussed the perspectives and preferences of prescribers and dispensers in using PDMPs. Our analysis determined two broad categories of data useful for understanding how providers use PDMP systems in their clinical practices and envision a system for enhanced adoption and sustained use.

Firstly, providers described many *Perceived Goals and Benefits* that can be categorized under three broad but interrelated functions. The first is an information function, through which some providers described instances of being surprised with the information from the program, as it conflicted with their preconception of which patients they perceived to be

doctor shopping and who genuinely needed controlled drugs to maintain a healthy lifestyle. The second is a patient safety function, through which providers described that they perceived the programs to prevent patients from seeking multiple prescriptions from different providers. At the same time, due to the sensitive nature of the information, some providers expressed uncertainty as to how patients might respond to learning their providers accessed program information. In some circumstances, providers described concerns for their own safety due to potential conflict and physical altercations, which was raised as a major barrier to program use. The third function is an engagement function, through which providers described that programs facilitated ongoing dialogue between them and their patients about drug safety. Here, providers described that programs can be seen to shift responsibility away from them in terms of prescribing decisions, thereby adding legitimacy in particular for decisions to not prescribe controlled substances. The engagement function exemplifies the educational role that prescribers and dispensers play in discussions about substance abuse and awareness. While perhaps not an intended goal of prescription drug monitoring programs, engagement and discussion resulting from program use appears to have become common practice by the majority of providers included in this review. Health systems may find it helpful to formalize and promote the engagement function allowed through PDMPs. For example, training on PDMPs may include education that the programs have the potential to raise patients' awareness and open discussion about drug safety and abuse, which has been seen to ultimately motivate treatment-seeking behaviour for their medical conditions. Relatedly, supports and infrastructure should be provided to facilitate challenging discussions with patients about PDMP information in an environment that is conducive to an open-dialogue, while respecting the integrity and safety of healthcare providers.

The second category of information, *Administrative and Design Features*, described approaches, barriers, enablers, and preferences with regards to PDMPs from the perspective of prescribers and dispensers. Two broad approaches to PDMP use were discussed: subjective and systematic. The approach—whether subjective, systematic, or somewhere in between—to PDMP use determined what barriers were experienced and which enablers were most relevant to providers. In general, barriers to using PDMPs were discussed in terms of managing PDMP use in busy clinical environments. Reported barriers include challenges accessing systems, using systems to their full advantage, and also updating systems appropriate as patients fill their prescriptions. At the same time as experienced barriers were described, providers also expressed a variety of strategies to address them. Specific design features to enhance access and to better integrate programs into clinical workflows were suggested as means to increase adoption and sustain use of programs over time. These included integrating programs into existing electronic health record systems, which may include real time updating of prescription information and also moving towards a national linked system. In addition, a strong need for a user-friendly display of information was expressed, which includes ensuring the most relevant information is available in an accessible and intuitive manner to ensure efficient prescribing decisions can be made. Providers also described a desire for a streamlined login process, automatic enrollment, and a map of all dispensers in the area.

More detail and information available within PDMPs was generally viewed by healthcare providers as advantageous because it was seen to likely make decisions regarding the prescription of controlled substances easier; but, at the same, more information was seen as not advantageous if new information was organized in a non-user-friendly manner. Providers preferred easy reference to the most pertinent information, and as such, user-

friendliness, interactiveness, intuitiveness, and appeal underscored their suggestions for improvement. Enhancing existing PDMP systems should be carried out in a user-friendly manner that makes the prescribing process easier and more efficient.

Lack of time was a cited strong barrier to using PDMPs as a routine practice. Many providers identified access-related barriers and their suggested strategies to improve PDMP systems stemmed from a desire to reduce the time it takes to access and use PDMPs in clinical workflows. From this review, it appears that if accessing PDMPs requires time beyond what providers can tolerate logistically, then access-related issues will become prominent concerns and may lead to misuse or nonuse of PDMPs. A lack of time was especially important for those providers who did not have administrative support or training on how to use PDMPs. Therefore, any enhancements to PDMPs should accompany considerations of how the system can be easily integrated into existing clinical workflows reducing the time providers need to access and interact with PDMPs. Ongoing guidance and training on how to integrate PDMP into workflows is likewise seen as an enabler.

