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ORIGINAL ARTICLE – RECONSTRUCTIVE ONCOLOGY

Immediate Reconstruction Swing Room Scheduling Reduces Wait Times to Surgery and Increases Breast Reconstruction Rates

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ABSTRACT

Background. Despite benefits in quality of life, patient satisfaction, overall healthcare costs, and number of surgeries, historically fewer than 30% of patients undergo immediate breast reconstruction following mastectomy for breast cancer. A paucity of qualified oncologic and plastic surgeons coupled with inefficient use of operating room (OR) resources presents challenges in offering immediate breast reconstruction in a timely manner. To address these challenges, an immediate reconstruction swing room (IRSW) program was developed.

Methods. IRSW scheduling leverages two concurrently running ORs, with the surgical oncologist and plastic surgeon moving between rooms to complete 2–4 combined mastectomy cases with immediate reconstruction, in addition to 1–2 independent cases, each operative day. The final year of traditional booking was compared with IRSW scheduling to assess wait times and reconstruction rates.

Results. Comparing the 2 years, fewer surgical breast cases were performed with IRSW scheduling (1250 vs. 1178), however the overall number of oncology cases increased from 735 (59%) to 857 (73%). The number of immediate reconstructions performed increased from 75 to 139 ($p < 0.0001$), which reflects a mean of 1.2 IR cases versus 2.9 combined cases in IRSW. Overall, this facilitated an increase in the rate of immediate reconstruction following therapeutic mastectomy from 35 to 49% ($p = 0.0004$) and decreased wait times from core biopsy to surgery from 70 to 52 days ($p < 0.0001$).

Conclusions. A multidisciplinary model with optimized scheduling has the potential to improve resource utilization and access to breast cancer care.

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Although breast-conserving surgery (BCS) when combined with radiotherapy has been shown to have equivalent survival to mastectomy,[1] many women still require mastectomy for treatment.

For patients treated with mastectomy, the option of reconstructive surgery to rebuild the breast is available in many centers. Research has shown that breast reconstruction improves quality of life following mastectomy[2–4] with no increased breast cancer recurrence risk.[5] Improved cosmetic outcomes are seen with immediate breast reconstruction (IBR) compared with delayed breast reconstruction.[6,7] Arranging IBR can be challenging as the concerns regarding wait times to surgery for cancer and the logistics required for arranging for a plastic and general surgeon to be available for a combined procedure can be considerable.[8]

Whether or not wait time to surgery affects outcomes for breast cancer is controversial. A metaanalysis[9] demonstrated decreased survival with wait times of 3–6 months from presentation to treatment. A recent study[10] looking at Surveillance, Epidemiology, and End Results (SEER) and National Cancer Data Base (NCDB) data demonstrated that greater time to surgery resulted in decreased overall and disease-specific survival. Their data demonstrated an overall decrease in survival of 2–4% with waits longer than 60 days from diagnosis to surgery, and the authors felt that benefits from decreasing time from diagnosis to surgery by 30 days were similar to those attributable to standard therapy such as extended hormone therapy.

A number of strategies to improve timely access to IBR have been reported, such as use of a breast reconstruction surgery coordinator[11] and a comprehensive breast center.[12]

Since 2006, scheduling strategies to improve access to IBR have been developed at our center. This study looks at the effectiveness of immediate reconstruction swing room (IRSW) scheduling on wait times for IBR.

METHODS

A retrospective review of a prospectively maintained breast clinic database was performed to assess patient and surgical characteristics before and after implementation of IRSW scheduling at Mount Saint Joseph Hospital (MSJH), Vancouver, BC. Ethics approval was obtained from the University of British Columbia Providence Health Care review board.

MSJH is a regional referral center for breast cancer with five breast surgical oncologists and two breast reconstructive surgeons.

Scheduling for Immediate Reconstruction

Figure 1 outlines OR booking for typical slates, immediate breast reconstruction, accommodating one reconstructive case, and IRSW scheduling. Traditionally, to accommodate a case for IBR, either the plastic surgeon or breast surgical oncologist will accommodate the case on their operating day and the other will need to free themselves of their other responsibilities, such as seeing patients in the office, in order to be available for the operation (Fig. 1a, b). This will result in a loss of productivity, as either the plastic surgeon is waiting while the oncologic surgeon is starting the case, or in the situation where more than one combined case is booked, the oncologic surgeon is waiting for the reconstructive portion to be completed.

