Improving surgical access: the Vancouver experience

Daniel H. Williams, MBBCh, MSc
Carolyn Iker, MSN, MN-NP
Laurie Leith, RN, BSN, MA
Bassam A. Masri, MD

From the *Department of Orthopaedic Surgery, University of British Columbia, Vancouver, BC

Accepted for publication
Jan. 12, 2011

Correspondence to:
Dr. B. Masri
3114-910 W 10th Ave.
Vancouver BC V5Z 4E1
bas.masri@vch.ca

DOI: 10.1503/cjs.020110

The University of British Columbia Hospital program was designed to augment existing provincial capacity for hip and knee replacement. The patient–surgeon relationship was maintained throughout the entire care pathway and “ring-fenced” capacity (i.e., designated hospital ward bed and operating room capacity that is geographically remote from the emergency intake of patients) minimized the risk of cancellations. Analysis of the results revealed a mean patient satisfaction score of 4.7 out of 5, a complication rate of 4.4%, a mean operating room time of 1 hour and 45 minutes and a mean postoperative length of stay in hospital of 3.4 days. More than 1600 joint replacements — an additional 16% provincial capacity — were performed within budget during each of the first 2 years of operation. A high standard of care was maintained, with high rates of patient satisfaction and a low complication rate.

Le programme hospitalier de l'Université de la Colombie-Britannique a été conçu pour augmenter la capacité existante de la province en remplacement de hanche et de genou. Le lien patient–chirurgien a été préservé pendant tout le cheminement clinique et la « territorialisation » de la capacité (c.-à-d., nombre de lits et temps opératoires réservés dans un établissement géographiquement éloigné du système d'accueil des patients en situation d'urgence) a réduit le risque d'annulations. L'analyse des résultats a révélé un taux moyen de satisfaction des patients de 4,7 sur 5, un taux de complication de 4,4 %, un temps opératoire moyen de 1 heure 45 minutes et un séjour hospitalier postopératoire moyen de 3,4 jours. Plus de 1600 arthroplasties (capacité provinciale additionnelle de 16 %) ont été effectuées à l'intérieur des limites budgétaires durant chacune des 2 premières années de fonctionnement. On a su maintenir des normes thérapeutiques élevées et on a obtenu des taux élevés de satisfaction des patients et un taux faible de complications.

Demands have been placed on national health care systems throughout the western world in recent years to reduce long treatment waiting times and efficiently manage patient care.¹ In December 2005, the provincial and territorial governments of Canada announced national waiting time benchmarks in 5 priority areas: cancer treatment, cardiac care, hip and knee surgery (joint replacement and hip fracture fixation), sight restoration and diagnostic screening. Following this announcement, the British Columbia (BC) Ministry of Health (MOH) announced a Can\$60.5 million waiting time management strategy. The plan included an investment of \$21.8 million in each of the 2006/07 and 2007/08 fiscal years to fund the development and implementation of a provincial specialty resource surgical program.

The University of British Columbia Hospital (UBCH) Centre for Surgical Innovation (CSI) was opened on Apr. 3, 2006, accommodating 2 new operating rooms and a 38-bed inpatient ward. The CSI was resourced to perform an additional 1600 hip and knee replacements annually to help reduce provincial waiting times to less than 26 weeks for 90% of patients. There follows a summary of the operating plan and a report of progress over the first 2 years of operation.

OPERATING PLAN

British Columbia is home to 4.4 million people, 13% of the Canadian population.^{2,3} Half of the BC population live in metropolitan Vancouver, with the

rest spread over a vast area of nearly 1 million km².³ Five health authorities administer health care throughout BC, with the majority of hospital services and orthopedic surgeons located in the southern part of the province. Patients are therefore accustomed to travelling to access care.

The CSI operating plan was based on a pilot model of preoperative, operative and postoperative care practised at the Richmond General and Vancouver General hospitals. These programs were successful at decreasing operating room times and postoperative length of stay in hospital by 25%, resulting in a 27% reduction in waiting list times. The keys to this success were

- improved patient flow through a centralized joint clinic designed to assess patients with osteoarthritis and related disorders (delivery was either through the Complex Joint Reconstruction Clinic at Vancouver General Hospital, relying on rapid assessment by tertiary care joint replacement surgeons, or through the Osteoarthritis Service Integration System [OASIS], providing coordinated multidisciplinary early access assessment, referral and rehabilitation);
- “ring-fenced” capacity (i.e., designated hospital ward bed and operating room capacity that is geographically remote from the emergency intake of patients), minimizing the risk of surgical cancellation; and
- an optimized service continuum, reducing inpatient postoperative length of stay in hospital to 3 days for knee replacement and 4 days for hip replacement.

