



Providence Health Care  
**St. Paul's Hospital**

# Opioid Stewardship Program

Year Five Program Report | January–December 2024



BRITISH COLUMBIA  
CENTRE ON  
**SUBSTANCE USE**  
Networking researchers, educators & care providers

Published: September 2025

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# Executive Summary

In the midst of the overdose crisis within British Columbia (BC) and in response to the longstanding prescription opioid crisis, the St. Paul's Hospital (SPH) Opioid Stewardship Program (OSP) was established in January 2020. The goal of the OSP is to improve opioid prescribing at SPH to reduce adverse events, long-term dependence and avoid future opioid misuse, while maintaining or improving pain management for individuals receiving opioids during their acute admission. This is the first OSP within the Providence Health Care (PHC)/Vancouver Coastal Health (VCH) authority, and the third within BC. Following its inaugural year, the program secured sustained funding from PHC beginning in 2021. Since then, the program has demonstrated continued success including clinical interventions, prescriber and learner education, and research and quality improvement initiatives.<sup>1</sup> The impacts of the program can largely be grouped into prescriber-level and system-level interventions.

In the fifth year of the program (2024), the OSP has continued to provide audit and feedback and consultation services to numerous clinical programs at SPH. Other initiatives at SPH have included a number of educational presentations, clinical trainee rotations, reviews of inpatient prescribing protocols and PowerPlans, and the continued convening of the established Opioid Stewardship Advisory Committee (OSAC).

Audit and feedback is an integral part of the OSP clinical portfolio, targeting provider-level interventions. However, this mechanism fails to address the increasing contribution of the electronic system (Cerner) to prescribing. Results of our overarching research study looking at high-risk opioid prescribing indicators prior to and after OSP implementation demonstrate that although OSP reduced high-dose opioid prescribing, other indicators did not benefit from OSP,

potentially due to the simultaneous Cerner roll-out at the time OSP was being implemented.<sup>2</sup> This highlights the need for ongoing system-level efforts to address high-risk opioid prescribing upstream. Furthermore, as SPH is a major teaching hospital, a considerable volume of providers rotate through the site. Targeted educational initiatives and prescribing tools are necessary to effect a more sustained prescriber-level intervention beyond feedback mechanisms. To support a pivot towards increasing program engagement at a system level, as well as targeting more upstream prescriber-level interventions, a restructuring has been proposed.

The OSP will continue to collect data detailing our audit and feedback efforts, including patient demographics, audit statistics (patients screened, included, and intervened), and total intervention numbers and acceptance rates. With a transition to auditing three times weekly, we expect there may be a modest reduction in numbers observed, however we will describe the non-clinical activities, such as development and delivery of educational initiatives, development of prescribing policies and tools, revision and development of protocols (e.g. PowerPlans), qualitatively and how these initiatives are impacting/are expected to impact clinical practice to demonstrate ongoing program success. In addition to the publication of our annual report with the inclusion of the above reporting measures, the OSP Clinical and Operational Teams will review these measures and overall program operations at our OSP Program Review meetings monthly for three months and quarterly thereafter.

Through our audit and feedback approach, the OSP provided a total of 1,887 recommendations for improving opioid prescribing among 777 unique patient encounters in 2024. Examples of the most common recommendations provided include: stopping as needed (PRN) opioids (31%), adjusting opioid dosage (17%), and adding or increasing non-opioid analgesic medications (12%). The OSP has demonstrated continued success in its fifth year, with 90% of recommendations offered being accepted and integrated into clinical practice.

In addition to the program's clinical activities, a number of educational initiatives have been undertaken to improve opioid prescribing. During the fifth year of the program, the OSP team has successfully delivered presentations at 21 educational events to increase awareness of the program and disseminate results regarding its effectiveness. The range of educational events is substantial and spans across a number of clinical groups within the hospital (e.g., general surgery monthly resident and fellow teaching, surgical nursing staff, pharmacy students). The OSP has also provided clinical rotations and observerships to two pharmacist trainees in its fifth year of operation.

Furthermore, the OSP team has been actively participating in research and quality improvement initiatives such as discharge opioid prescribing for patients in obstetrics and gynaecology and urology. Funded by the Vancouver Foundation, our overarching research project evaluating the impact of the OSP on high-risk opioid prescribing continues, with results expected by the end of 2025.

Finally, the SPH OSAC, a group of interdisciplinary health care providers at SPH, continues to convene quarterly to review system-level changes that may be required to optimise opioid prescribing in the hospital setting. Activities have included: submitting requests for the review of new and modifications of existing Cerner opioid-related PowerPlans, as well as collaboration to improve medical staff education and confidence in providing appropriate opioid discharge prescriptions where a BC Controlled Prescription is required.

To date, the OSP has demonstrated tremendous success at improving patient care and safety with regard to opioid prescribing in the hospital setting. Such success could not have occurred without the incredible support of all of the staff at SPH and their commitment to improving patient care. The OSP team are committed to ensuring that the changes we make today have an equally substantial, positive impact moving forward.

This report describes key indicators for the fifth year (January – December 2024) of the SPH Opioid Stewardship Program.

St. Paul's Hospital

# Opioid Stewardship Program

January 2024 – December 2024

## Objective

To improve opioid prescribing practices to reduce adverse events and long-term dependence and avoid future misuse, while maintaining or improving pain management for individuals receiving opioids during their acute admission.

## Program Activities

### Clinical Activities

- Consultations
- Audit & Feedback

### Education

- Presentations
- Guideline Development

### Quality Improvement, Research & Evaluation

- Research Projects
- Quality Improvement Initiatives

## In the fifth year...

# 16,480

patient encounters identified to be potentially prescribed opioid inappropriately

# 1,745

screened patient encounters that were reviewed

# 3,977

identified patient encounters that were screened

# 777

reviewed patient encounters that were offered an intervention

# 1,887

recommendations were provided by the OSP

# 5

most common recommendations

**31%** stop as-needed opioids

**17%** adjust opioid dosage

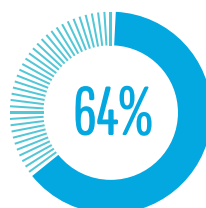
**12%** add or increase non- opioid pain medication

**10%** patient education

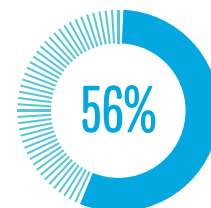
**4%** change IV/IM/SC to PO or add PO route

# 90%

recommendations accepted



opioid naïve  
n=6,142



>60 years  
n=6,142



Providence Health Care  
St. Paul's Hospital



## Background

**Prescription opioid misuse and illicit use have become an increasing problem globally and are linked to an array of negative consequences, including addiction, overdose and mortality.<sup>2-5</sup> Canada, the second highest opioid consumer in the world after the United States, demonstrated rates of prescription opioid use tripling over the past decade alone.<sup>3,6</sup> As rates of opioid prescribing increase, so too has the development of opioid misuse, addiction and prescription opioid related overdose deaths, as well as other related morbidities<sup>7-10</sup>**

Hospitals are a major contributor to the prescription opioid epidemic and related harms. Hospitals that use opioids most frequently have been shown to have increased rates of adverse drug events (ADEs) which can also have a negative impact on length of stay and related costs.<sup>11-13</sup> Past research has also documented inappropriate opioid prescribing practices in hospitals that can lead to various harms in the community, such as the development of opioid dependence and opioid use disorder, overdose, or opioid-induced hyperalgesia.<sup>10,14-16</sup>

Despite this evidence, there have been relatively few initiatives put in place to target opioid prescribing within hospitals. Prescribing stewardship programs in the past have broadly focused on other medications, notably antimicrobial prescribing which has resulted in reduced antimicrobial use, reduced C. difficile infections, and significant cost savings.<sup>17,18</sup> From the small number of hospital-based opioid stewardship programs in North America, preliminary results show cost-savings, a reduction in opioid-associated rapid response calls and code blues, and successful interventions and consultations related to pain medication reconciliation.<sup>19,20</sup>



## Opioid Stewardship at St. Paul's Hospital

**The SPH OSP was implemented in January 2020. The clinical team consists of a clinical pharmacy specialist and an addiction medicine physician. The SPH OSP is the third OSP within acute care in the Lower Mainland and Canada. Other programs in Canada focus on community prescribing. Furthermore, the SPH OSP is the only acute care program that includes both a physician and a pharmacist along with a significant research program running concurrently with the clinical program.**

SPH is an optimal location for an inpatient opioid stewardship program as it is an acute care, teaching, and research hospital servicing the heart of downtown Vancouver. Every day, hundreds of patients are admitted for care at SPH and at least half of these patients are prescribed an opioid medication. SPH has a number of world-class surgical programs (e.g. cardiac, colorectal, vascular, and orthopaedic surgery) which often involve the prescribing of opioid medications. It is also a centre for internal medicine, urban health, and mental health services for downtown Vancouver which provides care for structurally vulnerable patients who may be more likely to have opioid addiction. With Vancouver being at the epicentre of North America's overdose crisis, SPH has an important opportunity to lead clinical practice locally and beyond by demonstrating a commitment to improving opioid prescribing to reduce adverse events and long-term dependence.

