

# Same-day discharge pathway for elective total hip and knee arthroplasty patients: a quality improvement project at a Canadian community hospital

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## ABSTRACT

Total hip arthroplasty (THA) and total knee arthroplasty (TKA) surgeries performed annually are increasing, with over \$1.26 billion in hospital costs, according to the 2021/2022 Canadian Institute of Health Information report. A trend towards same-day surgery has helped support the rising demand for arthroplasty in an ageing population and has established evidence for patient safety and satisfaction.

Burnaby Hospital sought to develop a same-day pathway to increase at-home recovery opportunities and associated recovery benefits. The aim was to increase the same-day discharge (SDD) rate for THA and TKA from 8% to 15% within a 12-month period. The project team used the Model for Improvement framework to guide the team in achieving the project aim. A series of Plan-Do-Study-Act cycles and ramps were conducted on five interventions: screening tool, focused arthroplasty same-day track automation, surgical and anaesthesia standardisation and patient education resources.

The health authority's electronic health records (MEDITECH) were used to extract 18 months of baseline data. The data analysis software (SQCPack) was used to monitor the data throughout the project to assess its progress. The results of the SDD rate increased from 8% to 20% with a success rate of 82% SDD, while achieving a decrease in readmission rates to 4–7% from a baseline average of 7–8%. There was no increase in emergency room visits and readmission within 30 days for SDD when compared with the standard inpatient cases. Both staff and patients reported high levels of satisfaction.

Driven by a working group creates success with clear goals, strong departmental collaboration, and substantial stakeholder and leadership support. The team viewed failures as learning opportunities to adapt new Plan-Do-Study-Act cycles and strategies for developing continuous improvement throughout the project's life cycle. Process automation was key for a sustainable path for improvements; this provided resiliency against changes from external and staffing pressures.

## PROBLEM

Burnaby Hospital (BH), a 286-bed publicly funded community hospital, serves 350 000 people within the Fraser Health Authority.

BH has emerged as a high-volume centre of excellence for total hip arthroplasty (THA) and total knee arthroplasty (TKA), collectively

## WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Creation of a formal same-day discharge pathway for elective total hip and knee arthroplasty patients who meet select criteria will help improve patient experience, decrease healthcare spending, and improve access and flow in the hospital.

## WHAT THIS STUDY ADDS

⇒ It is feasible to implement a successful safety-equivalent same-day discharge pathway for total hip and knee arthroplasty patients at a community hospital, while more than doubling the successful throughput numbers.

⇒ This project uses the Institute for Healthcare Improvement Model of Improvement Quality Improvement framework which is unique as it has not been published previously in same-day arthroplasty literature.

## HOW THE STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ This quality improvement pathway supports the utility and feasibility to implement same-day discharge for total hip and knee arthroplasty patients. This pathway provides an actionable change bundle to create a site-specific same-day pathway for other arthroplasty programmes.

referred to as total joint arthroplasty (TJA). In 2017, the arthroplasty programme underwent innovative changes, encompassing minimally invasive surgical techniques, anaesthetic approaches, nurse practitioner integration, centralised intake optimisation clinic (CIOC) establishment and streamlined allied healthcare services to meet the rising demand for TJA. These efforts successfully reduced the average length of stay (LOS) for TJA from 3.9 days in 2016 to 1.7 days in 2019—a 230% decrease. However, despite these improvements, only 8% of patients were discharged on the day of surgery. The programme's potential for increasing case throughput was hindered by the lack of a clear

pathway, effective communication systems and multidisciplinary buy-in.

With increasing arthroplasty volumes and growing pressure on resources, further system changes were needed to optimise hospital access and flow. The development of a sustainable, evidence-based same-day discharge (SDD) pathway—referred to as the focused arthroplasty same-day track (FAST Pathway)—was identified as a solution to address these needs. The goal was to eliminate barriers throughout the patient journey and create a smooth, well-defined pathway. This project is unique, being rooted in a quality improvement (QI) framework, which has not yet been published.

The aim was to increase the rate of SDD from 8% to 15% for elective TJA patients within a 12-month period.