The nonemergency UBC hospital, located on the university campus, has access to internal medicine and cardiology consultation but does not have an intensive care unit. Thus, qualifications for admission to the program were set at

- age younger than 80 years;
- body mass index (BMI) less than 45;
- American Society of Anesthesiologists (ASA) grade 1 or 2 (i.e., patients without significant comorbidities; this criterion has since expanded to include ASA 3 patients who do not have major cardiopulmonary comorbidities, thus stable coronary artery disease or revascularized coronary arteries are deemed acceptable but moderate to severe aortic stenosis is not);
- primary, low-complexity hip and knee reconstruction;
- physical and financial ability to travel to Vancouver and provide accommodation for their support person throughout the hospital stay; and
- absence of a high dose of preoperative narcotic (contraindication for surgery).

REFERRAL TO OPERATION

The director of the CSI program contacted all orthopedic surgeons in British Columbia to invite them to participate. Patient access to the program, either by direct referral from the treating surgeon or via BC Nurseline, which matches suitable patients without a participating surgeon to a sur-

geon taking part in the program, was initially preferred for patients who had waited more than 26 weeks. The hospital confirms the availability of preassessment, preanesthetic and consent documentation and contacts the patient to have him/her attend UBCH for an anesthetic consultation and necessary investigations. Additional medical consultation is available at UBCH if required. Out-of-region patients travel to UBCH 2–3 days before surgery; otherwise, the anesthetic consultation takes place up to 1 week before surgery. Patients are given medication advice, eating and drinking (NPO) orders and reporting instructions for the day of surgery. In addition, patients are offered a “prehab” class via the physiotherapy-based OASIS. Recent improvements in efficiency have been achieved by a telephone preoperative anesthetic consultation in suitable patients after review of the appropriate consultation paperwork, blood tests and electrocardiogram results.

Visiting surgeons are scheduled to operate on their own patients. Instrument and prosthesis availability is determined ahead of time, and every effort is made to accommodate the wishes of the visiting surgeons to maintain familiarity with implants. Follow-up and complications are subsequently managed back in their respective regions. If the patient’s own surgeon is unavailable to operate, then referral proceeds directly to a participating surgeon, or the patient is assigned to a participating surgeon by the UBCH office. In the latter case, follow-up, depending on the patient’s proximity and/or willingness to travel, may be by patient visit at 2–3 months and at 12 months after surgery or by remote radiographic assessment (sent to the operating surgeon). For complications requiring hospital admission, the patient is assessed at their local emergency department: dislocations are treated locally, and patients with periprosthetic fractures and infections are transferred back to the treating orthopedic surgeon (as arranged by BC Bedline).

The first patient of the day is asked to report at 6:30 am on the day of surgery. Nurse-led admission paperwork is checked, anesthetic and orthopedic preoperative checks proceed at 7:15 am, and the patient is brought through to the first operating room by 7:40 am. Spinal anesthesia is preferred to facilitate surgical knife to skin by 8:00 am. Suitable surgical assistance includes a general practitioner, retired orthopedic surgeon, fellow or resident surgical trainee. While the senior surgeon is mandated to participate in the time-out portion of the Surgical Safety Checklist, this combination of staff allows a double “swing” room to commence following a 30- to 40-minute stagger, with 2 hours scheduled per operation. Every attempt is made ahead of time to achieve consensus among participating surgeons for a standard set of instrumentation to facilitate an efficient turnover of patients. The daily presence of the implant manufacturer’s representative plays a key role in ensuring that inventory stock levels of all prostheses are maintained. All auxiliary, operating room, anesthetic and surgical staff buy into a daily routine that allows 8 or 9 primary joint

operations to proceed during a working day from 8:00 am to 4:00 pm, using the 2-room model. One of the surgeons routinely completes 9 joint replacements per day.