This review identified instances of PDMP misuse or nonuse, which were exacerbated if access-related barriers to PDMP use were present. For example, prioritizing competing demands in a busy clinical environment may cause some providers to forego conducting PDMP searches, ignore the need for PDMPs, or delay transferring patient information to the system. Suboptimal use has important implications for patients' health and well-being, as it may mean that instead providers are resorting to their fallible preconceptions of which patients genuinely need controlled substances and which do not. In instances where these preconceptions are inaccurate, providers' decisions to prescribe may encourage doctor shopping behaviour on the one hand, or refrain from providing precriptions to patients who genuinely need them on the other hand, putting them at risk for adverse outcomes or seeking illicit drugs. This barrier may be addressed through policy and institutional mandates to use PDMPs, as in systematic and not subjective approaches. This decision may have other consequences if not implemented systematically, for example by ensuring appropriate administrative support. This review identified instances of prescribers, at times, relegating responsibility for PDMP use to dispensers, residents, or other healthcare professionals and students but who may likewise have busy clinical workflows or lack experience in using PDMPs. In addition to appropriate administrative support, ongoing guidance and training on the value, and optimal ways in which PDMPs can be effectively integrated into existing clinical workflows, is required.

The findings presented in this review would have benefited from the additional perspectives of patients. As such, future research should explore the perspectives and experiences of patients interacting with providers who use PDMPs to make prescription decisions. As mentioned earlier, this information may provide insight into the conflicts and tensions that may exist with regards to the engagement function of PDMPs. This information may also contribute to improvements in training and guidance available to providers, which may ultimately contribute to more patient-centred care. This information may further reveal important considerations for administrative and design features of PDMPs that may address important barriers and bolster enablers to their use.

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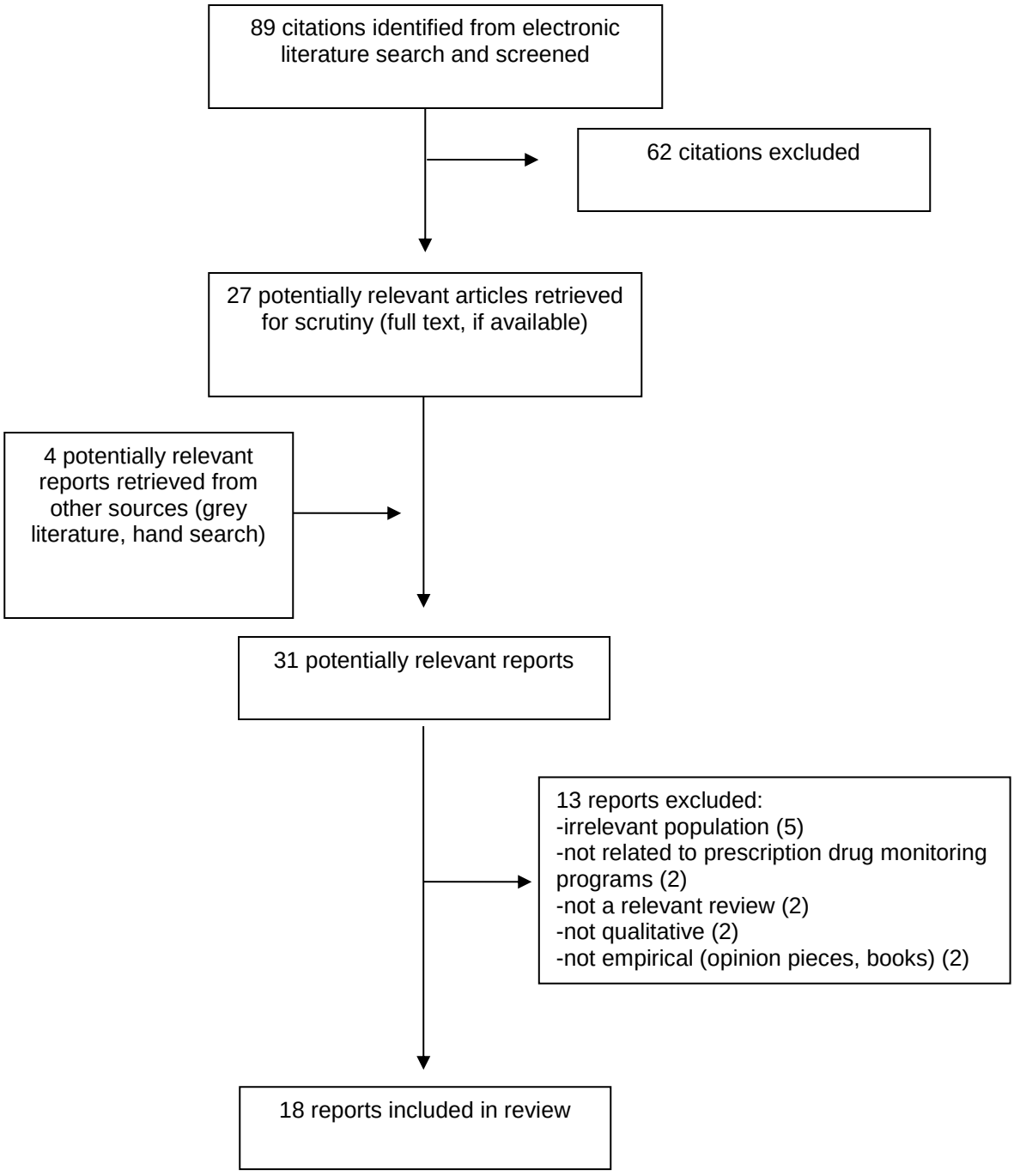
Appendix 1: Selection of Included Studies



