Feasibility of a multidisciplinary Transitional Pain Service in spine surgery patients to minimise opioid use and improve perioperative outcomes: a quality improvement study

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ABSTRACT

Introduction  Spine surgery patients have high rates of perioperative opioid consumption, with a chronic opioid use prevalence of 20%. A proposed solution is the implementation of a Transitional Pain Service (TPS), which provides patient-tailored multidisciplinary care. Its feasibility has not been demonstrated in spine surgery. The main objective of this study was to evaluate the feasibility of a TPS programme in patients undergoing spine surgery.

Methods  Patients were recruited between July 2020 and November 2021 at a single, tertiary care academic centre. Success of our study was defined as: (1) enrolment: ability to enrol ≥80% of eligible patients, (2) data collection: ability to collect data for ≥80% of participants, including effectiveness measures (oral morphine equivalent (OME) and Visual Analogue Scale (VAS)-perceived analgesic management and overall health) and programme resource requirements measures (appointment attendance, 60-day return to emergency and length of stay), and (3) efficacy: estimate potential programme effectiveness defined as ≥80% of patients weaned back to their intake OME requirements at programme discharge.

Results  Thirty out of 36 (83.3%) eligible patients were enrolled and 26 completed the TPS programme. The main programme outcomes and resource measures were successfully tracked for ≥80% of patients. All 26 patients had the same or lower OME at programme discharge than at intake (intake 38.75 mg vs discharge 12.50 mg; p<0.001). At TPS discharge, patients reported similar overall health VAS (pre 60.0 vs post 70.0; p=0.14), improved scores for VAS-perceived analgesic management (pre 47.6 vs post 75.6; p<0.001) and Improved Brief Pain Inventory pain intensity (pre 39.1 vs post 25.0; p=0.02).

Conclusion  Our feasibility study successfully met or exceeded our three main objectives. Based on this success and the defined clinical need for a TPS programme, we plan to expand our TPS care model to include other surgical procedures at our centre.

INTRODUCTION

In surgical practice, long-term opioid therapy is considered when opioids are still used past the postoperative period, typically for longer than 90 days.1 When comparing surgical patients, those undergoing spine surgery have the highest rates of chronic pain, preoperative opioid use and persistent opioid use following surgery, with a prevalence of approximately 20%.2-6 Patients taking opioids preoperatively have a dose-dependent tendency to escalate or persistently use opioids postoperatively.7-10 Other risk factors include comorbid psychiatric disorders (eg, depression, anxiety), high levels of negative ruminations, hopelessness, perceived threat from the pain (catastrophisation) and/or history of substance use.8 10-20 Patients with complex pain and opioid dependence also consume greater healthcare resources due to increased hospital length of stay (LOS), repeated emergency and clinic visits, and sequelae of high-dose opioid use and chronic

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Transitional Pain Service (TPS) programmes have shown benefit in early studies but have never included a spine surgery population, who are known to have complex pain needs with significant opioid tolerance.

WHAT THIS STUDY ADDS

⇒ Our TPS feasibility study in patients undergoing spine surgery demonstrated that this patient population is possible to run a TPS programme for, with early signals of benefit.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Our feasibility study further contributes to the growing body of evidence that multidisciplinary TPS programmes can have substantial benefit for all patients undergoing major surgery with complex pain needs by showing benefit in a patient cohort who historically has poorly managed postoperative pain and high opioid requirements.
post-surgical pain (CPSP)\textsuperscript{9,10,12,21,22}. In our centre, spine surgery patients who are high-risk opioid users, defined as either using >200 mg oral morphine equivalent (OME) daily before surgery or taking opioids without any adjunctive therapy, experienced an almost twofold increase in LOS compared with opioid users who were not high risk.\textsuperscript{22} Therefore, strategies to improve care of patients with, or at risk of, persistent opioid use after surgery are required.\textsuperscript{23-25}