At times, challenges finding a time for surgery arose when both surgeons were scheduled in the OR on the same day, and a strategy where the surgeons switched OR rooms after the first case was started in 2006 (Fig. 1c). An extension of this strategy was then trialed from 2010 to 2011 in order to accommodate more reconstructive cases on a day when the breast surgical oncologist and plastic surgeon were scheduled in the OR on the same day (intermittent IRSW scheduling). The ability to arrange reconstruction in a timely manner with these intermittent IRSW days led to the idea of planning these days intentionally (IRSW scheduling).

IRSW Scheduling

Starting in 2012, a preplanned weekly scheduled IBR day assigning an operating room to both a breast surgical oncologist and breast reconstruction surgeon was implemented with scheduling that allowed the reconstructive surgeon to follow the surgical oncologist between the two rooms to allow for IBR for multiple patients in 1 day (IRSW booking, Fig. 1d). The breast surgical oncologist will start a case for IBR in the first operating room, and the plastic surgeon starts a shorter independent case in the second operating room. The scheduling is planned so that, when the plastic surgeon is finished their independent case, the breast surgical oncologist will be finishing the mastectomy and the reconstructive surgeon then joins the first operating room to perform the immediate reconstruction. The breast surgical oncologist then moves to the second operating room to care for the next patient having a mastectomy and is again followed by the plastic surgeon who performs the IBR. Once all of the IBR are scheduled, the remainder of the operating time for the day is filled by independent cases performed in one room by the breast surgical oncologist and the other room by the plastic surgeon.

Patients eligible for pedicled autologous or implant-based reconstruction were booked on an IRSW day. Patients planned for immediate microsurgical reconstructions were scheduled separately and excluded from the study.

Data Analysis

All cases performed by the breast surgical oncologists were identified from our database and confirmed by OR list review. We identified patients with IBR between July 1, 2009 and June 30, 2010 (final year with no IRSW days) and January 1 to December 31, 2015 (IRSW). Patients having delayed reconstruction, second-stage reconstruction, or nonbreast surgery were excluded. Surgical and wait time details were further assessed by chart review. The primary endpoint was wait time from core biopsy to surgery, and secondary endpoints were time from general surgery consultation to surgery, breast reconstruction rate, number of cases done per OR day, and rescheduled time. Rescheduled time was defined as time a surgeon needed to be available on a day they were not originally scheduled at the hospital in order to do the combined case. It was averaged between time required to be in attendance for the case by the general surgeon (mastectomy) and the plastic surgeon (time starting with marking of the patient until case completion). This average was then estimated to represent 33% of a day in the office or clinic. Statistical analyses used the Chi square test for categorical variables and the Student t test for continuous variables. Significance was set at $p < 0.05$.

RESULTS

The final year before IRSW booking was compared with the latest year of the IRSW scheduling. Characteristics of patients having IBR at our site during these two time frames are outlined in Table 1.