In the fifth year of the program, the primary goal of the OSP remains to improve opioid prescribing, utilisation, and monitoring at SPH in order to prevent or reduce adverse events, risk of inappropriate long-term use and dependence, and to improve or maintain adequate pain control for SPH patients.

This is accomplished through:

1. Clinical activities including implementation of a prospective audit and feedback intervention as well as clinical consults;
2. Quality improvement and research initiatives including evaluation of the program and outcomes as well as collaborative projects around opioid use in various departments; and
3. Education including development of clinical tools, presentations to various departments and health disciplines.

## OSP Team Members

### Clinical Team

The clinical team consists of the Opioid Stewardship Clinical Pharmacy Specialist (Dr. Arielle Beauchesne) and the Opioid Stewardship Physician Lead (Dr. Seonaid Nolan). Together, they work on the front line providing audit and feedback and clinical consultations, as well as education to SPH staff, review/development of clinical guidelines and protocols, and dissemination of program data. Dr. Nolan also collaborates with Dr. Lianping Ti as part of the Research Team (see below).



**Arielle Beauchesne**

PharmD\*

\*Pharmacist until November 2024



**Seonaid Nolan**

MD

### Operational Team

The operational team consists of Dr. Michael Legal (Pharmacy Director PHC Acute and Long Term Care) and Dr. Steven Shalansky (SPH Pharmacy Clinical Coordinator). They support the program by providing overall direction, logistics, and pharmacy management.



**Michael Legal**

PharmD



**Steven Shalansky**

PharmD

## Research Team

The research component of the OSP is led by Drs. Lianping Ti (Research Scientist at the BCCSU) and Seonaid Nolan (Clinician Scientist at the BCCSU and holder of UBC's Steven Diamond Professorship in Addiction Care Innovation). They work to conduct research and evaluation initiatives related to review of the OSP, as well as research related to opioid prescribing in hospital settings.



**Lianping Ti**  
PhD



**Seonaid Nolan**  
MD



“They were there.  
I didn’t feel so alone  
and overwhelmed  
they were here  
to guide me and  
reassure me.”

- Patient

## Opioid Stewardship Advisory Committee (OSAC)

The OSAC was developed by the OSP in order to bring together representatives from major stakeholder groups to provide advisory support, as well as to disseminate information from the OSP to their respective practice areas. Current OSAC members include:

- Elizabeth Dogherty (Addiction Medicine, Nursing)
- Naomi Watt (Addiction Medicine, Nursing)
- Dr. Joan Ng (Addiction Medicine, Pharmacy)
- Dr. Renee Janssen (Addiction Medicine, Internal Medicine)
- Linda Jang (Medication Safety, Pharmacy)
- Teresa Hsieh (Medication Safety, Pharmacy)
- Isabel Diogo (Professional Practice, Nursing)
- Derreck Lee (Professional Practice, Nursing)
- Terry Wong (Professional Practice, Nursing)
- Courtney Symes (Medication Safety, Nursing)
- PJ Matras (Acute Pain Service)
- Dr. Ainsley Sutherland (Acute Pain Service)
- Dr. Michael Legal (Pharmacy)
- Dr. Steve Shalansky (Pharmacy)
- Dr. Felicia Yang (Addiction Medicine, Pharmacy)
- Dr. Arielle Beauchesne (Opioid Stewardship, Pharmacy)
- Dr. Seonaid Nolan (Opioid Stewardship)

# Program Activities

## Overview

The program activities of the OSP can be divided into three sections: 1) clinical activities, 2) education, and 3) research and quality improvement. Below, activities and preliminary findings from each of the sections are described in detail.

### Clinical Activities

Audit and Feedback

Consultations

### Education

Presentations

Development and  
review of guidelines

### Quality Improvement, Research and Evaluation

Quality Improvement  
Initiatives

Research Projects

## Audit and Feedback Program

Audit and feedback is an evidence-based strategy to improve professional practice. It involves the review of specific professional performance (in this case opioid prescribing) then provision of feedback to the healthcare provider on opportunities to improve prescribing based on available guidelines and literature. The SPH OSP utilises a screening list of patients on opioids (as described below) to identify those who would most benefit from reassessment and intervention. Audit and feedback in opioid stewardship is often more time-intensive compared to other audit and feedback strategies (e.g. antimicrobial stewardship) as pain is multi-factorial and subjective, thus requiring a more in-depth assessment with the patient to determine the most optimal areas for adjustment and improvement.

As an initial screening, the OSP clinical team extracts daily reports from the pharmacy of patients who have been admitted to SPH (excluding emergency department, critical care areas, and palliative care unit) and have an active opioid order. Patients are then further assessed if they are not followed by another consulting service specialising in opioid prescribing (e.g. acute pain service [APS], addiction medicine consult team [AMCT], palliative care team). Full details regarding the screening process are included below.

## Screening Process

### STEP 1: Computer generated report

Pharmacy generates a daily report of patients receiving opioids, acetaminophen, NSAIDs, antiepileptics, and antidepressants at SPH

### STEP 2: Computer algorithm

Patients are removed if: (1) they are without an opioid order; (2) they have a PCA/epidural (followed by APS); (3) have an opioid order from an AMCT attending physician; or (4) they are admitted by the palliative care service

High risk opioid orders are flagged

### STEP 3: Manual Screening: Patients screened

OSP team then manually remove any remaining patients followed by AMCT, APS, and Palliative Care and identifies a final list of patients eligible for inclusion in the OSP

### STEP 4: Manual Assessment: Patients included

OSP pharmacist triages the final list according to the number of high-risk opioid orders (e.g., a patient with 4 high-risk opioid orders would be seen preferentially over a patient with 1)

### STEP 5: Manual Assessment: Patients receiving recommendations

OSP team reviews full patient electronic health record and may speak to patient and care team, if felt appropriate, and provides recommendations on improving opioid prescribing

\* Abbreviations: NSAID – non-steroidal anti-inflammatory drug, SPH – St. Paul's Hospital, PCA – patient-controlled analgesia, APS – acute pain service, AMCT – addictions medicine consult team

## Screening Steps

The steps listed above are reviewed in more detail:

### STEP 1: Computer Generated Report

An initial screening list is compiled by the OSP Clinical Pharmacy Specialist using the Cerner electronic health record and includes all patients that are prescribed opioids or other target medications (e.g. antidepressants, anticonvulsants, benzodiazepines, zopiclone, acetaminophen, NSAIDs) who reside on an inpatient ward at SPH (excluding critical care and palliative care units).

### STEP 2: Computer Algorithm

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A separate screening algorithm then removes any patients without an opioid order, those with patient-controlled analgesia (PCA) or epidural orders (as a marker of APS involvement), and orders written by an attending physician from the addiction medicine consult team (AMCT).

Following this, the screening algorithm then identifies the number and type of high-risk opioid orders for each patient. The 13 criteria used to identify a high-risk opioid order were developed based on a comprehensive literature review and consultation with physicians with expertise in chronic pain and addiction management. These include:

#### Patient-related Risk Factors:

1. Use of opioid medication in a patient who is opioid naïve
2. Use of opioid medication in a patient with personal history of depressive disorder, anxiety disorder, and/or post-traumatic stress disorder
3. Use of opioid medication in a patient greater than 60 years old

#### Prescription-related Risk Factors:

4. Use of parenteral opioids when orders suggest the patient is receiving a normal diet and taking nutrition orally
5. High frequency opioid prescribing (<4 hours)
6. Multiple different opioids prescribed concomitantly for regular and as needed (PRN) use
7. Regular dosing of an opioid prescribed for PRN use
8. Long-acting opioid prescriptions within the first 5 days of a patient's hospital stay
9. High daily dose of an opioid, defined as a prescribed daily dose of 90 morphine milligram equivalent (MME) or greater
10. Long duration of opioid prescribing, defined as a patient on opioids on or beyond day 5 of hospitalisation
11. Concurrent opioid and sedative (e.g. benzodiazepine) prescription
12. No adjunctive order for non-opioid analgesics, including acetaminophen, NSAIDs, and/or medication for neuropathic pain (where appropriate)
13. Use of an opioid medication where naloxone administration was required in the last 24 hours

Of note, there are other evidence-based criteria that increase the risk of opioid-related adverse events (e.g. renal and hepatic impairment, history of or active substance use disorder) that we were unable to include due to limitations with our screening list. However, these are assessed during STEP 4 by the Opioid Stewardship Clinical Team.