There is a lack of guidance/evidence to inform how to best manage patients’ opioid consumption when transitioning from acute to chronic pain, especially in the context of pre-existing painful conditions and chronic opioid use.\textsuperscript{26-28} A proposed solution to improve the quality of care and enhance functional postoperative outcomes while minimising opioid exposure and their sequelae in patients with, or at risk of, complex pain is to bridge the care gap with a Transitional Pain Service (TPS).\textsuperscript{11,13,20,24-28}

The TPS is a multidisciplinary programme, originating from Toronto General Hospital in Toronto, Canada, with the goal of modifying the pain trajectories of patients who are at increased risk of long-term excessive opioid consumption and/or developing CPSP.\textsuperscript{11,13} TPS programmes reduce patient anxiety, preoperative opioid consumption and hospital LOS while increasing patient satisfaction scores.\textsuperscript{7,11,20,26,27} However, the generalisability of clinical, economic and logistical feasibility of establishing a TPS programme is yet to be established.\textsuperscript{7,20,26}

Furthermore, there is a paucity of evidence on the clinical and feasibility outcomes of TPS programmes targeting patients undergoing spine procedures.

To address this important knowledge gap, we conducted a quality improvement study with an overarching objective of evaluating the feasibility of a TPS programme in patients undergoing spine surgery. We designed this feasibility study with three specific objectives. First, to demonstrate that we could engage and enrol patients in our programme. Second, to demonstrate the ability to collect data of interest, including measures of clinical effectiveness and programme resource requirements. Third, to estimate the effectiveness of our programme in managing patient opioid consumption, pain and overall well-being.

**METHODS**

**Design and setting**

This was a quality improvement project conducted using a prospective cohort of patients awaiting spine surgery at an urban tertiary care academic health sciences centre. Our centre, the Civic Campus of The Ottawa Hospital (TOH), is the referral centre for spine surgery for a catchment area of 1.2 million people serving eastern Ontario. The spine service is jointly run by the Divisions of Orthopedic Surgery and Neurosurgery. The pilot project ran from July 2020 to March 2022, inclusively. We considered recommendations of the Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials in the design of the project and followed the Standards for Quality Improvement Reporting Excellence 2.0 guidelines and the Template for Intervention Description and Replication checklist for reporting of our programme (online supplemental appendices 2 and 3).

**Patient and public involvement**

A patient partner, Ms DK, was recruited as a former patient from our co-Principal Investigator’s (AS) surgical patient roster. She generously provided input on our TPS programme design, including advice on number of appointments patients could reasonably attend, and input on patient-centred outcomes. She also served an important role in designing our patient satisfaction surveys with a patient relations specialist from our centre. Having recently undergone a lumbar spine surgery, she provided lived patient experience to our programme.

Based on the pilot nature of the study, we did not have patients formally involved in the recruitment or conduct of the study, but instead solicited their feedback on these aspects via the patient satisfaction surveys and informally at appointments with their TPS care providers. We plan to disseminate results of our study via publication and presentation of findings at national and international conferences.

**Patient selection**

A convenience sample size of 30 patients was selected to complete recruitment in an estimated 1-year period. Participants were recruited if they were scheduled for spine surgery and met either >1 major or >2 minor criteria (figure 1). Patients without a family doctor or who were unable to complete surveys in either English or French were excluded from this study.

**Intervention**

The TPS programme was designed as a time-limited intervention consisting of virtual outpatient appointments with a TPS physician and psychologist, occurring before and after surgery. Providers included five anaesthesiologists with expertise in pain management and two clinical psychologists with experience treating patients with chronic pain. Following initial assessment, an individualised treatment plan was recommended with interventions consisting of opioid weaning or rotation, functional interventions, medication optimisation (eg, addition of multimodal analgesics), education and expectation setting for postoperative course and psychological interventions via a stepped-care model\textsuperscript{29} (online supplemental appendix 4). The majority of medication optimisations involved decreasing the patient’s existing medications. However, if a new medication was needed to be prescribed, this was facilitated through the primary care provider (PCP) as possible. On rare occasions, the prescription would be provided directly from the TPS physician. Due to the pilot nature of the programme, the TPS physicians did not want to enter into a prescribing relationship that could not be supported beyond the programme duration.
Visits with allied healthcare providers associated with our centre’s pain clinic (social work, occupational therapy and physiotherapy) were arranged based on patient need in coordination with the TPS psychologist as part of a stepped-care model. The majority of these allied health visits consisted of a large group format and were part of the usual education classes that patients enrolled in the pain clinic attend.

