Pharmaceutical Automated Reporting: An opioid stewardship tool

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ABSTRACT

Objective: *To develop and implement a customized clinical decision support system (CDSS) in an under-resourced health region aimed at promoting appropriate and safe opioid prescribing.*

Design: *The Pharmaceutical Automated Reporting (PAR) tool integrates inpatient prescription data from BDM Pharmacy (version 10) and categorizes patient information using predefined logic. It operates with Python (version 3.10) and Microsoft Excel®, functioning as decision trees. Nine risk factors (absence of naloxone prescription with an opioid prescription, naloxone administration, high-frequency opioid dosing, multiple opioids prescribed, concurrent benzodiazepine and opioid coprescribed, over 7 days of intravenous route opioid use, morphine equivalent dose received over or equal to 90, possible opioid agonist therapy, possible alcohol withdrawal therapy) are assessed through a decision matrix to classify patients for opioid-related risk.*

Results: *Over 7 months, the PAR tool detected one opioid-related risk factor in 98.9 percent (n = 10,450) of patients prescribed an opioid and multiple risk factors in 62.4 percent (n = 6,590). The tool identified areas where data-driven interventions by the Opioid Stewardship Program could promote appropriate prescribing practices and will be used to track and promote stewardship interventions, inform policy change, and evaluate the impact on quality indicators.*

Conclusion: *Small, resource-scarce health systems can use open-source programming methodologies to create an internal CDSS to assist in addressing opioid-related risk factors within their healthcare facilities.*

INTRODUCTION

As of 2019, Canada was among the countries with the highest opioid consumption rates.[1] In 2022, the province of Saskatchewan had 21.3 apparent opioid toxicity deaths per 1,000 population, compared to the neighboring province of Manitoba, which only had 3.7.[2] The misuse of opioids poses a notable hazard to community health; opioid stewardship initiatives aimed at optimizing pain management while minimizing opioid-related harms have begun addressing these pressing issues.[3]

Within the two acute care facilities in Saskatchewan's capital, Regina (~700 beds), resources for optimal opioid prescribing are severely limited or nonexistent; there are no inpatient addiction medicine teams or acute, chronic, or transitional pain services. Previously, the Saskatchewan Health Authority Opioid Stewardship Program (OSP) had no objective measures of opioid-related risk factors or publicly available data regarding high-risk individuals. Clinical decision support systems (CDSSs) have been suggested to address barriers with adherence to prescribing guidelines,[4] and to improve the safety of opioid use, it is recommended that OSPs use electronic CDSSs to support stewardship interventions.[3] To address the widespread use of opioids in acute care, we developed our own CDSS

to effectively direct daily interventions and understand data patterns and systemic deficiencies. The intended outcomes of this work are promoting safer opioid prescribing, optimizing resource allocation, and improving patient safety and health outcomes.

METHODS

The Pharmaceutical Automated Reporting (PAR) tool consolidates inpatient prescription information from the electronic pharmaceutical system (BDM Pharmacy, version 10) and organizes patient data according to predetermined logic. The tool uses Python (version 3.10) language and Microsoft Excel to function as a decision tree (Appendix Figure 1). Each risk factor provides a decision matrix that returns a true or false value to classify patients as having that particular opioid-related risk factor (ORRF) or not. The risk factors were chosen based on the pharmacist opioid safety and intervention tool,[5] published opioid stewardship research,[6,7] and information from the Opioid Stewardship Checklist.[8]

The risk factors include a daily morphine equivalent dose (MED) equal to or exceeding 90 (within the last 24 hours), potential opioid agonist therapy, administration of naloxone, absence of a naloxone prescription with an opioid prescription, having multiple opioids prescribed, intravenous opioid therapy lasting more than 7 days, frequent opioid dosing (≤3 hours), concurrent prescriptions for benzodiazepines and opioids, and potential use of the Clinical Institute Withdrawal Assessment for Alcohol (CIWA) protocol. Additionally, the total daily MED taken and available is calculated for each patient based on all opioids they are receiving and the total amount they have access to in the last 24 hours, including those ordered and consumed on a scheduled and as-needed basis. Data for patient-controlled analgesia, parenteral fentanyl, epidurals, intrathecal pumps, or cassettes could not be validated and were excluded from MED calculations. This information can be filtered to ward or physician service lines. A historical version of the PAR tool was also developed using the same code and ORRFs to provide summary metrics. Black-, grey-, and white-box testing along with clinician evaluation were employed to validate the tool for accuracy.

RESULTS

In the first 7 months of use (July 10, 2023 to January 15, 2024), the PAR tool evaluated 10,562 distinct patient visits (55.9 per day) and 65,688 prescriptions (347.6 per day), resulting in the detection of 10,450 (98.9 percent) patients with at least one opioid-related risk factor and 6,590 (62.4 percent) with multiple risk factors. The average available opioid MED per patient visit was 389 with an average percent utilization (average received MED divided by average available) of 16 percent. Further breakdown of risk factors are described in Table 1.