### **STEP 3: Manual Screening: Patients Screened**

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The OSP Team manually screens through the list and patient charts to remove additional patients followed by AMCT, APS, and palliative care.

### **STEP 4: Manual Assessment: Patients Included**

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The OSP pharmacist triages the final list of patients according to the number of high-risk opioid orders (i.e. a patient with 4 high-risk opioid orders would be seen preferentially over a patient with 1).

Based on a preliminary review of the electronic health record, patients are identified who may benefit from an intervention to optimise opioid prescribing.

### **STEP 5: Manual Assessment: Patients Receiving Recommendations**

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Patients identified in STEP 4 then receive a full clinical assessment from the opioid stewardship pharmacist (including full review of electronic health record and often discussion with the patient and clinical team) to determine how analgesic therapy can be optimised to improve or maintain pain management while improving opioid safety.

For patients who would benefit from an intervention, recommendations are delivered in any combination of the following four ways: (1) documenting a note in the patient's electronic medical record; (2) speaking to the patient; (3) speaking to the attending physician; and/or (4) speaking to the ward pharmacist. Multiple actions may be done for the same assessment (i.e. speaking to physician and documenting in note).

## Review of Audit and Feedback Statistics

This section summarises the baseline demographics, risk factors, and opioids ordered for patients exposed to opioids at SPH from January 01, 2024, to December 31, 2024. The patients included in this analysis are from “STEP 2: Computer Algorithm” of the screening process listed on page 10.

Furthermore, this section will also provide details regarding all patients screened for and assessed by the OSP as well as the number and type of recommendations and acceptance rate of these recommendations between January and December 2024.

## Patient Baseline Demographics

Below, we have described patient characteristics, patients’ admitting clinical service, and patients’ history of opioid use prior to hospital admission among a total of 6,142 patient encounters across 5,407 unique patients (as some patients were admitted multiple times) who were exposed to opioids between January and December 2024. These patients were identified by pharmacy’s daily generated report (and prior to manual screening by the OSP team). Many patients appeared on multiple daily reports during their hospital stay, but only the data from the first day are included in this review of patient baseline demographics.

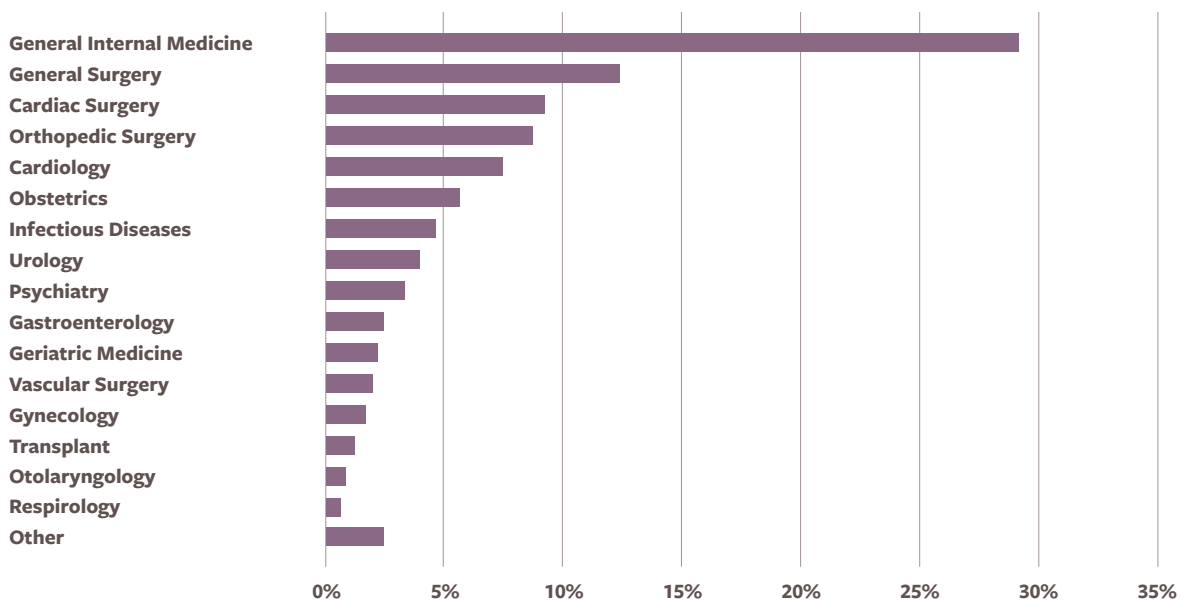
### Age and Sex

Of the 5,407 unique patients exposed to opioids from January to December 2024: 46% were female and 54% were male. The mean age was 57 years for females, and 61 years for males.

### Admitting Clinical Service

Of the total patient encounters ( $n = 6,142$ ), patients were admitted under the care of a variety of clinical services at SPH. The largest proportion of patients were admitted to General Internal Medicine (29%), Cardiac Surgery (12%), and General Surgery (10%). It is important to note that some of these patients may be prescribed opioid agonist therapy for opioid use disorder and would have been excluded from further assessment by the OSP during the next step of the screening process. Also, the distribution of patients prescribed opioids by various services does not necessarily reflect suboptimal prescribing practices on these services, rather it may relate to the volume of patients admitted under these services.

**Figure 1: Admitting Clinical Service of Patients Prescribed Opioids at SPH (n=6,142)**



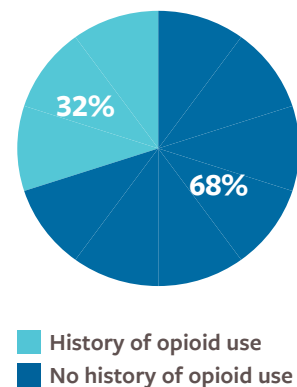
\* Other includes: Hematology, Nephrology, Emergency Medicine, Plastic Surgery, Neurology, Critical Care, Neurosurgery, Ophthalmology, Otolaryngology, and Pain Medicine.

### Opioid Use Prior to Admission

History of opioid prescription within 30 days prior to hospital admission was collected as a marker of whether the patient was opioid naïve or not (n = 6,142). The majority of patients (68%) were opioid naïve at the time of hospital admission.

Patients prescribed opioids who are previously opioid naïve are at higher risk of adverse events from opioids due to a lack of tolerance. This provides an opportunity for the OSP to provide recommendations to encourage safer use of opioids. Patients who do have a history of opioid use often have a complex pain history, escalated doses of opioids in community, and may be at higher risk for poorly managed acute pain in hospital. There is an opportunity for the OSP to intervene and provide recommendations to improve acute pain management (including liaising with our pain teams) and reduce inappropriate, long-term use of opioids for both patient populations.