The TPS appointment timeline is outlined in figure 2. Surveys were distributed either via email using Simple-Survey or EPIC MyChart (EPIC, Vernoa, Wisconsin, USA). This consisted of intake questionnaires prior to the appointment with the anaesthesiologist of a Brief Pain Inventory Short Form (BPI-SF), Douleur Neuropathique-4 (DN4), Prescription Opioid Misuse Index (POMI), Alcohol abuse screening (NIAAA Single

**Figure 1** TPS enrolment criteria. CR, Continuous Release; NSAIDs, non-steroidal anti-inflammatory drugs; TPS, Transitional Pain Service.

**Figure 2** TPS appointment timeline. BPI-SF, Brief Pain Inventory Short Form; DN4, Douleur Neuropathique-4; GAD-7, General Anxiety Disorder-7; MH, mental health; OT, Occupational Therapy; PCP, primary care provider; PHQ-9, Patient Health Questionnaire-9; PT, Physiotherapy; SPOC, Somatic Pre-Occupation and Coping; SW, Social Work; TPS, Transitional Pain Service; VAS, Visual Analogue Scale.
Alcohol Screening Question, followed by Alcohol Use Disorders Identification Test, if positive), Visual Analogue Scale 0–100 (VAS) of both perceived analgesic management and overall rating of health. VAS measures were repeated at each subsequent appointment. Intake questionnaires prior to the initial appointment with the psychologist included Patient Health Questionnaire-9, General Anxiety Disorder-7 and the Somatic Pre-Occupation and Coping.

Patients were screened for eligibility by an orthopaedic or neurosurgical spine surgeon at the time of surgical booking. Patients were referred for TPS intake assessment 6–8 weeks prior to their surgery. Once the surgery was completed, patients were followed by the TPS anaesthesiologist and psychologist for one to four visits completed by telephone, up to 3–4 months post-surgery. The frequency and number of follow-up visits were left to the discretion of the TPS physician or psychologist, along with patient preference. The focus of these follow-up visits would vary based on individual patient needs but typically consisted of the following broad topics: reviewing patients’ current levels of pain control and providing support either with optimising pain medications (weaning and assistance with optimal timing/dosing), discussing expectations for progress in mobility or pain levels after surgery, outlining coping strategies to better live with the pain when it does occur (pacing, Cognitive Behavioural Therapy; etc) and reframing setbacks as part of a normal recovery process (e.g. pain may be better 1 day and worse the next). Additionally, participants were booked for standard follow-up appointments with the orthopaedic surgeon at 2 weeks, 3 months and 6 months postoperatively.

A patient satisfaction survey was distributed either via email using SimpleSurvey or EPIC MyChart at programme completion. Upon discharge, patients were transitioned back to the care of their PCP with a clearly detailed plan outlining progress made, current analgesics and further treatment recommendations.

**Study measures**

**Descriptive data**

Patient demographics including age, sex, weight, height, body mass index (BMI), comorbidities and medication history were collected. Numerical Rating Scale pain scores were collected at each visit with the TPS physician and while in hospital as part of standard care on our Acute Pain Service (APS) on postoperative day 1, and at the time of discharge from APS.

**Feasibility measures**

The feasibility of our TPS programme was assessed through three primary domains. In consultation with clinical and methodological experts and a patient partner, we identified reliable outcome measures that would allow us to assess the feasibility of the programme model on a small scale before expanding to a larger population.