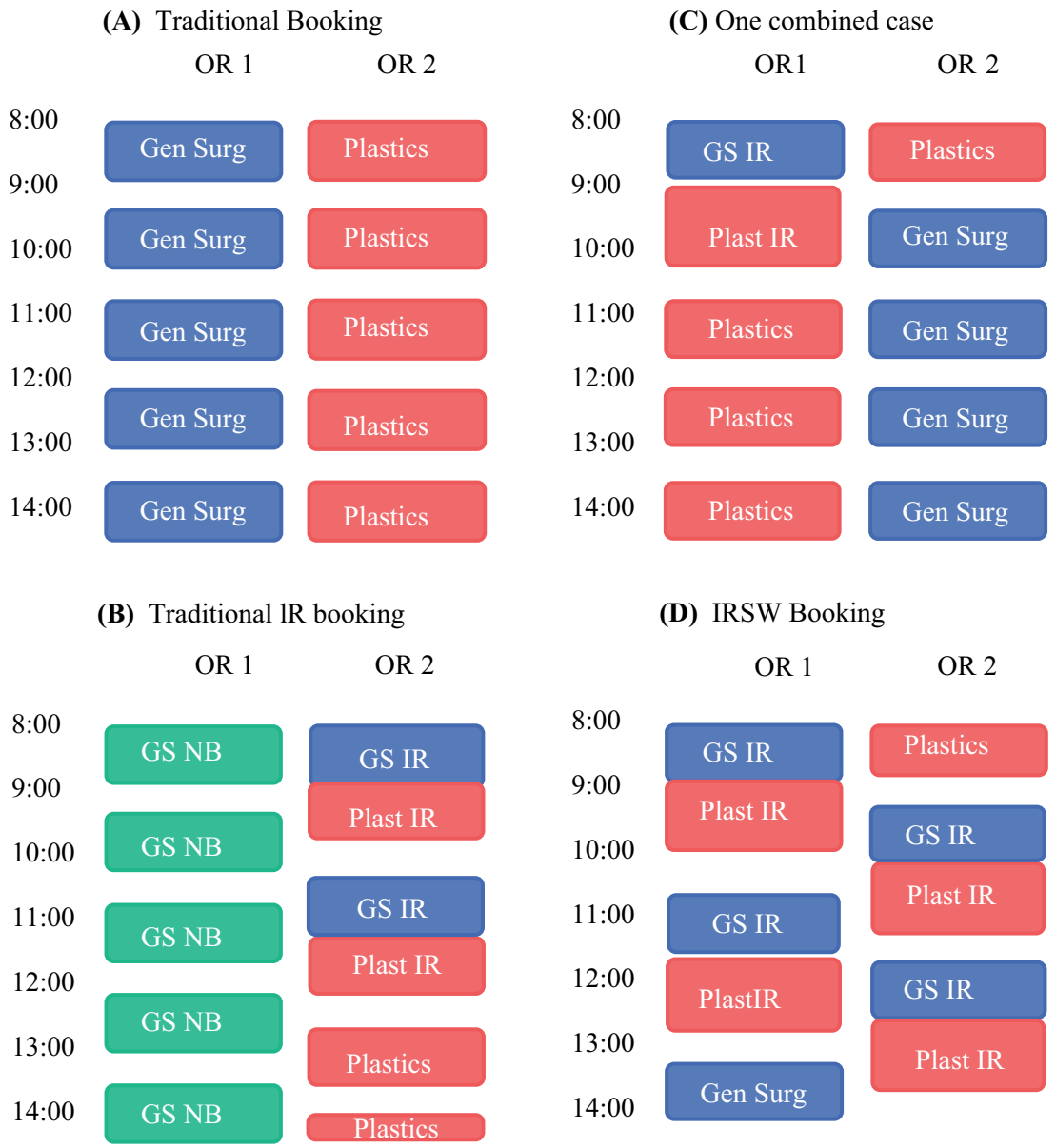

FIG. 1 Scheduling for mastectomy with immediate breast reconstruction. Gen Surg, general surgery; GSNB, general surgery nonbreast; IR, immediate reconstruction; IRSW, immediate reconstruction swing room scheduling

Table 2 outlines the number of cases performed and wait times for surgery. With the IRSW scheduling, 0–4 cases were done on each IRSW day in 2015 with a mean of 2.9 cases per possible IRSW day. For patients having initial surgical treatment with mastectomy and IBR, wait times from diagnosis to surgery decreased from a mean of 70 days (range 11–190 days) before IRSW scheduling to a mean of 52 days (range 19–133 days) with weekly IRSW scheduling ($p < 0.0001$). Overall, the breast reconstruction rate improved from 35% with traditional scheduling to 49% with IRSW scheduling ($p = 0.0004$). In order to perform the immediate reconstructions, 25 days' worth of patients/commitments needed to be rescheduled in 2009/10 compared with 3.33 days in 2015. However, if traditional scheduling had been used in 2015, it would have required the rescheduling of 46 days' worth of other clinical responsibilities.

The types of mastectomy and immediate reconstruction performed and complications are outlined in Table 3. Overall, the rate of autologous reconstruction was 29% in 2009/10 and 20% in 2015, with most flap procedures booked outside of the IRSW.

TABLE 1 Patient demographics, clinical and pathological characteristics

	2009/10 cohort (n = 75)	2015 cohort (n = 145)
Average (range) age (years)	52 (27–80)	52 (29–76)
Female sex (%)	75 (100)	145 (100)
Prophylactic mastectomy (%)	2 (3)	5 (3)
Multifocal malignancy or completion mastectomy (%)	23 (31)	30 (21)
DCIS unifocal initial treatment (%)	13 (17)	18 (12)
Average (range) preop. size (mm)*	28 (6–70)	39 (7–90)
Low/intermediate grade (%)	8 (62%)	12 (67%)
High grade (%)	5 (38%)	6 (33%)
Lymph nodes positive for malignancy (%)	0 (0%)	0 (0%)
Average (range) pathology size DCIS (mm)*	21 (4–60)	30 (2–65)
Upstage to invasive disease	4 (31%)	10 (56%)
Estrogen receptor positive (%)	5 (38%)	12 (67%)
Invasive cancer unifocal initial treatment (%)	35 (47)	72 (50)
Average (range) preop. size (mm)*	24 (7–50)	23 (5–65)
Histology		
Ductal (%)	30 (86%)	60 (83%)
Lobular (%)	5 (14%)	8 (11%)
Other (%)	0 (0%)	4 (6%)
Receptor status		
ER positive (%)	22 (63%)	53 (74%)
PR positive (%)	17 (49%)	44 (61%)
HER2 positive (%)	7 (20%)	3 (4%)
Lymphovascular invasion (%)	12 (34%)	20 (28%)
Lymph nodes positive (%)	22 (63%)	21(29%)
Average (range) pathology size (mm)*	24 (6–80)	16 (2–43)
Grade		
1	5 (14%)	12 (17%)
2	18 (51%)	39 (54%)
3	12 (34%)	21 (29%)
Invasive cancer neoadjuvant chemotherapy	2 (2)	20 (14)