**Figure 2: 30-day Opioid Use of Patients Receiving Opioids at SPH (n=6,142)**



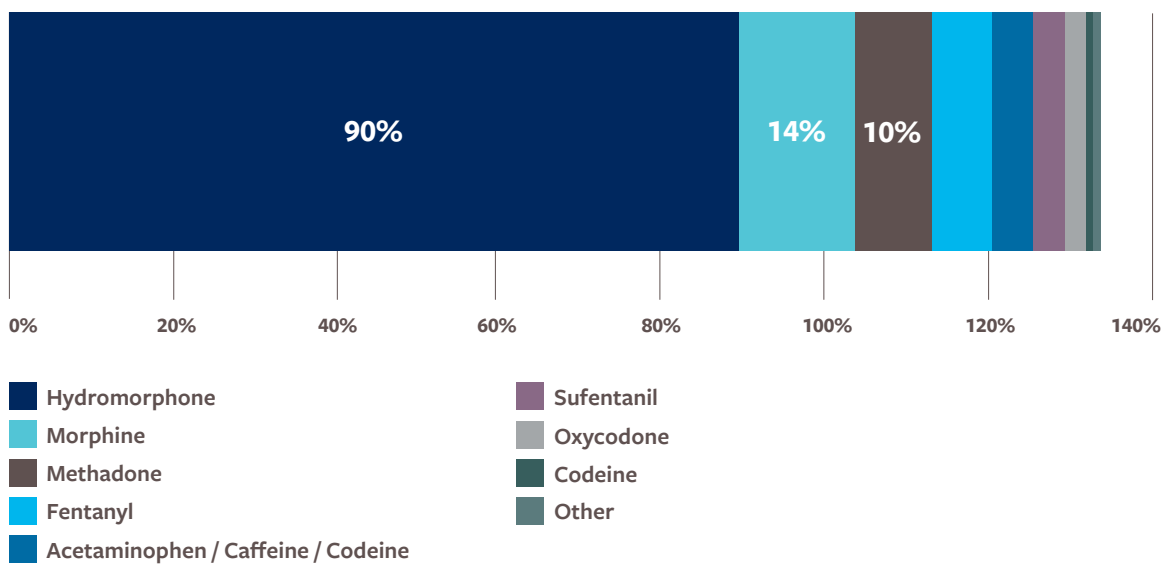
## Review of Opioid Orders

Below, we have reported on active opioid orders during unique patient encounters among patients exposed to opioids from January to December 2024 that were included in the OSP screening list. Key indicators included: type of opioid(s) prescribed, whether opioids were prescribed regularly or as needed, and route(s) of administration.

### Type of Opioid Prescribing

Numerous formulations of opioids were prescribed for patients at SPH. Hydromorphone was the most common opioid prescription, and the majority of patients received hydromorphone during their hospital stay (90%), with morphine as the second most common (14%). Patients could have multiple opioids prescribed; thus, the sum of the percentages is greater than 100%.

**Figure 3: Type of Opioid Prescribed (n=6,142)**



\*Other category includes: Meperidine, Oxycodone-Acetaminophen, Tramadol, Tramadol-Acetaminophen, Diacetylmorphine.

### Frequency of Opioid Prescribing

The majority of patients (70%) were exclusively prescribed as needed (PRN) opioids, 30% received a mixture of both PRN opioids and regularly prescribed opioids, while none were prescribed only regularly scheduled opioids.

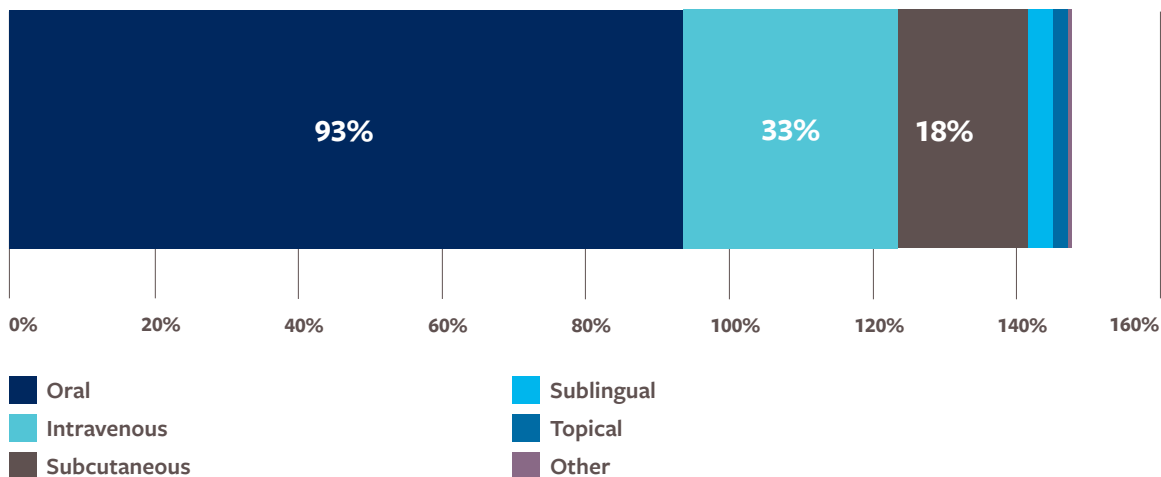
As the majority of opioids are prescribed as needed, this presents an opportunity to reduce or discontinue opioids that are no longer required (to avoid inappropriate long-term use or exposure) or to optimise pain control by recommending a change to a regularly scheduled regimen for patients that require it.

### Route(s) of Administration for Opioid Prescribing

For patients exposed to opioids, the majority of patients were prescribed at least one opioid with an oral administration route (93%). About a third of patients (33%) were prescribed an intravenous opioid and 18% had a subcutaneous opioid order. Patients could have multiple treatment routes; thus, the sum is greater than 100%.

Although the most common route of opioid prescribing is oral, several patients were still receiving parenteral opioids. This may represent an example of inappropriate use if patients were able to take an oral formulation. Accordingly, an opportunity arises for the OSP to intervene and reduce the unnecessary use of parenteral opioids which have been associated with increased risk of adverse events and medication errors.

**Figure 4: Opioid Routes of Administration (n=6,142)**

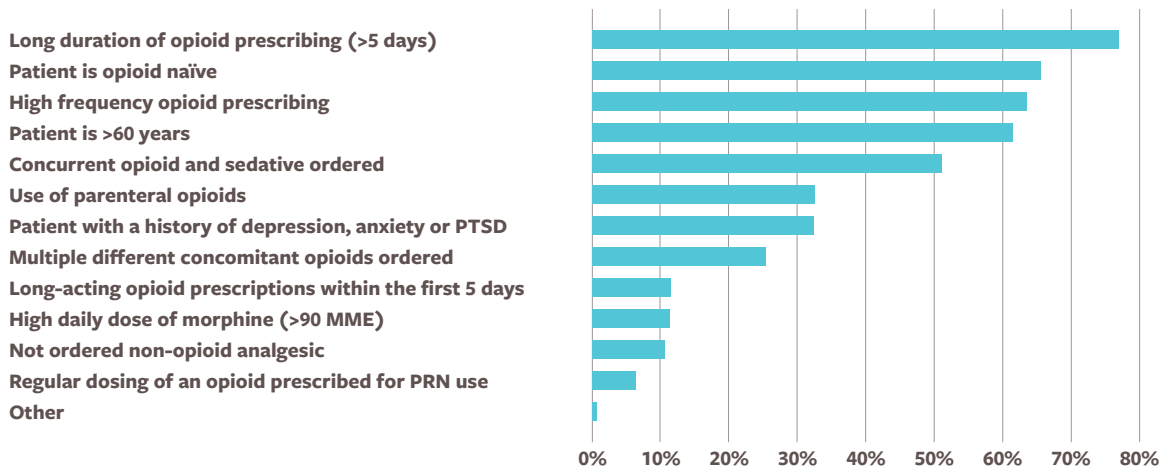


\* Other category includes: Buccal, G-tube, GJ-tube, Intramuscular, Intradermal, NG-tube, OG-tube, and PEG-tube

## Identified Risk Factors

The screening algorithm identified risk factors for 16,480 total patient encounters among 6,142 unique admissions for 5,407 unique patients exposed to opioids between January to December 2024. The most common risk factors identified included: long duration of opioid prescribing (74%; risk factor #10 above), patient is opioid naïve (64%; risk factor #1 above), and high frequency opioid prescribing (63%; risk factor #5 above).