1. **Patient engagement:** success was defined as ≥80% of patients eligible to be enrolled into our programme in a consecutive manner.
2. **Ability to track outcomes of interest and programme resource utilisation:**
   - **Clinical effectiveness measures:** success was defined as the ability to track our main patient outcomes in ≥80% of patients (obtain OME, VAS scores for perceived analgesic management and overall health at programme intake, and programme discharge).
   - **Cost-effectiveness measures:** success was defined as the ability to track resource utilisation outcomes in ≥80% of patients (LOS in hospital, 60-day return emergency department (ED) visit rate (from a chart review or patient phone call)) and resources used to run the TPS programme: number of appointments preoperatively and postoperatively attended per patient, by provider type.
3. **Programme effectiveness:** success was defined as ≥80% of patients taking the same amount or fewer daily OMEs upon discharge from the programme compared with OME usage at programme intake, with balancing measures demonstrating ≥80% of patients showing maintenance or improvement in VAS scores for perceived analgesic management and overall health. Each patient’s cumulative average daily opioid consumption was tallied at four time points: (1) TPS enrolment (first TPS physician appointment); (2) last visit prior to surgery; (3) initial outpatient TPS visit after surgery and (4) last visit prior to transition of care to PCP. All doses were converted to OME based on standardised conversion table (online supplemental appendix 1).

**Analysis**

All data were collected using Microsoft Excel (Microsoft Corporation, Redmond, Washington, USA) and analysed using a statistical software, R V.4.2.1. The Shapiro-Wilk test and visual inspection of data histograms were used to assess the normality of quantitative data. A X² test was used to detect outliers. Descriptive statistics (means and SDs for normal continuous variables; medians and IQRs for non-normal continuous variables; frequencies and proportions for categorical variables) were calculated. Pre-TPS and post-TPS intervention differences in continuous variables were calculated using a paired t-test for normally distributed data, or Wilcoxon paired samples test for non-normal data. For categorical data collected only at follow-up, proportions with 95% CIs were calculated using exact binomial methods. Given the scope of our study, we did not input missing data or apply statistical
RESULTS

Between July 2020 and November 2021, 239 patients consented consecutively for spine surgery at TOH were screened for eligibility in our TPS programme. Of those, 43 (18.0%) met TPS inclusion criteria. Seven were excluded as their surgery was scheduled <2 weeks from time of booking, four were unable to be contacted for enrolment and two declined participation. Thirty patients were enrolled; however, four were subsequently excluded (three did not undergo surgery due to concerns of COVID-19 exposure, and one was over the allowable maximal daily OME). Of the 26 patients included in analysis, 14 (53.8%) were female and 12 (46.2%) were male. The average age of participants was 60 years old (range: 43–75), and the average BMI was 30 kg/m² (range: 22.1–51.5). All procedures included at least two levels of fusion. The most common type of procedure patients underwent was a 2–3 level lumbar posterior decompression and instrumented fusion (PDIF) (n=16, 61.5%). Other procedure types included revision PDIF, 2–3 level oblique lateral interbody fusion, major deformity correction and posterior and anterior cervical decompression and fusions. The average length of hospital stay was 6.7 days (IQR: 4.25–9.75) and the average ED return visit rate per patient was 0.08.

Table 1 shows which eligibility criteria patients met to be included and success in tracking our predefined outcome measures.

Preoperatively, patients attended a total mean 3.57 (IQR: 2–4) TPS appointments. Postoperatively, patients attended a total mean 4.16 (IQR: 1–7) TPS appointments. The average time to discharge from the TPS programme after surgery was 8.3 weeks (IQR: 2.5–20).

Twenty-three patients (88.5%) consumed fewer OME at programme discharge than at intake, including eight (30.8%) patients who completely discontinued opioid medications and three (11.5%) who were back to their baseline OME at discharge from TPS (table 2 and figure 3). Patients had, on average, significantly lower OME levels at discharge from TPS compared with their intake visit (table 2). This represented a mean total OME wean of 56.01%, with an average weekly wean of 6.75%. The Pearson correlation coefficient between the amount weaned and number of weeks to discharge from TPS was calculated to be 0.0468; therefore, a moderate correlation was noted.