Appendix 2: Characteristics of Included Studies

Table 2: Characteristics of Included Studies

First Author, Publication Year, Country	Study Design or Analytic Approach	Study Objectives	Study Setting	Sample Size	Participants or Medical Professions or Specialties	Data Collection*
Allen, 2019, United States[12]	Thematic analysis and adapted approaches	Explore the implementation of mandatory prescription drug monitoring program technology in primary care practice and the effects on treatment of people with possible substance use disorders	Primary care clinics	53	Primary care physicians	Semi-structured interviews
Leichtling, 2019, United States[16]	Thematic analysis and adapted approaches	Examine how physicians respond to sample enhanced prescription drug monitoring profiles based on patient vignettes	Community and academic primary care clinics	93	Primary care, emergency medicine, and pain medicine physicians	Semi-structured interviews
Penm, 2019, United States[17]	Thematic analysis and adapted approaches	Explore emergency physicians' perceptions on barriers and strategies for Ohio emergency department opioid prescribing guidelines	Emergency departments	20	Emergency department physicians	Semi-structured interviews

First Author, Publication Year, Country	Study Design or Analytic Approach	Study Objectives	Study Setting	Sample Size	Participants or Medical Professions or Specialties	Data Collection*
Click, 2018, United States[26]	Not specified	Learn more about what factors lead to physicians' prescribing of controlled drugs for non-cancer pain	Primary care clinics	32	Primary care physicians, clinical directors, and clinical pharmacists	Five focus groups
Fendrich, 2018, United States[27]	Not specified	Understand how pharmacists viewed and used a newly implemented prescription drug monitoring program; understand their orientations toward dispensing controlled subtances and the people who obtain them	Community and hospital pharmacies	11	Pharmacists	Three focus groups
Finley, 2018, United States[19]	Grounded theory and adapted approaches	Assess baseline knowledge and practices in opioid risk mitigation and providers' preferences and needs for a military-based prescrption drug monitoring program	Military hospitals	26	Emergency medicine, primary care, pain medicine	Semi-structured interviews