The core project leads consisted of an orthopaedic surgeon, an anaesthesiologist, nurse practitioners, a CIOC nurse, a QI project manager and a patient partner. Stakeholder engagement was completed with hospital staff including the department of orthopaedic surgeons and anaesthesiologists, nursing, allied health and patient experience team. Full endorsement from the hospital executive sponsors, department heads and regional partners positioned the programme for success. Funding and support were secured from the BH Facility Engagement and Physician Quality Improvement, enhancing engagement and collaboration.

Stakeholder support was strong, as the project offered a sustainable system change solution to streamline patient access and flow, and communication, benefiting both staff and patient satisfaction and clinical outcomes.

## BACKGROUND

The annual rate of TJA is rising in North America.<sup>1</sup> To address this, the prevalence of SDD for TJA is increasing.<sup>2</sup> SDD pathways, with select patients, are a safe, cost-effective solution to reducing LOS, healthcare costs and system strain.<sup>1 3–15</sup> No prior quality improvement publications were found on this topic.

Patient safety for SDD TJA is well established. The literature reports no significant difference in emergency room (ER) visits, readmission rates or adverse events 30–90 days postoperatively compared with standard inpatient TJA.<sup>4 6 9 10 13–21</sup> One study reported no difference in outcomes between SDD and standard inpatient THA at 1 year.<sup>12</sup>

Successful SDD rates vary, reporting 74%–93%, with ambulatory centres representing the majority of the higher rates.<sup>4 6 22–30</sup> SDD success rates are higher when inclusion/exclusion criteria are used to select candidates.<sup>3 5 31–33</sup> Successful SDD candidates are those with optimised medical comorbidities, Body Mass Index under 35–40, adequate social support, hospital proximity and willingness.<sup>3 5 8 17 32 34–36</sup> Exclusion criteria included American Society of Anesthesiologists (ASA) score 3 or higher, lack of transportation or support, age greater than 80, severe obstructive sleep apnoea, significant comorbidities

and BMI greater than 35.<sup>6 8 16 23 31 37</sup> Rates of patients who were unsuccessfully discharged the day of surgery, referred to as failure to launch (FTL), were similar between THA and TKA.<sup>24</sup> FTL reasons included lack of patient confidence, orthostatic hypotension, urinary retention, nausea, pain and delayed spinal anaesthetic recovery impeding physical therapy.<sup>4 9 11 23 24 26 27 29 32 38</sup>

Literature reports that refining surgical and anaesthetic approaches was key to successful SDD TJA. Advancements in surgical techniques, with reduced bleeding, have made SDD more achievable by incorporating clear anaesthetic protocols, using multimodal approaches and motor-sparing peripheral nerve blocks.<sup>3 34</sup> These methods have enhanced the patient outcomes.<sup>3 5 6 31 34</sup> Some of the contributing factors include scheduling patients as the first or second case of the day and using a multidisciplinary approach, and ensuring adequate staffing consistent protocols.

Finally, a well-defined discharge criteria is imperative to ensure a safe SDD TJA.<sup>3 34</sup> When a patient is discharged, they must include adequate pain control, achievement of physical therapy targets and independent voiding to ensure successful SDD.<sup>3 34</sup> Patient and caregiver education, adequate social support and post-discharge follow-up phone calls have been identified as key ingredients to successful SDD pathways.<sup>7 34 39</sup>

High rates of patient satisfaction have been demonstrated for SDD pathways, with reports of higher satisfaction as compared with standard inpatient pathways.<sup>4 5 39</sup>

## MEASUREMENT

The outcome measure is the percentage of SDD patients undergoing TJA. The project goal was to increase the SDD rate for TJA from 8% to 15% in a span of 12 months ending in October 2023. The data were extracted from the health authority's electronic health system (MEDITECH) and were plotted on a time series control chart (p-chart). Interventions were tested and were represented as annotations on the control chart to observe improvement in SDD rates. This allowed the team to easily compare the effects of the interventions to baseline data. The rationale for selecting this measure as an outcome measure is that the data were easily obtainable electronically. In terms of the validity and reliability of the data, the data source is high as these data are managed by data custodians, and the information collected in the surgical database was used for the Ministry of Health's reporting purposes.

The process measure is the percentage of successful discharge on the same day as surgery and it was collected on a monthly basis. This measure was used to evaluate the effectiveness of the FAST Pathway. When FAST Pathway patients failed to be discharged on the day of surgery, known as 'failure to launch', they were admitted as inpatients. These cases are analysed on a monthly basis through in-depth reviews of individual patient charts, followed by Plan-Do-Study-Act (PDSA) cycles to make continuous improvements to the pathway.