**Figure 5: Identified Risk Factors for Patients Receiving Opioids at SPH (n=16,480)**

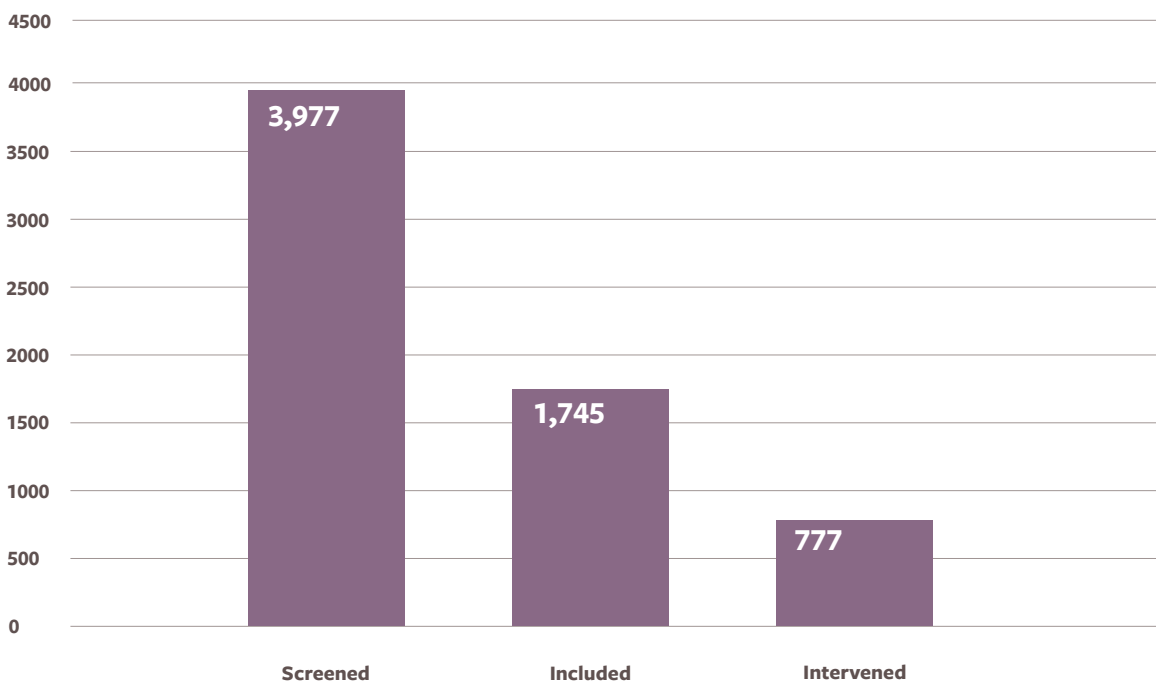


A number of the most common risk factors are modifiable and can be intervened on to reduce the risk of adverse events. Additional risk factors such as patient being opioid naïve or age >60 years further increase risk of adverse events and allow for opportunities for the OSP to provide targeted interventions to those who would benefit most. The most common risk factor (i.e., long duration of opioid prescribing) is also associated with increased risk of long-term dependence and provides a major opportunity for intervention that could have a long-term impact beyond acute care.

## Patient Screening and OSP inclusion

In the fifth year of the program, the OSP clinical team screened 3,977 patient encounters from 1,792 unique patients who were exposed to opioids (STEP 3: Manual Screening: Patients Screened). The number of “patient encounters” reflects that some patients were assessed multiple times during the course of their admission or over repeat admissions. Of these, 1,745 patient encounters from 1,063 unique patients met the criteria for inclusion (i.e. admitted to a non-critical care unit and not followed by addiction medicine, acute pain, or palliative care services) and received further assessment to determine if intervention to improve opioid prescribing was required (STEP 4: Manual Assessment: Patients Included). A subset of 777 patient encounters for 623 unique patients resulted in recommendations for interventions being offered (STEP 5: Manual Assessment: Patients Receiving Recommendations).

**Figure 6: Patient Encounters Screened, Included, and Interventions Offered by OSP (n=1,792 unique patients)**



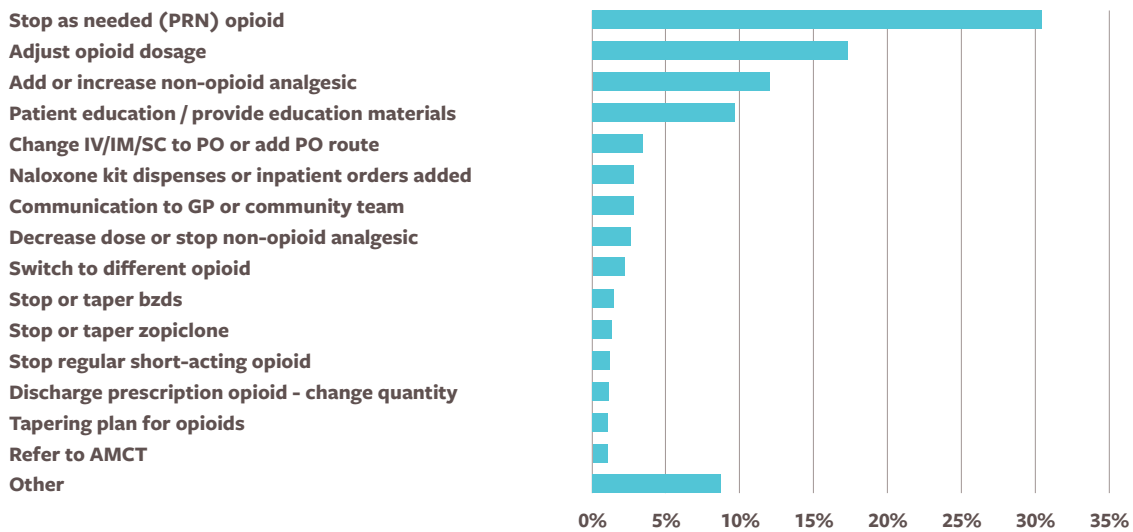
## Recommended Interventions and Acceptance Rate

Below, we have reported on the different intervention recommendations, acceptance rate of these recommendations, and number of consultations received.

### Type of Recommended Intervention

Of the 777 patient encounters from 623 unique patients that the OSP clinical team assessed, a total of 1,887 interventions were recommended. The three most common were: stopping as needed PRN opioids (31%), adjusting the opioid dose (17%), and add or increase non-opioid analgesic (12%).

**Figure 7: Types of Interventions Provided by the OSP (n=1,887)**



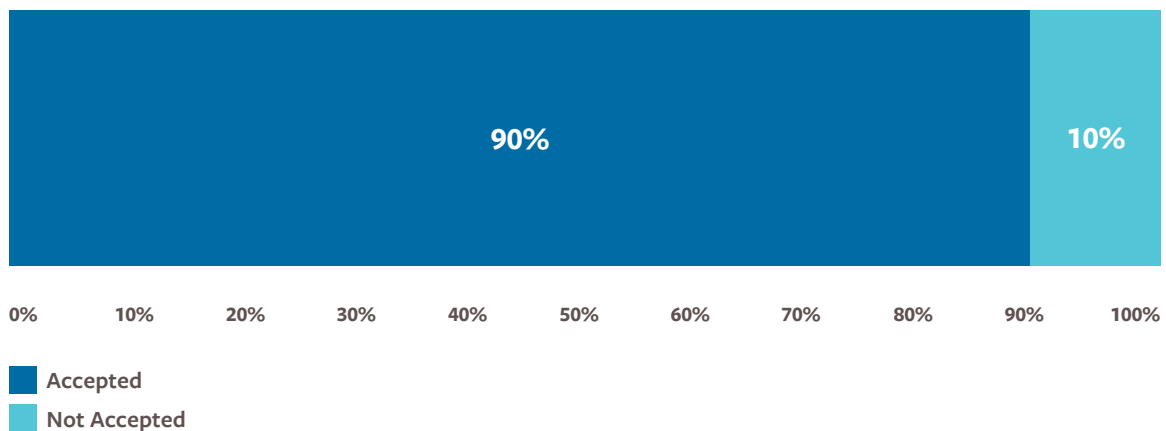
\* Other category includes: Add bowel medications, Naloxone kit assessed – not given because patient already has a kit, Refer to APS, Refer to Palliative Care, Stop or taper zopiclone, and organizing drug coverage

The most common recommendations are indicative of the general overall approach to improving opioid prescribing through optimizing non-opioid analgesia, educating patients on the use of opioid medications and associated adverse effects, and reducing or discontinuing opioids where appropriate. The recommendations correspond to the most common risk factors described above (i.e. long-duration of opioid prescribing may lead to discontinuation of PRN opioid, use of opioid in opioid naïve patient or patient > 60 years of age may lead to adjustment in dose).

### Acceptance Rate of Recommended Interventions

In the fifth year of the OSP, we offered a total of 1,887 recommended interventions. The overall acceptance rate of OSP recommendations for this period was 90%. Of the 10% of recommended interventions that were not accepted ( $n = 186$ ), 9% were not accepted by the patient, and 33% were not accepted by the prescribing physician (or their team). Reasons for not accepting were not provided for the remaining 58%. Instances of patient non-acceptance were often due to concern for worsened control or escalation of pain. Similarly, prescribers may also have been hesitant to make adjustments to opioid regimen due to perceived severity of pain and fear of destabilizing patients. These cases often required further education and collaborative care between the patient, prescriber and the OSP.