Patients’ self-reported VAS scores, measured from 0 to 100, showed a non-significant trend towards improvement in perceived overall health (median (IQR): TPS intake 60.0 (47.5–66.25) vs TPS discharge 70.0 (60–87.5); V=59, p=0.13) as well as improved perceived analgesic management levels (mean (SD): TPS intake 47.6 (40–50) vs TPS discharge 75.6 (56.25–91); t=−4.92, p<0.05). At the individual patient level, intake versus discharge VAS scores for perceived analgesic management, 21 of 26 (80.77%) patients had either improved or similar scores (17 improved, 4 same), 2 reported worsening pain and 3 did not provide perceived analgesic management data. For intake versus TPS discharge VAS scores for overall health, 17 of 26 (65.38%) patients had either improved or similar scores (10 improved, 7 same). 6 reported worsened health and 3 did not provide overall health score at discharge.

On the BPI, participants reported that their levels of pain were reduced from intake (M=6.41, SD=4.21) to discharge (M=4.20, SD=2.44; t=2.92, p<0.05). There was also a non-significant trend suggesting reduction in pain-related interference from intake (M=6.55; Med=6.64; IQR=2.04) to discharge (M=5.42, Med=5.64; IQR=3.93; V=80, p=0.09).

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**Table 1** Summary of TPS programme eligibility and data tracking outcome measures

<table>
<thead>
<tr>
<th>Data tracking measure</th>
<th>Number of patients n (%)</th>
<th>(95% CIs)</th>
</tr>
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<tbody>
<tr>
<td><strong>Eligibility criteria</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OME &gt;60–200 mg preoperatively</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>On opioids alone</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Minor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. On opioids ≥6 months preoperatively</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>2. Taking ≥3 types of narcotics</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3. Prescribed long-acting opioid</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>4. Self-reported fibromyalgia OR depression OR anxiety OR high emotional stress</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td><strong>Data tracking</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcome of interest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OME</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intake</td>
<td>26/26 (100); (0.87, 1.00)</td>
<td></td>
</tr>
<tr>
<td>Discharge</td>
<td>26/26 (100); (0.87, 1.00)</td>
<td></td>
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<tr>
<td>VAS of perceived analgesic management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intake</td>
<td>24/26 (92.3); (0.75, 0.99)</td>
<td></td>
</tr>
<tr>
<td>Discharge</td>
<td>24/26 (92.3); (0.75, 0.99)</td>
<td></td>
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<tr>
<td>VAS of overall health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intake</td>
<td>24/26 (92.3); (0.75, 0.99)</td>
<td></td>
</tr>
<tr>
<td>Discharge</td>
<td>24/26 (92.3); (0.75, 0.99)</td>
<td></td>
</tr>
<tr>
<td><strong>Resource utilisation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOS in hospital</td>
<td>26/26 (100); (0.87, 1.00)</td>
<td></td>
</tr>
<tr>
<td>Appointment attendance</td>
<td>26/26 (100); (0.87, 1.00)</td>
<td></td>
</tr>
<tr>
<td>ED return visit at 60 days</td>
<td>26/26 (100); (0.87, 1.00)</td>
<td></td>
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</tbody>
</table>

ED, emergency department; LOS, length of stay; OME, oral morphine equivalent; TPS, Transitional Pain Service; VAS, Visual Analogue Scale.
Programme feedback

Based on an informal survey of the TPS providers (physicians and psychologists) and the limited results from the patient satisfaction survey submitted, some areas of success and improvement were identified. Interestingly, both patients and physicians seemed to find the preoperative education piece and discussions around expectations following surgery to be of high value, and both gave positive feedback on the flexibility that the virtual appointments allowed.

It was felt that having patients see different staff may be more efficient for staff scheduling flexibility.