Balancing measures included 30-day ER visits, 30-day readmissions, patient satisfaction and staff satisfaction. These measures were selected to monitor negative outcomes of SDD that can lead to patients returning to the hospital. Anonymous patients' experience and staff satisfaction surveys were conducted to help provide insights into the overall impact of SDD. The data gathered from respondents were analysed using Pareto and frequency charts.

Finally, the family of measures was collected for an additional 6 months post-project end date to assess the project's sustainability and monitor the sustained gains.

## DESIGN

The working group consisted of five lead members: two nurse practitioners, an orthopaedic surgeon, an anaesthesiologist and a CIOC nurse. The group met monthly to ensure project progression and monitor PDSA cycles based on the change ideas. Stakeholder engagement was critical to the pathway's success, involving hospital leaders, nursing, allied health and medical staff across the continuum of care from preoperative CIOC, operating room (OR) booking, to OR staff, postoperative anaesthetic care unit, surgical day care and surgical inpatient units. Engaging a patient partner was essential to ensure that patient resources were understandable and clear.

A comprehensive evidence-based SDD pathway was developed, considering all aspects of the spectrum of care from preoperative consult to postoperative follow-up.

The team used a quality improvement project charter to clearly define the problem statement, scope, aim, measures, data collection plan, milestones, barriers and stakeholders, ensuring alignment across the team.

From the creation of the driver diagram, the team derived the primary and secondary drivers needed to achieve the project's aim and change ideas. Four primary drivers were identified: streamlining the surgical process, improving communication, increasing patient willingness and standardising the perioperative approach.

The change ideas included:

- ▶ Creation of an inclusion/exclusion screening tool (used at the time of consult to help identify appropriate patients).
- ▶ Development of an automatic electronic booking flag to identify SDD patients for clear team communication.
- ▶ Creation of preoperative and post-discharge patient education resources to improve the transition home.
- ▶ Standardisation of the perioperative approach to promote timely recovery from spinal anaesthesia and reduce postoperative side effects.

These bundles of change ideas addressed the project aim, as well as outcome, process and balancing measures.

Process flow maps were created to illustrate the current patient journey before and after implementing change ideas.

## STRATEGY

Using the Model for Improvement framework, we addressed three fundamental questions and applied PDSA cycles across four key change ideas: screening tool, automaticity, standardisation and patient education.

### Change idea: screening tool

We identified the patient population for SDD and standardised the process. Based on literature, we developed an evidence-based screening tool with specific inclusion and exclusion criteria (online supplemental file 1). The tool was distributed to CIOC and surgeons' offices to identify eligible patients. If suitable, patients were booked as surgical daycare (SDC) instead of standard overnight inpatient status. This designation communicated SDD eligibility to perioperative teams, triggering implementation of FAST Pathway interventions.

### PDSA cycle: inclusion/exclusion criteria

We hypothesised that expanding inclusion/exclusion criteria would increase SDD patient participation without compromising safety. We included patients with low-risk to medium-risk obstructive sleep apnoea using CPAP machines, with final approval from anaesthesia pre-op, and those with borderline elevated BNP levels, in the absence of significant cardiac history. The exclusion of diabetes mellitus patients was refined to those with insulin dependence and significant comorbidities. Data confirmed no increase in failure rates, ER visits or readmissions. We found when patients were prompted early with presurgical education and discharge planning, their success for discharge was greater than the previously unprepared candidates presented with SDD option on the day of their surgery.

### PDSA cycle: screening tool utility

To improve usage, we distributed physical and electronic copies of the screening tool to surgeons' offices and communicated the practice change. Initially, inconsistency was observed when staff had to remember to include the form in consultation packages. By integrating the tool into every preoperative chart pack, all patients were automatically screened. We also revised and redistributed the tool to clarify sections for completion by surgeons and RNs.

### Change idea: FAST Pathway automatisation

Improving team communication was key to mobilising resources for SDD patients. Flagging patients electronically for OR booking under the SDC designation ensured all were informed. Laminated screening tools were placed in consultation rooms and every preoperative chart pack included the screening tool for completion. Scheduling SDC patients as the first or second case of the day optimised discharge success by allowing ample time for recovery assessments. The automatic SDC designation also triggered allied health, anaesthesia and perioperative teams to recognise FAST candidates.