**Figure 8: Overall Acceptance Rate of Recommended Interventions (n=1,887)**



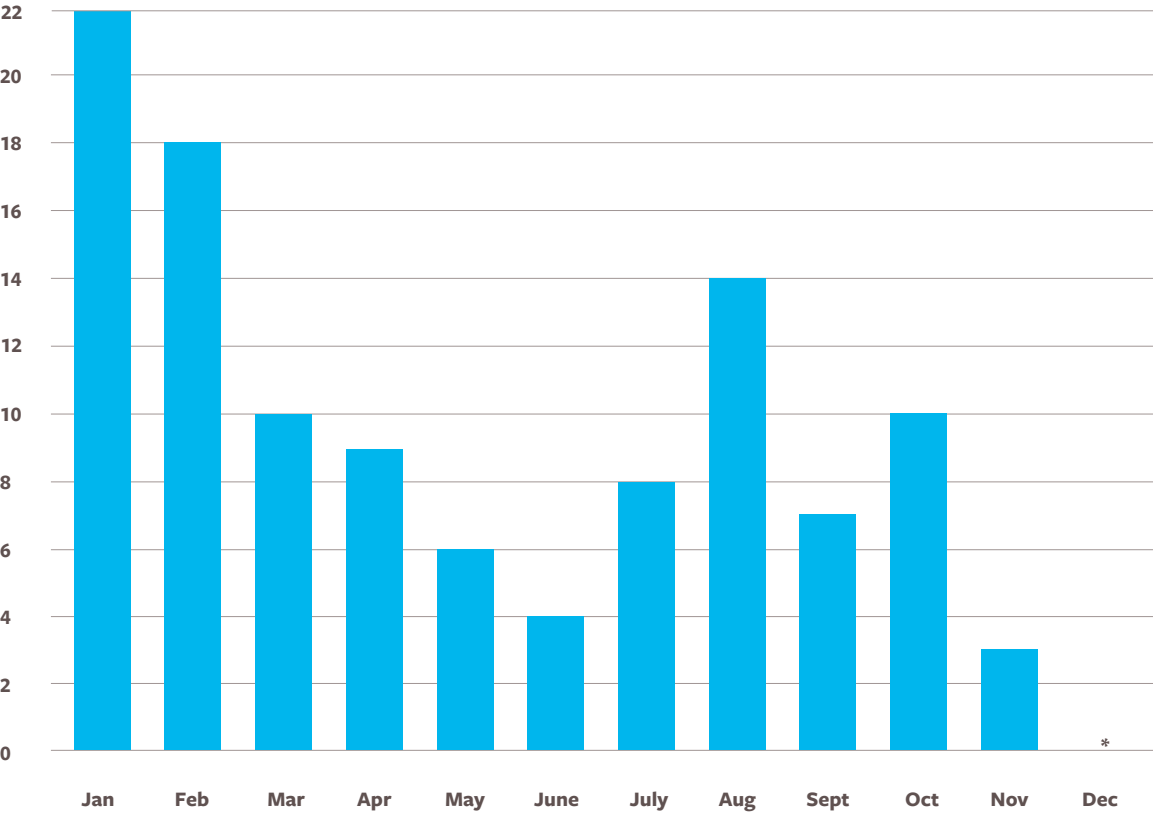
“Very thorough evaluation of the patient’s pain management and needs. Communication was very clear to both the team and patient.”

– Provider

Consultations

The total number of consultations the OSP received over year five of the program was 112. The number of consultations per month spanned a wide range with 3 in November 2024 to a high of 23 in January 2024, averaging at about 10 consultations per month. These consultations are generally more complex and help the OSP identify patients at higher need of an assessment in a timelier manner than through general screening. It is our hope to further increase awareness of the program, increase consultations, and increase impact of the OSP on providing recommendations for patients who would most benefit from it. As the OSP is one of a number of consult services available at SPH in regards to opioid prescribing (in addition to the Acute Pain Service, Addiction Medicine Consult Team, and Palliative Care Service) we also anticipate that we may continue to act as a bridge to facilitate appropriate consultations to other services for more comprehensive, targeted interventions and longitudinal follow-up.

Figure 9: Number of Consultations the OSP Received (n=112)



\* OSP pharmacist position vacant.

## Education and Presentations

The OSP has been involved in a number of educational activities to improve the prescribing and use of opioids at SPH in a number of clinical areas including:

Date	Area	Presentation	Approximate number of attendees
January 22, 2024	General Surgery Resident & Fellow Teaching	Intro to Opioid Stewardship Program and Principles and the Acute Pain Service	5
February 26, 2024	General Surgery Resident & Fellow Teaching	Intro to Opioid Stewardship Program and Principles and the Acute Pain Service	5
February 27, 2024	PHC Quality, Safety & Risk Steering Committee	Opioid Stewardship Program Overview	26
March 16, 2024	General Surgery Resident & Fellow Teaching	Intro to Opioid Stewardship Program and Principles and the Acute Pain Service	5
April 8, 2024	UBC Pharmacy Students	Introduction to Opioid Stewardship Principles	4
April 23, 2024	Surgical nursing staff	Surgery Education Day, opioid stewardship from the nursing perspective	30
May 6, 2024	General Surgery Resident & Fellow Teaching	Intro to Opioid Stewardship Program and Principles and the Acute Pain Service	5
May 13 – June 7, 2024	Pharmacy	Clinical rotation for Lower Mainland Pharmacy Services year 1 Resident	1

Date	Area	Presentation	Approximate number of attendees
June 17, 2024	General Surgery Resident & Fellow Teaching	Intro to Opioid Stewardship Program and Principles and the Acute Pain Service	5
July 11, 2024	UBC Pharmacy Students	Introduction to Opioid Stewardship Principles	2
July 22 – 24, 2024	Pharmacy	BCCSU Pharmacy fellowship abbreviated rotation	1
August 26, 2024	General Surgery Resident & Fellow Teaching	Intro to Opioid Stewardship Program and Principles and the Acute Pain Service	5
August 29, 2024	Pharmacy	Opioid Tapering Project Defense, led by PGY2 Pharmacy Resident Kaitlyn Baldwin	25
September 10, 2024	Internal Medicine Medical residents	Safer Opioid Prescribing	20
September 23, 2024	General Surgery Resident & Fellow Teaching	Intro to Opioid Stewardship Program and Principles and the Acute Pain Service	7
October 9, 2024	Acute Nursing Practice Council	Opioid stewardship program and principles for nursing staff	42

Date	Area	Presentation	Approximate number of attendees
October 10, 2024	Internal Medicine Medical residents	Safer Opioid Prescribing	15
October 28, 2024	General Surgery Resident & Fellow Teaching	Intro to Opioid Stewardship Program and Principles and the Acute Pain Service	7
November 4, 2024	Pharmacy	New Hires Opioid Stewardship Program and Principles	4
November 25, 2024	PHC Division of Addiction Medicine	Opioid Stewardship Principles	20
November 25, 2024	General Surgery Resident & Fellow Teaching	Intro to Opioid Stewardship Program and Principles and the Acute Pain Service	2

## Quality Improvement and Research

The OSP has also been involved in quality improvement projects and initiatives around opioid prescribing at SPH.

### Peripherally Inserted Central Catheter (PICC) Insertion PowerPlan Discontinuation

Through audit and feedback, the OSP has observed that patients who undergo Peripherally Inserted Central Catheter (PICC) insertion are often left with lorazepam orders beyond the time of insertion given there is no stop date associated with this order. This order places patients at increased risk of adverse events, including sedation and overdose, should they be combined with opioid medications. The extraneous order also results in medication administration record (MAR) cluttering and increased risk of errors, including potentially providing this medication for reasons outside of the true indication (PICC insertion).

Given the potential risks, a request was submitted to include an automatic order stop date to this PowerPlan to ensure that lorazepam was discontinued after PICC insertion was complete. In collaboration with PICC nurses at various sites as well as Professional Practice, a 48 hour stop date was selected on the lorazepam order. This change went live within the EMR system in February 2024.