Postoperatively, patients spend about 2 hours in the recovery ward before transfer to the dedicated 38-bed elective ward. Routine postoperative orders are prescribed by the surgical team for patient-controlled analgesia and allied medication, 24-hour cover of cephalosporin or macrolide antibiotic, routine thromboprophylaxis with low-molecular heparin or rivaroxaban extending to 14 days for patients who had TKR and 35 days for those who had THR (unless contraindicated or a longer period is indicated) and full weight-bearing status (unless contraindicated). There is a maximum ratio of 1 nurse to 6 patients on the recovery ward. Patients judged to be at higher postoperative risk for medical complications spend the first night in the surgical observation unit, where there is a maximum ratio of 1 nurse to 2 patients; 24-hour medical coverage is provided for this unit. While the surgical team remains responsible for the ward patients, there is dedicated daytime nurse practitioner coverage, and there is nonresident senior orthopedic fellow coverage overnight and on weekends. In BC, nurse practitioners are licensed, autonomous practitioners at the Master's degree level with a broad scope of diagnostic and prescriptive authority.

REHABILITATION

Each member of the physiotherapy team is assigned 6 patients, allowing mobilization to standing on the day of surgery if the effects of the spinal anesthetic have abated. This ratio facilitates a minimum of 2 physiotherapy sessions, each lasting 30 minutes, per patient each day. These services maximize the possibility of each patient achieving discharge eligibility within the 3- to 4-day target. Physiotherapy staffing levels throughout the working week reflect patient demand, and Saturday is staffed as a normal working day. Physiotherapist and occupational therapist presence on a Sunday ensures the 38-bed ward is ready for the start of a new working week. All arthroplasty patients are given an extensive self-management program for exercise during their stays in hospital. Resource material includes an information booklet, *Before, during and after your joint replacement*, and an exercise booklet specific to either total hip (THR) or knee replacement (TKR). Criteria for discharge include the ability to transfer independently, walk more than 30 minutes with crutches, safely go up and down 3 steps (or more if needed) and the ability to independently execute the home exercise program.

Acute rehabilitation at a local hospital, homecare visits or outpatient physiotherapy is arranged at the point of discharge, as appropriate. Each patient therefore has a definite next physiotherapy appointment, often within 2 days, to maintain the trajectory of their recovery. These services are arranged by UBCH with the help of each local health

authority. Patients who are deemed likely to require discharge to an inpatient rehabilitation program are generally not included in the program. The level of exercise increases at 2 weeks, 6 weeks and 12 weeks for patients who had THR and twice a week for patients who had TKR (i.e., 12 physiotherapy visits at 2 visits per week for a duration of 6 weeks). This standard rehabilitation pathway, with funding provided through the CSI program, is adequate for about 83% of patients. About 17% of patients — as identified by the physiotherapist, private care doctor or orthopedic surgeon — require an extended rehabilitation pathway of the maximum 12 physiotherapy visits. Thus, with 83% participating in the standard pathway and 17% requiring the extended rehabilitation pathway, the overall cost for rehabilitation is budgeted at \$750.00 per patient who had TKR and \$360.00 per patient who had THR. These visits also assess for suture or staple removal, adherence to the exercise program and identification of any other needs or issues.

RESULTS

The results of the CSI program are assessed annually by the management team in terms of the following.

- Patient access: achieving the target number of hip and knee replacements
- Service quality and efficiency: achieving a high level of patient satisfaction with an efficient use of resources
- Finance: cost effectiveness and efficiency

Patient access

In the 2006/07 and 2007/08 fiscal years, the CSI program achieved its headline target by performing 1609 and 1600 joint replacements, respectively (Table 1), or about 16% of the total number of provincial cases (Table 2).

The raw provincial waiting list (Table 3) and median waiting time data (Table 4) for joint replacement are useful indicators of the success of projects such as CSI. They may, however, present an oversimplified picture and should, in isolation, be viewed with caution. That said, the total number of patients waiting more than 26 weeks in BC decreased by 15% from 3878 at the end of 2005/06 to

Table 1. Joint replacements performed at the Centre for Surgical Innovation

Surgery	Year; no. (%)	
	2006/07	2007/08
Hip replacements	834 (52)	770 (48)
Knee replacements	775 (48)	830 (52)
Total	1609	1600
Length of wait for surgery		
≤ 26 wk	1047 (65)	1352 (84)
> 26 wk	525 (33)	224 (14)
Unknown	37 (2)	26 (2)

3203 in 2006/07 and by a further 14% to 2768 in 2007/08. The total number of patients on the waiting list decreased by 16% over the first year of the program (Table 3). The result is a median waiting time of 3 months for hip replacements and 4 months for knee replacements (Table 4).