### PDSA cycle: surgical daycare designation

We hypothesised that flagging SDD patients at booking as SDC would automatically notify all team members. Educational efforts, including huddles and emails, reinforced this practice change.

This designation triggered patients to be booked at the beginning of the surgical day, as the first or second case, which helped increase successful SDD. Further, when inpatient surgeries were cancelled secondary to hospital congestion, we maintained case throughput by booking waitlisted SDC patients their place.

### PDSA cycle: follow-up phone calls

The SDC designation streamlined communication by automatically flagging CIOC nurses for follow-up. Previously, the team had to notify the CIOC staff when a patient was discharged on the day of surgery. Additionally, patient charts were unavailable electronically for reference. The SDC designation eliminated this step. It also allowed for the addition of a stat chart scan order for SDD patient charts to the postoperative SDD order set, ensuring timely access for patient support.

### Change idea: surgical and anaesthesia standardisation

Standardising perioperative medications to help minimise postoperative side effects, to meet our aim of early recovery and SDD success. Muscle-sparing hip replacement techniques, the use of tranexamic acid and staple-free incisional closures were promoted to decrease pain and bleeding. An evidence-based streamlined anaesthetic approach achieved consensus from the anaesthesia and orthopaedic departments, promoting early anaesthetic recovery and an effective multimodal pain strategy to further SDD success. High patient satisfaction with the FAST Pathway was reported by patients.

### PDSA cycle: surgical standardisation

We hypothesised that engaging a surgeon project lead would improve collaboration among arthroplasty surgeons to standardise surgical approaches. Consensus was reached on medication changes, including the removal of morphine from joint cocktails and the addition of postoperative dexamethasone. A tracking tool was introduced to review FTL cases, leading to refinements such as discontinuing routine magnesium intravenous orders and adding early nutrition to preprinted orders. These changes reduced FTL rates related to presyncope and hypotension.

### PDSA cycle: anaesthesia standardisation

Similarly, recruiting an anaesthesia lead helped engage the anaesthesia group in streamlining evidence-based approaches. The anaesthesia lead championed changes to spinal anaesthetic doses, drug choices and nerve block techniques and reviewed FTL cases to promote best practices. The team standardised spinal medication dosing, and post anaesthesia care unit nurses were asked to notify anaesthesiologists if a patient's stay exceeded 2 hours.

These measures reduced variability and increased predictability in early recovery.

### Change idea: patient education resources

To boost patient confidence in managing postoperative symptoms, we developed educational resources focused on pain management, wound care and mobilisation. These included a FAST Pathway handout and a Home Medication Record tailored to each patient, along with a Patient Urgency Algorithm Handout. To support at-home recovery, CIOC nurses provide phone follow-up on postoperative days 1–3, excluding weekends and holidays. If patients receive an abductor canal block catheter, an anaesthesiologist will provide education and phone follow-up.