### Guideline and Order Set Review – Department of Obstetrics and Gynecology

The SPH OSP, in collaboration with regional Obstetrics and Gynecology, has been working on updating obstetrics and gynecology PowerPlans to more accurately reflect opioid stewardship prescribing principles. The diversity in PowerPlans, in addition to difference in both clinical scenarios and clinical staff between obstetrics and gynecology required separation of these two initiatives to allow for more fulsome stakeholder engagement and expertise at all affected Cerner sites. Both requests center around the judicious use of opioids including appropriate hydromorphone dose ranges, opioid administration routes, and utilization of multimodal analgesia to support pain management.

The changes to the gynecology powerplans went live by the end of 2024, and the obstetrics changes went live in 2025.

## **Urology Admission and Post-Operative Pain Management Review – Department of Urology**

Through audit and feedback, the OSP identified several orders within the Urology Admission and Post-Operative Pain and Symptom Management PowerPlans that required review. This included wide opioid range doses (e.g. hydromorphone 1-4mg orally every four hours as needed), inclusion multiple types of opioids, and inclusion of subcutaneous opioids where they are generally not required. All three of these instances places patients at increased risk of opioid-related adverse events and requires a system-level change to produce sustained benefit particularly given protocolized ordering supports the majority of opioid ordering at these transitions in care (e.g. admission, post-operative).

After interprofessional collaboration and review with departments such as the PHC Acute Pain Service as well as both PHC and VGH Urology departments, a request was submitted to address the aforementioned areas. This request went live at all Cerner sites in 2025.

## **Anesthesia Transfer Pain Management PowerPlan Review – Department of Anesthesia, Acute Pain Service**

Through audit and feedback, the OSP identified that many patients in whom the Acute Pain Service were previously following would have active hydromorphone PRN orders but no active acetaminophen orders. After further review, it was determined that the root cause of this issue was that acetaminophen scheduled orders were placed as part of the anesthesia transfer PowerPlan, however this order contained a 7-day stop-date and had no acetaminophen PRN following the completion of that order. In a joint, collaborative effort by the OSP and PHC Acute Pain Service, a request has been submitted to add a time-delayed acetaminophen PRN order to the Anesthesia Transfer Pain Management PowerPlan to provide patients multimodal analgesia beyond the initial 7-days of scheduled acetaminophen therapy when the Acute Pain Service is signing-off. Looking forward, this request will be reviewed.

## **Opioid Stewardship Principles for PowerPlan Review and Development TipSheet**

The expansion of the electronic medical record, Cerner, across the Lower Mainland has simultaneously increased the demand for opioid stewardship purview of opioid orders contained within PowerPlans. To support increased demand both within PHC and beyond, the OSP developed a toolkit with key, accessible tips for opioid order review and inclusion into PowerPlans. The tips included in this resource are informed by literature review, best practice, and expert consensus. The document was endorsed by the PHC Opioid Stewardship Advisory Committee and has been posted on PHC Connect for widespread use and dissemination. Next steps will include utilizing this tool to advocate for systems-level change to improve the landscape of opioid prescribing enterprise-wide, as well as for education to a variety of providers, stakeholders, and subject matter experts.



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## Opioid Stewardship Principles for PowerPlan Review and Development

NOTE: This does not apply to PowerPlans used for Substance Use Stabilization and/or Addiction Medicine

### 1 Include only one opioid medication

Choose one opioid medication for inclusion (e.g. either HYDROmorphine OR morphine OR oxycodone). Multiple different opioids should not be included in the same PowerPlan in order to prevent accidental ordering of multiple different opioids for the same patient. This includes Tylenol #3 which contains codeine.

### 2 Do not include long-acting opioids

Long-acting opioids should not be used for acute pain and therefore should not be present in admission or post-operative pain and symptom management PowerPlans. When ordered, long-acting opioids should be individualized to the specific patient, not as part of a protocolized order set.

### 3 Do not include wide PRN ranges (e.g. HYDROmorphine 1-4mg)

Opioid dosing ranges included in PowerPlans should be appropriate for use in patients who are opioid naive to prevent accidental opioid-induced toxicity. For example, HYDROmorphine 0.5-1mg or 1-2mg PO q4h PRN.

### 4 Include the following order comment for subcutaneous opioid orders: "Administer ONLY if unable to tolerate PO"

Subcutaneous opioids should only be used as an alternative to oral opioids when the patient is unable to tolerate oral medications. Subcutaneous opioids should not be given at the same time as oral opioids.

### 5 Oral and subcutaneous opioid doses available within a PowerPlan should be equivalent

To prevent higher dosing of opioid with one route compared to another, available doses should be equivalent. Subcutaneous opioids are 2-3x more potent than oral opioids. For example, if the oral dose of HYDROmorphine is 1-2mg PO q4h PRN, a reasonable subcutaneous dose would be 0.5-1mg SUBCUT q4h PRN.

### 6 Naloxone PRN and monitoring should be ordered for every patient prescribed opioids

Appropriate monitoring includes Sedation Scale (POSS) and Respiratory Rate q4h (or at the same frequency as the PRN opioid order) and prior to every dose of opioid.

#### Questions?

Please contact the **Opioid Stewardship Program**

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## Opioid Tapering in Acute Care

Overprescribing and under prescribing opioids can lead to negative outcomes like decreased quality of life and increased hospitalizations. Research indicates that opioid prescriptions at discharge are often excessive, and follow-up opioid management is frequently not planned. While considerable research supports pharmacist-led opioid tapering in outpatient settings, opioid tapering in inpatient settings is less well described.

This mixed-methods study included a cross-sectional observational component and a provider survey. The chart review analyzed patients who received opioid tapering recommendations from pharmacist-led opioid stewardship programs (OSP) at three teaching hospitals in British Columbia. A sample of practitioners working at these hospitals participated in the provider survey. The study aimed to describe opioid tapering interventions and assess provider perceptions of opioid tapering during hospitalization.

At discharge, the milligram morphine equivalents (MME) were significantly lower compared to MME at OSP consult. All six opioid tapering strategies resulted in reductions in MME. 70.5% of survey respondents viewed opioid tapering as a shared responsibility among healthcare providers, though only 27% reported initiating opioid tapering “often” or “very often” during hospitalization. Thematic analysis identified three key themes: seamless care, professional responsibility, and patient-centered care.

The study demonstrated that pharmacist-led opioid tapering during hospitalization is effective, with a variety of strategies employed. However, there were discrepancies between provider perceptions and action regarding opioid tapering. The findings suggest that while opioid tapering during hospitalization is feasible, there is room for improvement, such as expanding OSP services and enhancing knowledge dissemination on optimal opioid practices.

This study revealed a gap in both provider knowledge and readiness to initiate opioid tapering during hospitalization. Further education should focus on improving provider confidence, opportunities for collaboration, and continuity of care. Shared, inter-professional responsibility in opioid tapering presents an opportunity for improved care through collaboration and promotion of patient-centered care. Findings support policies prioritizing early involvement of OSP or similar services during hospitalization.

## AESOP Project

High-risk opioid prescribing (e.g., high-dose opioids, concurrent opioid-sedatives) is prevalent in hospitals and can be associated with adverse outcomes, including increased risk for long-term opioid use and dependence. Opioid stewardship programs (OSP) have the potential to reduce high-risk opioid prescribing through audit-and-feedback recommendations and prescriber consultations.

We evaluated an OSP implemented in January 2020 at a Vancouver, Canada tertiary care hospital using interrupted time series (ITS) analysis. Cerner, an electronic medical record (EMR) system, was simultaneously operationalized. The main outcome was: any high-risk opioid prescribing (based on 10 evidence-based indicators), including high daily dose of morphine milligram equivalent (MME) prescribing ( $>90$ MME), opioid duration ( $>5$  days post-admission), and concurrent opioid-sedative prescribing.

Between January 2018 and December 2022, 5,477 patient encounters were included. While no significant change occurred in overall high-risk opioid prescribing post-OSP ( $p>0.05$ ), a significant reduction was seen in the level of high daily dose of MME prescriptions (estimate: -0.044; 95% confidence interval [CI]: -0.082, -0.006). Conversely, the slope of opioid use  $>5$  days during the study increased (estimate: 0.006; 95%CI: 0.000, 0.011), likely due to the removal of automatic stop dates in Cerner. In multiple ITS analysis, OSP initially reduced concurrent opioid-sedative prescriptions (estimate: -0.357; 95%CI: -0.579, -0.136), with a subsequent increase over time (estimate: 0.013; 95%CI: 0.005, 0.020). Interventions implemented in May 2021 reversed this trend, reducing both the level (estimate: 0.874; 95%CI: 0.374, 1.375) and slope (estimate: -0.022, 95%CI: -0.034, -0.011) of concurrent prescriptions.