Table 1. Proportion of patient visits with opioid-related risk factors identified in the first 7 months (July 10, 2023 to January 15, 2024) of PAR tool implementation

Risk factors	Patient visits (N = 10,562), percent (n)
Absence of naloxone prescription with an opioid prescription	79.2 (8,361)
High-frequency opioid dosing (q1h, q2h, or q3h)	42.8 (4,518)
Multiple opioids prescribed	37.8 (3,992)
Concurrent benzodiazepines and opioid coprescribed	9.7 (1,026)
Over 7 days of intravenous route opioid therapy	9.5 (1,004)
MED* received over or equal to 90	7 (724)
Possible opioid agonist therapy	6 (617)
Possible Clinical Institute Withdrawal Assessment for Alcohol use	1.2 (125)
Administration of naloxone†	1.2 (123)
Additional findings over the patient's entire visit (n = 7,988)	
Total population with calculable MED* ≥ 50 available	87.3 (6,970)
Total population with calculable MED* ≥ 90 available	75.9 (6,060)
Population with MED* available ≥ 50 and naloxone prescriptions	30 (2,088)
Total population with naloxone prescriptions	20.3 (2,139)

PAR: Pharmaceutical Automated Reporting; MED: morphine equivalent dose.
*MED calculations excluded patient-controlled analgesia, parenteral fentanyl, epidurals, intrathecal pumps, or cassettes.
†Naloxone usage was determined by removal from the automated medication cabinet.

DISCUSSION

The PAR tool has provided important insights into opioid prescribing practices within our facilities. We have identified hospital units, service lines, and specific risk factors where interventions could promote more appropriate prescribing practices. For example, prescription optimization, ie, dose, frequency, or rotation schedule, could be targeted with strategies such as audit and feedback. Access to system-level data will be used to direct and track stewardship interventions, inform systemic policy change around appropriate opioid use, evaluate the impact on quality indicators, and inform and support opioid-related research and quality improvement projects.

Limitations include the requirement for clinical interpretation and evaluation. Additionally, the tool is passive, lacking the ability to prevent potentially harmful orders in real time. The code is dependent on the standardized output of the pharmaceutical reports; therefore, changes in the report structure would require code modification.

Resource-constrained healthcare organizations can utilize an internally developed and open-sourced CDSS for collecting system- and local-level data, thereby enhancing the identification of opioid-related risk factors within their facilities. Future research should investigate the acceptance rate of OSP recommendations by the patient's most responsible practitioner and the effectiveness of practice change interventions.