### PDSA cycles: home medication record, patient urgent algorithm handout & SDD TKA handout

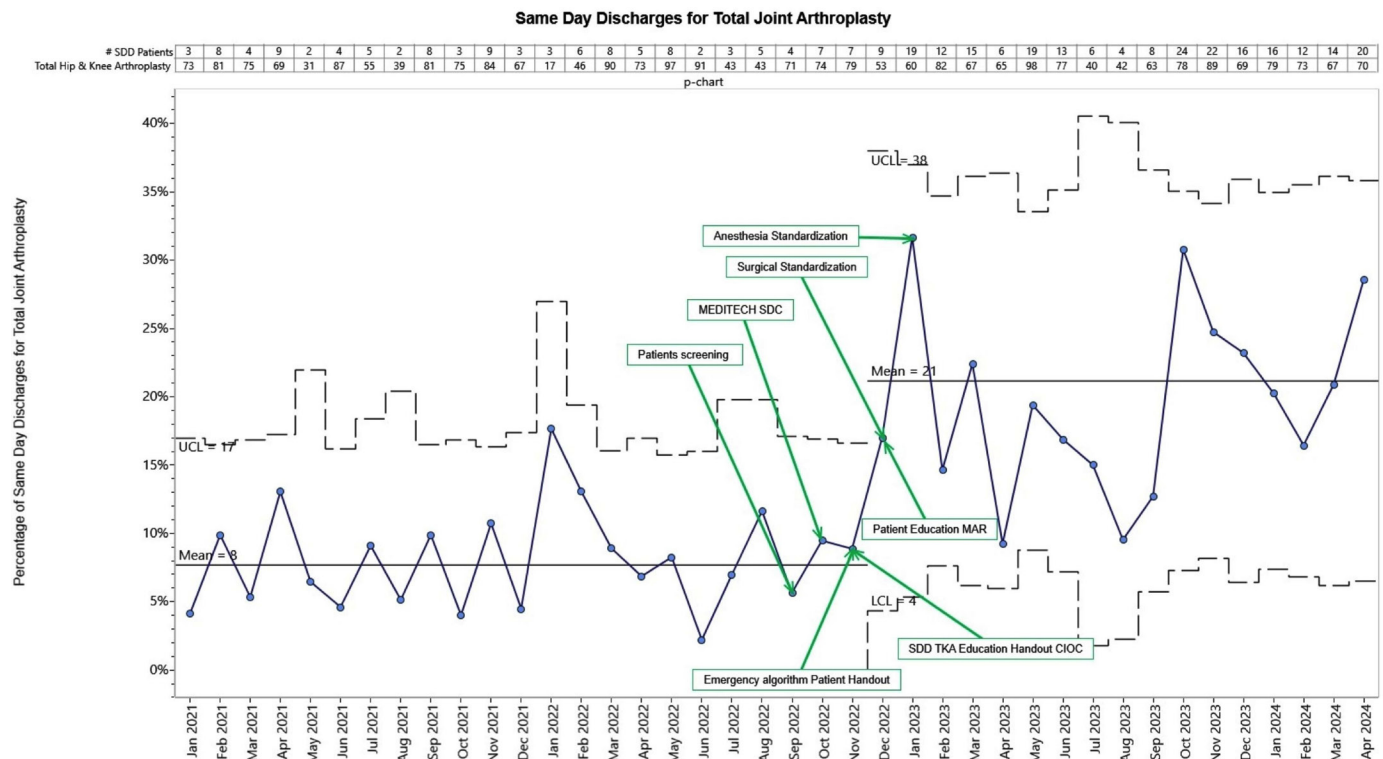
We hypothesised that by creating useful patient resources in collaboration with a patient partner, we could better support patients in their at-home recovery. Multiple Plan-Do-Study-Act ramps focused on refining the Home Medication Record and Patient Urgency Algorithm to promote clarity, usability and reduction in medical jargon use. Additionally, we created an SDD TKA education handout to support this new population within the programme. We observed through patient surveys that these resources were clear, easy to understand and effective in helping them manage at home.

## RESULTS

The outcome measure is the percentage of SDD from January 2021 to April 2024 plotted on a monthly time series control chart (known as P-chart). Prior to testing the interventions and implementing the FAST Pathway, the baseline data of SDD for TJA were a mean of 8%. After running a series of PDSA cycles on the following interventions:

- ▶ Inclusion/exclusion criteria.
- ▶ Screening tool utility.
- ▶ Surgical daycare designation.
- ▶ Follow-up phone calls.
- ▶ Surgical standardisation.
- ▶ Anaesthesia standardisation
- ▶ Home medication record.
- ▶ Patient urgent algorithm handout.

The mean for SDD went from a mean of 8% to 21%. This exceeded our initial aim of increasing the SDD from 8% to 15%. Among these interventions, introducing the electronic SDC designation flag in September 2022 had a particularly strong impact, resulting in higher SDD rates. This was due to enhanced communication among the multidisciplinary staff that a patient was on FAST Pathway, triggering a cascade of automatic steps. The data were collected for an additional 6 months to assess the sustainability and whether the gains were held. [Figure 1](#) demonstrates that the project achieved its aim.