A common theme was identified to improve communication and integration of care between the TPS physicians and psychologists, along with improved consistency of one person coordinating care (we had many staffing turnovers for the administrative support in this project as it was a part-time position).

DISCUSSION

Overall, our pilot quality improvement project examining the establishment of a TPS at our tertiary, academic centre for patients undergoing spine surgery demonstrated feasibility. We were able to enrol ≥80% of eligible patients, collected >80% of data points required to support evaluation of clinical and cost-effectiveness, and identified markers of clinical effectiveness as 100% of patients were taking the same amount, or fewer opioids, at programme discharge than at programme intake. VAS scores for overall health were similar for intake and discharge, while there was improvement on VAS pain control after discharge from the programme. Pain intensity (BPI) was improved after discharge, while pain-related interference levels remained relatively constant from intake to discharge.

Spine patients are particularly vulnerable to prolonged opioid use. This is well illustrated in the 2018 study of 2491 lumbar spinal fusion patients where 57% of patients maintained or increased their opioid dose after surgery, while only 9.1% discontinued their opioid use.\textsuperscript{40} Our TPS programme demonstrated 88.5% of patients consumed less OME at discharge than at intake and 30% successfully stopped using opioids. The remaining 11.5% went back to their baseline OME at TPS discharge. This degree of weaning is in keeping with previously published literature of TPS programmes treating opioid-experienced patients perioperatively.\textsuperscript{11,13,20,26} Previous studies have also shown that spine patients managing chronic pain with opioids preoperatively have poor postoperative function, decreased health-related quality of life and higher pain scores, regardless of their base OME consumption.\textsuperscript{41,42} Our study found patient perceived health was on average 10.0% higher upon programme discharge, with a 28.0% improvement in perceived analgesic management, the latter being statistically significant. As demonstrated in previous studies of TPS programmes, multidisciplinary care which provides education, psychological treatment and medical management leads to increased patient motivation, patient satisfaction scores, pain control and perceived health scores.\textsuperscript{11,20,27} Our study was able to replicate a number of patient-perceived benefits of a TPS programme despite switching to an exclusively virtual

<table>
<thead>
<tr>
<th>OME at intake</th>
<th>OME at hospital DC</th>
<th>OME at TPS DC</th>
<th>P value (intake to TPS DC)</th>
<th>Total mean % wean</th>
<th>Average weeks to TPS DC</th>
<th>Mean % wean/week</th>
</tr>
</thead>
<tbody>
<tr>
<td>38.7 (28.5–103.75)</td>
<td>82.5 (40.5–110.75)</td>
<td>12.5 (0–37.38)</td>
<td>&lt;0.0001</td>
<td>56.01</td>
<td>8.3</td>
<td>6.75</td>
</tr>
</tbody>
</table>

OME, oral morphine equivalent; TPS, Transitional Pain Service.

Figure 3 Oral morphine equivalent (OME, mg) at intake, hospital discharge (DC) and Transitional Pain Service (TPS) completion by each participant.
model. To our knowledge, this is the first study which focuses on TPS programme implementation for opioid-exposed patients undergoing spine surgery.

### TPS virtual model

We were able to pivot to an entirely virtual model of care after initially designing our intervention, but prior to patient enrolment. This virtual care model seemed better suited to many patients as it facilitated visits from home, particularly useful for those with complex pain-limiting mobility, and eliminated the demand for physical space on the hospital. There was however, a downside to programme implementation during the pandemic. The ability to enrol and see patients leading into surgery could be very unpredictable based on operating room slow-down and ramp-up periods, which led to an inconsistency in the amount of time patients were cared for (eg, there were periods where it was very challenging to enrol patients >4 weeks in advance of their surgery date). Additionally, some patients who were booked for surgery and began seeing our TPS providers ultimately decided to not go ahead with surgery due to fears of contracting COVID-19 while in hospital. Unfortunately, we had to discharge these patients from the programme to analyse our results in a timely fashion. In two out of the three of these patients, they ultimately did undergo surgery after we had closed our TPS programme.