First Author, Publication Year, Country	Study Design or Analytic Approach	Study Objectives	Study Setting	Sample Size	Participants or Medical Professions or Specialties	Data Collection*
Fleming, 2018, United States[14]	Thematic analysis and adapted approaches	Elicit salient beliefs of community pharmacists regarding their willingness to engage patients with suspected controlled substance misuse as identified from reviewing prescription drug monitoring program data	Community pharmacies	31	Community pharmacists	Four focus groups
Freeman, 2018, United States[28]	Not specified	Investigate how primary care providers and pharmacists utilized prescription drug monitoring programs when making prescribing and dispensing decisions	Primary care clinics and community pharmacies	108	Primary care providers and community pharmacists	Semi-structured interviews
Hagameier, 2018, United States[15]	Thematic analysis and adapted approaches	Understand prescription opioid abuse-related communication among prescribers and pharmacists	Primary care clinics	35	Primary care physicians, nurses, nurse administrators, and pharmacists	Five focus groups

First Author, Publication Year, Country	Study Design or Analytic Approach	Study Objectives	Study Setting	Sample Size	Participants or Medical Professions or Specialties	Data Collection*
Kohlbeck, 2018, United States[22]	Grounded theory and adapted approaches	Evaluate provider knowledge, attitudes, and behaviours regarding the Wisconsin prescription drug monitoring program	Emergency departments	8	Emergency medicine physicians, advance practice healthcare providers, medical residents and students	One focus group
Radomski, 2018, United States[29]	Not specified	Evaluate Veteran Affairs' physicians' perspectives and experiences regarding use of prescrption drug monitoring programs to monitor Veterans' receipt of opioids from non-Veterans Affairs prescribers	Primary care clinics of Veteran's Affairs	42	Primary care physicians	Semi-structured interviews
Rickles, 2018, United States[18]	Thematic analysis and adapted approaches	Develop and evaluate a candidate guideline, based on clinical experience and existing literature to help community pharmacists monitor and manage potential opioid prescription abuse	Community pharmacies	62	Community pharmacists, employees of public health department of municipality, members of the state board of pharmacy, and representatives of a pharmaceutical distribution company	Two focus groups and six semi-structured interviews

First Author, Publication Year, Country	Study Design or Analytic Approach	Study Objectives	Study Setting	Sample Size	Participants or Medical Professions or Specialties	Data Collection*
Carnes, 2017, United States[13]	Thematic analysis and adapted approaches	Explore licensed prescribers' and dispensers' opinions regarding prescription drug monitoring	Outpatient clinics or inpatient hospital departments	5994	Licensed medical physicians, pharmacists, nurse practitioners, dentists, and physician assistants	Survey with open-ended questions
Leichtling, 2017, United States[23]	Grounded theory and adapted approaches	Undertand how clinicians use, interpret, and integrate prescription drug monitoring program profiles with other information in making clinical decisions	Pain management clinics, emergency departments, primary care clinics, psychiatry units, dentist practices, and surgical units	33	Physicians, nurse practitioners, physician assistants, and dentists	Semi-structured interviews
Hildebran, 2016, United States[21]	Grounded theory and adapted approaches	Study a range of approaches clinicians report when communicating with patients about prescription drug monitoring and how practice, policies and procedures may influence this communication	Pain management clinics, emergency departments, primary care clinics, psychiatry units, dentist practices, and surgical units	33	Physicians, nurse practitioners, physician assistants, and dentists	Semi-structured interviews
Poon, 2016, United States[24]	Grounded theory and adapted approaches	Evaluate the usability of the Massachusetts prescription drug monitoring program by emergency medicine providers	Emergency departments	17	Emergency department physicians and physician assistants	Semi-structured interviews

First Author, Publication Year, Country	Study Design or Analytic Approach	Study Objectives	Study Setting	Sample Size	Participants or Medical Professions or Specialties	Data Collection*
Smith, 2015, United States[25]	Grounded theory and adapted approaches	Understand how emergency medicine physicians use prescription drug monitoring programs, for which patients and for what reasons	Emergency departments	61	Emergency department physicians	Semi-structured interviews
Hildebran, 2014, United States[20]	Grounded theory and adapted approaches	Understand the ways in which prescription drug monitoring programs are incorporated into the workflow and clinical decision-making, what barriers continue to exist, and how clinicians are sharing the results with their patients	Pain clinics, emergency departments, primary care and inpatient psychiatry units	35	Physicians, nurse practitioners, dentists, and physician assistants	Two online focus groups and seven semi-structured interviews

*The data collection strategies of the qualitative portion of multiple- and mixed-methods studies are shown in this column only