**Figure 1** Percentage of same-day discharge (SDD) for total joint arthroplasty.

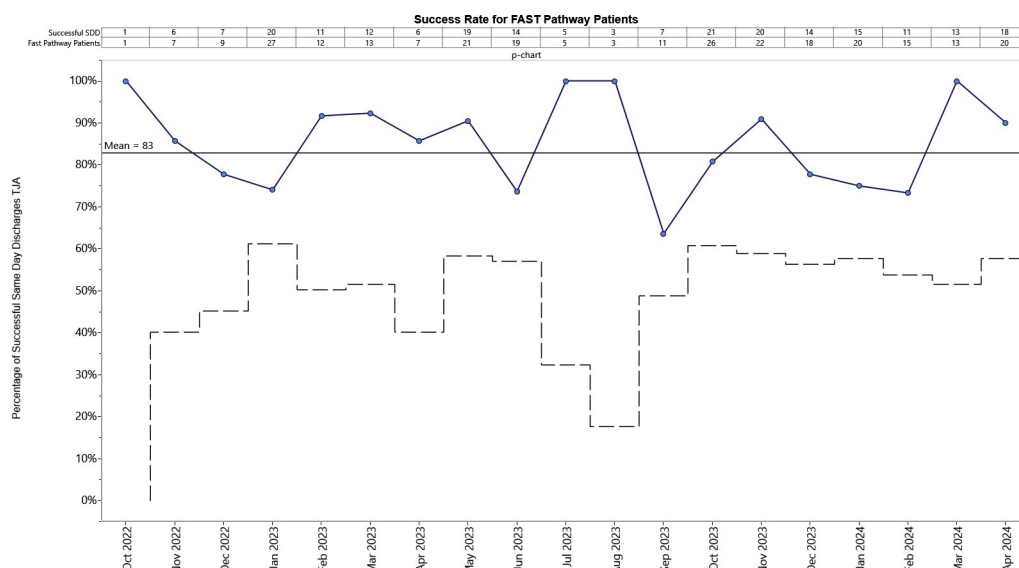
The process measure represents the percentage of successful SDD for TJA in [figure 2](#) (P-chart). From 31 October 2022 to 31 March 2024, 207 (83%) FAST Pathway candidates were successfully discharged, which falls within the range reported in the literature review.

There were three balancing measures:

1. **30-day ER visits and readmissions:** There was a decrease in patients visiting the ER within 30 days by 1–3% after implementing FAST Pathway (2023) at 4%, comparable to 2021–2022 data that showed 5–7% visits. The standard same-day admit 30-day ER visit rate

for 2021–2023 is 7–8% with <1% readmission rate. The FAST Pathway reduces ER visits and readmissions without compromising patient safety.

2. **Staff satisfaction:** An anonymous survey was conducted on 44 participants; 93% had worked at BH before the pathway's implementation. Most (84%) agreed the FAST Pathway benefited SDD patients, and 64% felt it improved communication. However, the SDC staff reported 39% felt their workload had increased.
3. **Patient satisfaction:** Over 50 patients were overwhelmingly positive and provided feedback regarding



**Figure 2** Percentage of successful same-day discharge (SDD) total joint arthroplasty.

discharge materials and follow-up communication. The FAST Pathway was reported by patients who had undergone multiple joint replacements to have favourable experiences.

### Patient quotes

- ▶ “My whole experience was excellent, clear instructions and steps throughout the journey. Everyone was thorough and fantastic.”
  - ▶ “This is my second [SDD TKA] knee in the past year. I had no issues after my last surgery. It went smoothly. I found the discharge materials so helpful, I kept them to review before this surgery.”
1. **Failure to launch (FTL) reasons:** A Pareto chart visualised the most common FTL reasons, including delayed spinal recovery (31%) and vasovagal or presyncope episodes (22%). Initiating early nutrition and fluid management strategies, as well as removing routine use of intravenous magnesium sulphate, helped improve this issue, leading to an increase in SDD rate of over 90% during the subsequent 4 months of data collection.

### UNINTENDED CONSEQUENCES AND UNEXPECTED BENEFITS

From the anonymous staff satisfaction survey results, the SDC staff perceived an increased workload due to higher flow of TJA patients. However, bed utilisation and workload were not changed at the system level.

An unexpected benefit was the increased QI engagements and collaboration among the multidisciplinary team, enhancing future QI project opportunities.

The project has improved hospital workflow, bed allocation and operating room utilisation, thereby producing soft green dollar savings. An example of such benefit is during situations with hospital bed capacity challenges leading to last-minute standard inpatient TJA cases being cancelled. We were able to efficiently pivot to maintain the OR capacity by filling the otherwise vacant spots with waitlist SDC patients (ie, FAST Pathway candidates), thus maintaining operating throughput of cases and reducing waitlist time.