The simultaneous roll-out of the OSP and Cerner led to mixed outcomes. While our research suggests the OSP reduced high-dose opioid prescribing, other indicators impacted by Cerner did not benefit as highly from the OSP. Nevertheless, the OSP proved able to rapidly respond to unintended consequences by introducing interventions to reduce concurrent opioid and sedative prescribing, when not indicated.

## Opioid Stewardship Program Beyond Year 5

The fifth year of the OSP held continued success and uptake for the program while maintaining a strong focus on education, teaching, and knowledge translation. Importantly, the OSP received guaranteed funding for continued operations from PHC in the Fall of 2021.

In the sixth operational year of the program, the OSP will continue with a strong clinical focus, providing audit and feedback services as well as consultations. In addition, the OSP will continue to advocate for system-level change and creation of other OSP or OSP-like programs to improve opioid prescribing across all Cerner sites, alongside ongoing educational and quality improvement initiatives at a site-specific level.



# Acknowledgements

The OSP would like to offer thanks to the participants of its program.

## **Providence Health Care and St. Paul's Hospital**

Additionally, we would like to acknowledge and thank senior leadership at SPH for its support of the OSP as well as the amazing staff and healthcare teams at SPH and their continued willingness to work with the OSP team. We would also like express our gratitude to Providence Health Care who assumed permanent financing for the OSP in the Fall of 2021.

## **BC Centre on Substance Use**

We would like to thank the BCCSU for their continued financial and resource contributions including research expertise, administrative and analytical support.

## **SPH Pharmacy**

We would like to thank the SPH Pharmacy Department for management and resource contributions including administration support.

## **Opioid Stewardship Advisory Committee**

We would like to express our gratitude to all the members of the OSAC for generously donating their time to tackle issues related to opioid prescribing.

## **Clinical Systems Transformation group**

We would also like to thank the CST group for their support of the OSP and working with us to develop a screening report to increase efficiency of our audit and feedback program.

## **Vancouver Foundation**

The OSP was originally made possible by a grant from the Vancouver Foundation.

## **Fraser Health Opioid Stewardship Programs**

We would like to thank the OSPs at Royal Columbian Hospital and Surrey Memorial Hospital for sharing their experience and expertise, and for the work that they do to improve opioid prescribing in the Fraser Region.

## **SPH Antimicrobial Stewardship Program**

We would like to thank the Antimicrobial Stewardship Program (AMS) for sharing their support and guidance as we worked to establish the OSP modelled around the success of AMS.

## **Providence Health Care Communications**

We would like to thank PHC Communications for their support in preparing this fifth year report.

**Suggested citation:** Fong N, Yang F, Beauchesne A, Legal M, Shalansky S, Ti L, Nolan S. (2025). St. Paul's Hospital Opioid Stewardship Program: Fifth Annual Program Report January – December 2024. British Columbia Centre on Substance Use and Providence Health Care. Vancouver, Canada.

# References

1. Beauchesne A, Crepeault H, Legal M, Shalansky S, Ti L, Nolan S. (2024). St. Paul's Hospital Opioid Stewardship Program: Fourth Annual Program Report January – December 2023. British Columbia Centre on Substance Use and Providence Health Care, Vancouver, Canada.
2. Ti L, Mihic T, Beauchesne A, Grant C, Legal M, Shalansky S, Nolan S. Impact of an opioid stewardship program on high-risk prescribing patterns. Submitted to Health Quality BC Conference, Vancouver, BC, March 11-13, 2025.
3. Fischer B, Argento E. Prescription opioid related misuse, harms, diversion and interventions in Canada: a review. *Pain Physician*. 2012;15(3 Suppl):ES191-203.
4. Miller M, Barber CW, Leatherman S, et al. Prescription Opioid Duration of Action and the Risk of Unintentional Overdose Among Patients Receiving Opioid Therapy. *JAMA Intern Med*. 2015;175(4):608-615. doi:10.1001/jamainternmed.2014.8071
5. Fischer B, Jones W, Urbanoski K, Skinner R, Rehm J. Correlations between prescription opioid analgesic dispensing levels and related mortality and morbidity in Ontario, Canada, 2005-2011. *Drug Alcohol Rev*. 2014;33(1):19-26. doi:10.1111/dar.12089
6. Shield KD, Jones W, Rehm J, Fischer B. Use and nonmedical use of prescription opioid analgesics in the general population of Canada and correlations with dispensing levels in 2009. *Pain Res Manag J Can Pain Soc*. 2013;18(2):69-74.
7. BC Coroners Service. *Illicit Drug Overdose Deaths in BC: January 1, 2007-August 31, 2016*. Office of the Chief Coroner, Ministry of Justice
8. Correa D, Farney RJ, Chung F, Prasad A, Lam D, Wong J. Chronic opioid use and central sleep apnea: a review of the prevalence, mechanisms, and perioperative considerations. *Anesth Analg*. 2015;120(6):1273-1285. doi:10.1213/ANE.0000000000000672
9. Carullo VP, Fitz-James IA, Delphin ES. Opioid-induced hyperalgesia: A diagnostic dilemma. *J Pain Palliat Care Pharmacother*. 2015;29(4):378-384. doi:10.3109/15360288.2015.1082006
10. Bannister K. Opioid-induced hyperalgesia: where are we now? *Curr Opin Support Palliat Care*. 2015;9(2):116-121. doi:10.1097/SPC.0000000000000137
11. Oderda GM, Gan TJ, Johnson BH, Robinson SB. Effect of opioid-related adverse events on outcomes in selected surgical patients. *J Pain Palliat Care Pharmacother*. 2013;27(1):62-70. doi:10.3109/15360288.2012.751956
12. Herzig SJ, Rothberg MB, Cheung M, Ngo LH, Marcantonio ER. Opioid utilization and opioid-related adverse events in nonsurgical patients in US hospitals. *J Hosp Med*. 2014;9(2):73-81. doi:10.1002/jhm.2102
13. Oderda GM, Said Q, Evans RS, et al. Opioid-related adverse drug events in surgical hospitalizations: impact on costs and length of stay. *Ann Pharmacother*. 2007;41(3):400-406. doi:10.1345/aph.1H386
14. Brat GA, Agniel D, Beam A, Yorkgitis B, Bicket M, Homer M, et al. Postsurgical prescriptions for opioid naive patients and association with overdose and misuse: retrospective cohort study. *BMJ*. 2018 Jan 17;360:j5790.

15. Jenkins BG, Tuffin PHR, Choo CL, Schug SA. Opioid prescribing: an assessment using quality statements. *J Clin Pharm Ther*. 2005;30(6):597-602. doi:10.1111/j.1365-2710.2005.00690.x
16. Zacny J, Bigelow G, Compton P, Foley K, Iguchi M, Sannerud C. College on Problems of Drug Dependence taskforce on prescription opioid non-medical use and abuse: position statement. *Drug Alcohol Depend*. 2003;69(3):215-232. doi:10.1016/s0376-8716(03)00003-6
17. Nowak MA, Nelson RE, Breidenbach JL, Thompson PA, Carson PJ. Clinical and economic outcomes of a prospective antimicrobial stewardship program. *Am J Health-Syst Pharm AJHP Off J Am Soc Health-Syst Pharm*. 2012;69(17):1500-1508. doi:10.2146/ajhp110603
18. Malani AN, Richards PG, Kapila S, Otto MH, Czerwinski J, Singal B. Clinical and economic outcomes from a community hospital's antimicrobial stewardship program. *Am J Infect Control*. 2013;41(2):145-148. doi:10.1016/j.ajic.2012.02.021
19. Ghafoor VL, Phelps P, Pastor J. Implementation of a pain medication stewardship program. *Am J Health-Syst Pharm AJHP Off J Am Soc Health-Syst Pharm*. 2013;70(23):2070, 2074-2075. doi:10.2146/ajhp120751
20. Erickson A. Knocking out pain: Hospital pharmacists launch new approach to pain management. *Pharmacy Today* [Internet]. 2015 Jun 1 [cited 2021 May 3]; Available from: [https://www.pharmacytoday.org/article/S1042-0991\(15\)30284-X/fulltext](https://www.pharmacytoday.org/article/S1042-0991(15)30284-X/fulltext)