One of the problems limiting the ability of the CSI program to affect patients waiting longer than 26 weeks relates to the design of the project. Only 33% of the joint replacements performed in 2006/07 and 14% of those performed in 2007/08 were for patients who had waited longer than 26 weeks (Table 1). It is clear that the CSI contributed to a substantial reduction in the total number of ASA grade 1 and 2 patients waiting for joint replacements. It remains difficult, however, for the CSI program to directly affect the backlog of patients waiting more than 26 weeks when a considerable proportion of these patients are ASA grade 3 or 4 and are not eligible for the program. The impact of other provincial initiatives active both before and during the CSI program also cannot be ignored. Importantly, 442 fewer joint replacements were completed in 2006/07 by other surgical facilities in the same health authority as UBC, mainly as a result of the redirection of "augment" funding toward the CSI program. The overall net effect was, therefore, an additional performance of 1167 joint replacements in 2006/07.

Table 2. Joint replacements performed in British Columbia*

Surgery	Year; no. (%)	
	2006/07	2007/08
Hip replacements	4244 (42)	4029 (41)
Knee replacements	5795 (58)	5831 (59)
Total	10039	9860
Length of wait for surgery		
≤ 26 wk	6502 (65)	6924 (70)
> 26 wk	3537 (35)	2936 (30)

*Data from the Standard Monthly Report SWIFT.⁴

Table 3. Patients waiting for joint replacement in British Columbia*

Surgery	Year; no. (%)		
	2005/06	2006/07	2007/08
Hip replacement			
Total waiting	2491	2119	2072
No. waiting ≤ 26 wk	1301 (52)	1097 (52)	1276 (62)
No. waiting > 26 wk	1190 (48)	1022 (48)	796 (38)
Knee Replacement			
Total waiting	5110	4263	4479
No. waiting ≤ 26 wk	2422 (47)	2082 (49)	2507 (56)
No. waiting > 26 wk	2688 (53)	2181 (51)	1972 (44)
Total no. patients waiting	7601	6382	6551
Change from previous year	—	-16%	+3%
Total no. waiting > 26 wk	3878	3203	2768
Change from previous year	—	-15%	-14%

*Data from the Standard Monthly Report SWIFT.⁴

Furthermore, and unsurprisingly, there was a reluctance of both surgeons and patients to travel to UBC from far outside of Vancouver. The vast Canadian geography will always be an important factor. Indeed, the 2 health authorities that are local to the program achieved their patient participation targets, whereas the 3 distant health authorities did not. Of the province's 99 orthopedic surgeons, 25 participated in the CSI program in 2006/07. This figure did not include any surgeons from the Northern Health Authority (NHA). In 2007/08, 28 surgeons participated in CSI activities; the additional 3 surgeons joined from local health authorities.

Service quality and efficiency

Patient satisfaction with the service provided at the CSI remains high, with a mean satisfaction score recorded at 4.7 out of 5 on a Likert scale⁵ for 599 patients randomly surveyed after discharge. Any reported concerns were mainly related to waiting time and travel rather than service quality.⁶

Data on patient readmission rates after surgery at the CSI for the first year were collected via a telephone survey of the first 1078 patients. Of these, 174 patients sought medical assistance, including 47 (4.4%) patients who self-reported an actual complication (i.e., deep vein thrombosis, wound infection requiring antibiotic therapy or anemia requiring blood transfusion).

Targets were well met for an average operating room time of 1 hour and 45 minutes, an average length of stay in postanesthesia recovery of 2 hours and 4 minutes and an average postsurgical length of stay in hospital of 3.4 days.

Finance

In 2006/07 the actual total expenditure was \$21 million. The actual cost per patient in 2006/07 was \$13 045. In 2007/08, CSI gross operating expenditure totalled \$19.5 million for a gross operating cost per patient of \$12 211. Start-up costs in 2006/07 accounted for the difference.

DISCUSSION

By establishing a specialty centre separate from the other provincial emergency hospitals, the CSI has achieved an extremely efficient service. It maintains a mean operating

Table 4. Median wait times for joint replacements performed in British Columbia*

Surgery	Year; no. wk	
	2006/07	2007/08
Hip replacements	13.3	11.0
Knee replacements	19.9	16.9

*Data from the Standard Monthly Report SWIFT.⁴

time of 1 hour and 45 minutes and a length of stay in hospital of 3.4 days. All surgeons perform a minimum of 4 operations per day in 1 operating room or a minimum of 8 per day if a double room is used. Scheduled operations are completed without the threat of being bumped by the emergency workload. Waiting lists and waiting times have decreased throughout the introductory 2-year period, staff and patient satisfaction is high and complication rates remain low. The model is regularly assessed and refined to ensure its continued success.