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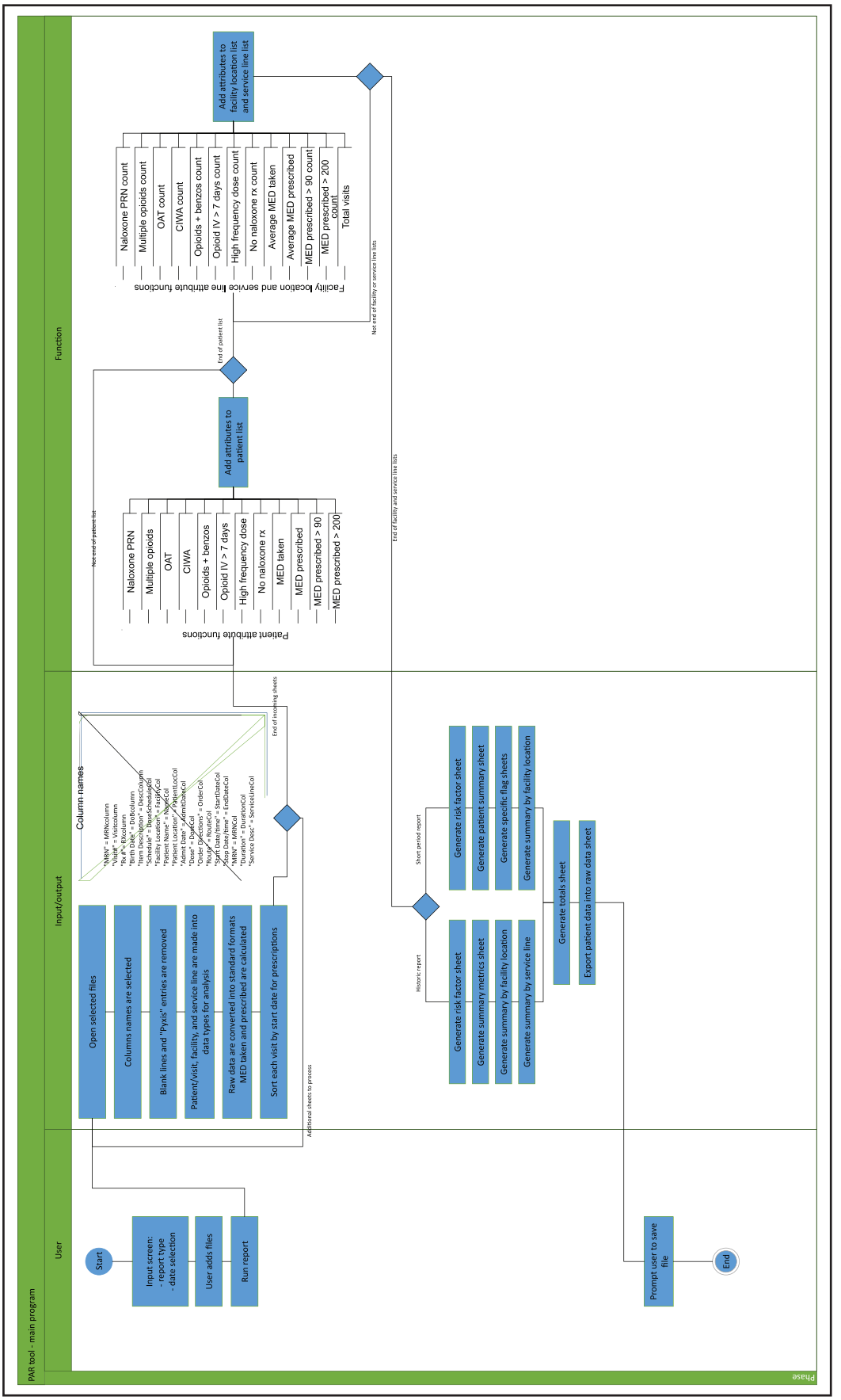
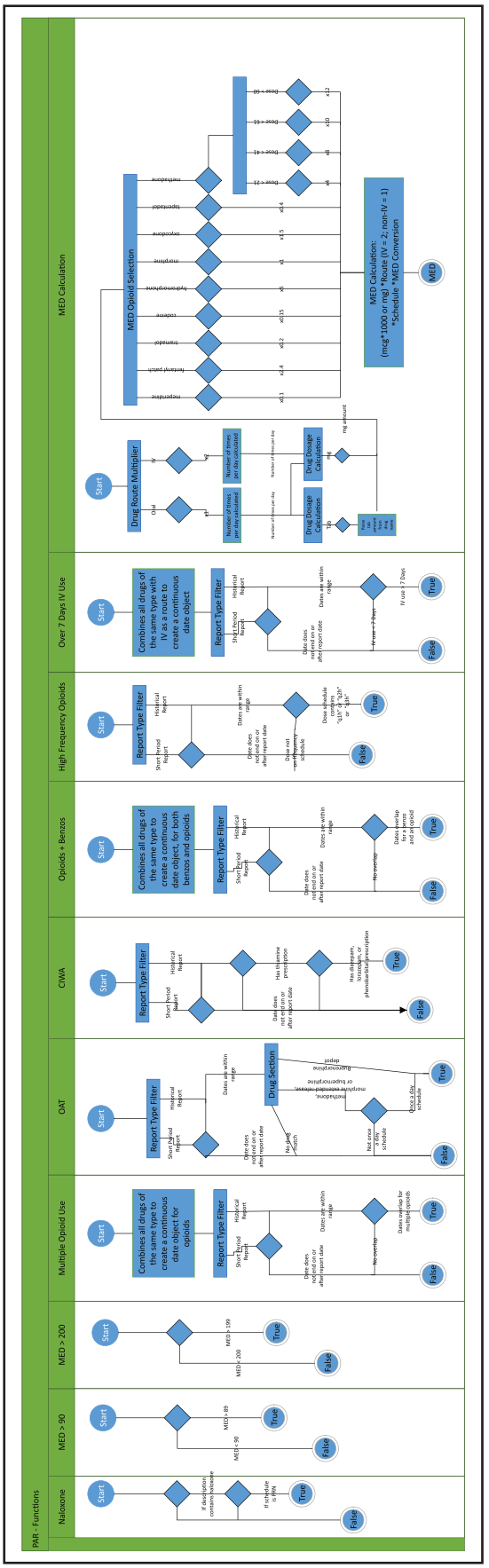
APPENDIX



Appendix Figure 1. Decision tree structure of the Pharmaceutical Automated Reporting (PAR) tool, illustrating the classification process for opioid-related risk factors. The blue diamond denotes a decision; the circle represents a start or end point; the rectangle represents a process; PRN: as needed dose; MRN: medical record number; OAT: opioid agonist therapy; CIWA: Clinical Institute Withdrawal Assessment; IV: intravenous; Rx: prescription; MED: morphine equivalent dose; Pyxis: automated medication dispensing system; mcg: micrograms; mg: milligrams.



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