Appendix 3: Characteristics of Study Participants

Table 3: Characteristics of Study Participants

First Author, Publication Year, Country	Sample Size	Sex (% male)	Age range in years
Allen, 2019, United States[12]	53	64.2	32 to 80
Leichtling, 2019, United States[16]	93	55.9	NR
Penm, 2019, United States[17]	20	55.0	NR
Click, 2018, United States[26]	32	53.1	NR
Fendrich, 2018, United States[27]	11	NR	NR
Finley, 2018, United States[19]	26	69.2	NR
Fleming, 2018, United States[14]	31	NR	NR
Freeman, 2018, United States[28]	108	58.3	NR
Hagameier, 2018, United States[15]	35	51.4	NR
Kohlbeck, 2018, United States[22]	8	NR	NR
Radomski, 2018, United States[29]	42	52.0	NR
Rickles, 2018, United States[18]	62	NR	NR
Carnes, 2017, United States[13]	5994	54	NR
Leichtling, 2017, United States[23]	33	57.6	NR
Hildebran, 2016, United States[21]	33	57.6	NR
Poon, 2016, United States[24]	17	47.1	NR
Smith, 2015, United States[25]	61	61.0	NR
Hildebran, 2014, United States[20]	35	77.1	NR

NR = not reported

Appendix 4: Critical Appraisal of Included Studies

Table 4: Strengths and Limitations of Included Studies

Strengths	Limitations
Allen, 2019[12]	
• Clear statement of research objectives or question • Clear description of phenomenon under investigation • Identification of a qualitative study design and how it was applied in the study context •	• Participant recruitment and sampling process is reported but requires elaboration • The data analytic approach is identified but the description is lacking specific processes, devices, and approaches • Strategies to improve the rigour of research were not identified or discussed • Data collection strategies were identified but not justified
Leichtling, 2019[16]	
• Clear statement of research objectives or question • Clear description of phenomenon under investigation • Identification of a qualitative study design and how it was applied in the study context • Data collection strategies were identified and justified • Data analysis procedures and protocols were identified and are congruent with research objectives • Strategies to improve rigour of research were identified and discussed	• Participant recruitment and sampling process is reported but requires elaboration
Penm, 2019[17]	
• Clear statement of research objectives or question • Clear description of phenomenon under investigation	• It is unclear which qualitative study design was used to guide data collection and analysis processes • Participant recruitment and sampling process is reported but requires elaboration • The data collection strategies are identified but specific procedures and protocols that guide data collection lack sufficient detail • The data analytic approach is identified but the description is lacking specific processes, devices, and approaches • Strategies to improve the rigour of research were not identified or discussed
Click, 2018[26]	
• Clear statement of research objectives or question • Clear description of phenomenon under investigation • Data analysis procedures and protocols were identified and are congruent with research objectives	• It is unclear which qualitative study design was used to guide data collection and analysis processes • Participant recruitment and sampling process is reported but requires elaboration • The data collection strategies are identified but specific procedures and protocols that guide data collection lack sufficient detail • Strategies to improve the rigour of research were not identified or discussed
Fendrich, 2018[27]	
• Clear statement of research objectives or question	• It is unclear which qualitative study design was used to