### LESSONS & LIMITATIONS

Our project success was multifactorial. The positive collaboration between the orthopaedic and anaesthesia departments, coupled with an engaged working group and committed leadership support, was critical. Shared goals fostered collective commitment, responsibility and secured funding among local and regional stakeholders. Funding supported project momentum through sustained engagement and collaboration among the team.

Long surgical wait times created a significant delay to the utilisation of the FAST Pathway. To navigate this challenge, we retroactively screened all booked patients, booking those eligible as SDC thereby allowing for a timely transition to the new pathway and readiness for PDSA cycles' execution. Failures were viewed as opportunities for further PDSA cycles and areas for improvement.

By continuously collecting data points over time, we were easily able to demonstrate a significant system change and sustainment post-implementation of our change ideas.

Three main factors limited the generalisability of the pathway. First, CIOC involvement was essential to ensure preoperative patient optimisation and screening of all potential SDD TJA candidates. Second, site environment changes, such as hospital overcapacity and seasonal operating room capacity changes, leading to cancellations and reduced surgery volumes, were also a factor resulting in fluctuations in SDD rates beyond the control of the pathway. Following the mandated 'first in first out policy', the number of patients booked on the SDD pathway was restricted by surgical waitlists, impacting SDD booked volumes. Finally, staff and patient satisfaction surveys were collected 12–15 months after implementation of the pathway.

### CONCLUSION

This project uses a quality improvement framework, which has not yet been published in same-day arthroplasty literature. Additionally, no other studies have reported the extensive spectrum of outcomes completed.

We have demonstrated the feasibility of implementing a successful safety-equivalent SDD pathway for TJA at a community hospital while more than doubling the successful throughput. Our SDD pathway has increased healthcare access and flow, demonstrates fiscal responsibility and has increased patient experience.

Our interventions address the entire perioperative process, creating a cohesive sustainable system change within the surgical programme. We believe the FAST Pathway could be applied to other arthroplasty sites within their unique healthcare settings.

We surpassed our initial SDD target, contributing success to regular PDSA cycles performed to promote continued improvement over time. Barriers encountered were seen as opportunities rather than failures. The team's cohesiveness, strong stakeholder engagement and leadership support were critical to success.

The FAST Pathway has been permanently integrated into our programme. Due to its success, it has been approved by the Fraser Health Physician Quality Improvement Spread Quality Improvement Steering Committee to spread to other regional arthroplasty programmes within the health authority, representing broader system change.

Our pathway achieved the IHI quintuple aim of 'reduce cost' by decreasing inpatient LOS. According to the 2024 Canadian Institute of Health Information data, the estimated daily cost per surgical patient is \$2000. Therefore, over an 18-month period, with 269 SDDs, we achieved a soft green dollar savings of approximately \$538 000, an average of \$29 889 per month.

We continue to seek opportunities to further refine the pathway and increase SDD volumes safely. First, we plan to expand the inclusion/exclusion criteria to include select



diabetic and ASA 3 patients. Second, we are exploring the feasibility of routine adductor canal nerve block catheters. Finally, we acknowledge the limitation of bed capacity in the SDC unit, which could be addressed with extended hours, staffing and bed allocation to increase throughput. Further study may explore the impact of robotic-assisted arthroplasty surgery on SDD success.

**Contributors** All authors contributed to the conceptualisation of this pathway and actively participated in the working group pathway interventions. Data collection and chart analysis were primarily conducted by JW, BS and JE. A patient partner, WA, reviewed two patient education materials. All authors contributed to the draft and approved final version of the manuscript. Revisions and final submission were completed by JW and JE. TK acts as the guarantor for this project.

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**Competing interests** None declared.

**Patient and public involvement** A patient partner was recruited through the Professional Practice Department, Patient Engagement, within Fraser Health Authority, to ensure that patient resources were understandable and clear. A patient partner was engaged in the reviewing two patient education materials (Discharge Medication Record and the Patient Discharge Algorithm) included at discharge to ensure usability and comprehension. There were several changes made to refine the tools for patient use, for example removing medical jargon and increasing the use of layman's terms.

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