Worldwide, national health care systems have employed various strategies to reduce long treatment waiting times and efficiently manage patient care.¹ The UBCS CSI program provides an additional 16% provincial operating capacity for hip and knee arthroplasty, helping to achieve the Canadian 26-week waiting time target. By using the expertise of BC surgeons practising under the Canadian health care umbrella, the Vancouver model has maintained the patient–surgeon relationship throughout the patient care pathway. In other countries, such as the UK, procurement of additional capacity from independent sector centres has not always achieved this continuity of care.⁷ Concerns have been raised regarding the ability of these independent centres to provide high-quality health care.^{8–10}

Challenges within the CSI framework relate to the fundamental design of the program to treat only ASA grade 1 and 2 patients. Early CSI surgeon feedback highlighted the need for the program to safely handle higher acuity ASA grade 3 patients to more directly impact the backlog of “long waiters.” Whereas the program has been effective at indirectly freeing up existing capacity in regional health authorities by taking ASA grade 1 and 2 patients, a more direct approach was deemed desirable. Furthermore, while acknowledging its success, concerns were raised that by “cherry-picking” only ASA grade 1 and 2 patients, the program leaves more complex and often more costly procedures to the more remote health authorities. These concerns also parallel criticisms levelled at independent treatment centres in other countries.¹¹ Changes have already taken place in Vancouver to accommodate ASA grade 3 patients within the program to more directly and effectively deal with the backlog of patients waiting longer than 26 weeks. The increased staffing levels and medical coverage on the surgical observation unit have been instrumental in facilitating this change. The change has been successful and, at present, very few patients are ineligible for the CSI program, thus alleviating concerns of so-called “cherry-picking.”

CONCLUSION

The Vancouver experience continues to provide the extra operating capacity that both patients and surgeons desire while protecting the patient–surgeon relationship throughout the entire patient care pathway. A high standard of care has thus been maintained with high rates of patient satisfaction and a low complication rate.

Competing interests: None declared.

Contributors: Ms. Leith and Dr. Masri designed the article. Dr. Williams and Ms. Iker acquired the data, which Dr. Williams analyzed. Dr. Williams wrote the article, which Mses. Iker and Leith and Dr. Masri reviewed. All authors approved the article’s publication.

References

1. *Delivering the 18-week pathway*. London (UK): Department of Health. Available: www.18weeks.nhs.uk (accessed 2009 Nov. 3).
2. *British Columbia Population Projections*. Victoria (BC): BC Government. Available: www.bcstats.gov.bc.ca (accessed 2009 June 1).
3. Census 2006 Community Profiles: Vancouver (Census Metropolitan Area). Ottawa (ON): Statistics Canada. Available: www12.statcan.ca (accessed 2009 Nov. 11).
4. Priority areas. In: website of the British Columbia Ministry of Health. Available: www.health.gov.bc.ca/swt/faces/PriorityAreas.jsp (accessed 2008 Mar. 1).
5. Likert R. A technique for the measurement of attitudes. *Arch Psychol* 1932;140:1-55.
6. Johnstone ML. CSI Hip and Knee Program: UBCS patient satisfaction report [internal]. Vancouver (BC): University of British Columbia Hospital; 2008.
7. Lewis R, Appleby J. Can the English NHS meet the 18-week waiting list target? *J R Soc Med* 2006;99:10-3.
8. Kempshall PJ, Metcalffe A, Forster MC. Re-operation rates following total knee arthroplasty at an independent sector treatment centre: the Cardiff experience [abstract]. *J Bone Joint Surg Br* 2009;91(Suppl 3):411.
9. Oussedik S, Haddad F. Further doubts over the performance of treatment centres in providing elective orthopaedic surgery. *J Bone Joint Surg Br* 2009;91:1125-6.
10. Cannon SR. Quality of elective surgery in treatment centres. *J Bone Joint Surg Br* 2009;91:141-2.
11. Dobson R. English treatment centres are treating less complex patients than hospitals. *BMJ* 2009;339:b4540.