Strengths	Limitations
• Clear description of phenomenon under investigation • Clear description of how and from where participants were recruited	guide data collection and analysis processes • The data collection strategies are identified but specific procedures and protocols that guide data collection lack sufficient detail • Data analysis section is missing from manuscript • Strategies to improve the rigour of research were not identified or discussed
Finley, 2018[19]	
• Clear statement of research objectives or question • Clear description of phenomenon under investigation • Identification of a qualitative study design and how it was applied in the study context • Data analysis procedures and protocols were identified and are congruent with research objectives • Strategies to improve rigour of research were identified and discussed	• Participant recruitment and sampling process is reported by requires elaboration • The data collection strategies are identified but specific procedures and protocols that guide data collection lack sufficient detail
Fleming, 2018[14]	
• Clear statement of research objectives or question • Clear description of phenomenon under investigation • Clear description of how and from where participants were recruited • Data collection strategies were identified and justified	• It is unclear which qualitative study design was used to guide data collection and analysis processes • The data analytic approach is identified but the description is lacking specific processes, devices, and approaches
Freeman, 2018[28]	
• Clear statement of research objectives or question • Clear description of phenomenon under investigation • Clear description of how and from where participants were recruited • Data collection strategies were identified and justified • Data analysis procedures and protocols were identified and are congruent with research objectives • Strategies to improve rigour of research were identified and discussed	• It is unclear which qualitative study design was used to guide data collection and analysis processes • Justification for analytic approach not provided
Hagameier, 2018[15]	
• Clear statement of research objectives or question • Clear description of phenomenon under investigation • Clear description of how and from where participants were recruited	• It is unclear which qualitative study design was used to guide data collection and analysis processes • The data collection strategies are identified but specific procedures and protocols that guide data collection lack sufficient detail • The data analytic approach is identified but the description is lacking specific processes, devices, and approaches to data analysis • Strategies to improve the rigour of research was not identified or discussed
Kohlbeck, 2018[22]	

Strengths	Limitations
• Clear statement of research objectives or question • Clear description of phenomenon under investigation • Identification of a qualitative study design and how it was applied in the study context • Strategies to improve rigour of research were identified and discussed	• Participant recruitment and sampling process is reported but requires elaboration • The data collection strategies are identified but specific procedures and protocols that guide data collection lack sufficient detail • The data analytic approach is identified but the description is lacking specific processes, devices, and approaches
Radomski, 2018[29]	
• Clear statement of research objectives or question • Clear description of phenomenon under investigation • Clear description of how and from where participants were recruited • Data collection strategies were identified and justified	• It is unclear which qualitative study design was used to guide data collection and analysis processes • The data analytic approach is identified but the description is lacking specific processes, devices, and approaches • Justification for analytic approach not provided • Strategies to improve the rigour of research were not identified or discussed
Rickles, 2018[18]	
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Carnes, 2017[13]	
• Clear statement of research objectives or question • Clear description of phenomenon under investigation • Clear description of how and from where participants were recruited	• It is unclear which qualitative study design was used to guide data collection and analysis processes • The data analytic approach is identified but the description is lacking specific processes, devices, and approaches • Strategies to improve the rigour of research were not identified or discussed • Data collection strategies were identified but not justified
Leichtling, 2017[23]	
• Clear statement of research objectives or question • Clear description of phenomenon under investigation • Identification of a qualitative study design and how it was applied in the study context • Clear description of how and from where participants were recruited • Data collection strategies were identified and justified • Data analysis procedures and protocols were identified and are congruent with research objectives	• Strategies to improve the rigour of research were not identified or discussed
Hildebran, 2016[21]	
• Clear statement of research objectives or question • Clear description of phenomenon under investigation • Identification of a qualitative study design and how it was applied in the study context	• Strategies to improve the rigour of research were not identified or discussed

Strengths	Limitations
• Clear description of how and from where participants were recruited • Data collection strategies were identified and justified • Data analysis procedures and protocols were identified and are congruent with research objectives	
Poon, 2016[24]	
• Clear statement of research objectives or question • Clear description of phenomenon under investigation • Clear description of how and from where participants were recruited • Data analysis procedures and protocols were identified and are congruent with research objectives • Strategies to improve rigour of research were identified and discussed	• It is unclear which qualitative study design was used to guide data collection and analysis processes • The data collection strategies are identified but specific procedures and protocols that guide data collection lack sufficient detail
Smith, 2015[25]	
• Clear statement of research objectives or question • Clear description of phenomenon under investigation • Identification of a qualitative study design and how it was applied in the study context • Data analysis procedures and protocols were identified and are congruent with research objectives • Strategies to improve rigour of research were identified and discussed	• Participant recruitment and sampling process is reported but requires elaboration • The data collection strategies are identified but specific procedures and protocols that guide data collection lack sufficient detail
Hildebran, 2014[20]	
• Clear statement of research objectives or question • Clear description of phenomenon under investigation • Identification of a qualitative study design and how it was applied in the study context • Clear description of how and from where participants were recruited • Data collection strategies were identified and justified	• Strategies to improve the rigour of research were not identified or discussed