### LOS and return ED visit

A 2016 prospective study of 583 elective surgical spine patients noted that every preoperative 100 OME correlated with a 1.1 increase in LOS days. Between 2010 and 2015, the mean LOS for elective spinal fusion in Ontario was 4.6 days (IQR 4), with a readmission rate of 6.3% at 30 days and 8.6% at 90 days. By comparison, in this complex patient cohort undergoing major spine surgery with baseline OME intake of 80 mg, our average LOS was 6.7 days, which is within Ontario’s IQR and a 60-day return to ED rate of 0.03%. Although a small sample size, we anticipate that our programme could have a beneficial impact by reducing hospital LOS and return ED visits for patients with complex pain.

### Limitations

Our study has several limitations. While we were successful in achieving our recruitment target of ≥80% of patients (30 of 36 eligible patients, 83.3%), we ultimately completed analysis on 26 patients due to obstacles presented by the pandemic (challenges with access to the operating rooms and refusal of surgery related to concerns of possible COVID-19 exposure in hospital).

Our inclusion and exclusion criteria may limit the generalisability of our findings. We purposefully chose an OME cut-off of 60–200 mg to identify patients who we knew would be at higher risk of opioid dependence and poorer coping with pain but used a maximum cut-off to avoid patients for whom an opioid wean may have been difficult. This could confound our feasibility assessment given the small sample size. We also excluded patients without a PCP to ensure newly prescribed medications could continue following programme discharge. However, we recognise that millions of Canadians have no, or limited access to, a PCP and this could limit generalisability. Ultimately, patients did not have many new medications added by the TPS physician, and thus we would feel comfortable including patients without a PCP in future TPS programme expansions. Finally, we excluded those where we anticipated a language barrier could influence our ability to receive meaningful survey data. In a future expanded TPS programme, we would want to include patients with a language barrier and/or without a PCP to ensure our programme is broadly applicable to patients who may benefit.

Finally, there was a very poor rate of survey completion by patients, particularly at the time of discharge from our programme. This was likely due to the use of a virtual model and ongoing staffing turnover, which unfortunately led to an inadequate sampling to use results from our patient partner-developed satisfaction survey. In its place, we used balancing measures of our VAS-perceived analgesia and overall health scores, and BPI-SF pain interference scores as a marker of the patient’s pain experience. It is encouraging to note our pain interference scores were overall improved from pre-TPS to post-TPS intervention, which is a validated method of examining the impact of the patient’s pain on overall well-being.

### CONCLUSION

Our TPS spine feasibility study quickly adapted to a virtual model and demonstrated significant benefit to patients by providing support to wean opioid medications. Based on the success of our feasibility pilot project, we plan to broaden our TPS programme model to include patients with, and at risk of, complex pain undergoing a variety of surgical procedures. Next steps would include evaluating our TPS programme for efficacy against a control group, examining the costs associated with a blended virtual model and overall cost-saving to the healthcare system.

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in reviewing our TPS protocol and drafting patient satisfaction surveys prior to patient recruitment.

**Contributors**

ST—author acting as guarantor, project design, data collection and analysis, manuscript preparation and review. M-CM—data collection and analysis, and manuscript preparation. AZ—data collection, manuscript review and preparation of appendices 2 and 3. DM—manuscript preparation and review. PP—project design, data analysis and manuscript preparation and review. AS—project design and manuscript review.

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**Competing interests**

None declared.

**Patient and public involvement**

Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

**Patient consent for publication**

Not required.

**Ethics approval**

This study involves human participants, but the project received exemption from review by the Ottawa Health Science Network Research Ethics Board (OHSN-REB) given its focus on quality improvement. Participants gave informed consent to participate in the study before taking part.

**Provenance and peer review**

Not commissioned; externally peer reviewed.

**Data availability statement**

All data relevant to the study are included in the article or uploaded as supplemental information. The data that support the findings of this study are available from the corresponding author, ST, upon reasonable request.

**Supplemental material**

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