DCIS ductal carcinoma in situ; *ER* estrogen receptor; *PR* progesterone receptor; *HER2* human epidermal growth factor receptor 2

DISCUSSION

This analysis demonstrates that we have been able to decrease our wait time to breast cancer surgery by a mean of 18 days for patients needing IBR. This was facilitated by implementing this OR scheduling change at our hospital. Furthermore, we have been able to improve our breast reconstruction rate following therapeutic mastectomy from 35 to 49% without additional OR resources. We believe that what has made the IRSW successful is the preplanned, weekly scheduling, which allows for multiple cases of IBR per week. We have previously demonstrated that there is no difference in complications between patients having surgery on IRSW days compared with patients having surgery with traditional booking.[13]

In Canada, a review of breast cancer surgery[14] demonstrated that 39% of women with invasive breast cancer are treated with mastectomy and 29% of patients treated with in situ disease are treated with mastectomy. Among patients having mastectomy, 7% had immediate breast reconstruction and a further 2% went on to have delayed reconstruction. Reviewing these numbers demonstrates that there is a lack of access to immediate breast reconstruction in Canada. Canadian national estimates are significantly lower than those published for the USA of 24%,[14] but those at our institution exceed Canadian and US averages.

Our reconstruction rate of 49% with our IRSW scheduling surpasses these reported rates, suggesting we are making progress in meeting the reconstructive needs of our patients. We acknowledge that there is an element of

TABLE 2 Comparison of surgery volume, wait time, and access to reconstruction between groups

	July 1, 2009–June 30, 2010	2015	*p*
Number breast cases general surgery	1250	1178	
Number of confirmed cancer cases	735	857	< 0.0001
Number of immediate recon general surgery	75 included	145 included	
	22 non IRSW*	37 non IRSW*	
% mastectomy with immediate recon	35%	49%	0.0004
# OR days for immediate recon included cases	62	57	
# OR days with more than one recon case	9	47	< 0.0001
Average cases per OR day included cases	1.2	2.5	
Average cases per swing day		2.9	
Days of patients rescheduled to perform immediate recon (either plastic or gen surgeon)	25	3.33 (would have been 46 if using old model)	
General surgery consult to OR for surg first rx (days)	55	41	0.005
Core biopsy to OR for surgery first treatment (days)	70	52	< 0.0001

IRSW immediate reconstruction swing room

*Excluded from analysis

referral bias in our reconstruction rate, since we care for patients throughout the province where breast reconstruction is not available. Despite our scheduling changes, some patients still alter their desired cancer management due to long wait times and lack of resources. We do not have data to estimate the unmet need for breast reconstruction in our area or how much of this unmet need is driven by local patients compared with patients living in other parts of the province. Even with referral bias, these results demonstrate that our IRSW scheduling allows us to increase capacity for immediate reconstruction.

With the Canadian public health care system, improving access to care for one group of patients may come at a cost of decreased access to care for other groups of patients such as patients presenting with benign disease.[15] A swing room model to improve access to extremity surgery has involved surgeons moving between two fully staffed operating rooms.[16,17] While this model improves access to a limited surgeon resource, it requires two operating rooms to provide the care and would push out other cases. In contrast, our strategy of deliberately scheduling the breast surgical oncologist and breast reconstructive surgeon in the OR on the same day does not increase assigned operating room time for either surgeon, but productivity is improved instead by decreasing the surgeons' wait time during the day and decreasing the number of times the surgeons have to cancel other clinical activities to accommodate available operating time on short notice; in 2015, only 3.33 days of clinical activities were rescheduled with IRSW scheduling, whereas if traditional scheduling had been used, 46 days of clinical activities would have been rescheduled to do IBRs.

Prior to weekly IRSW scheduling, we utilized strategies for IBR that are common in many hospitals such as planned reconstruction days and switching rooms for IBR when both surgeons are in the OR. The only scheduling change between the two study periods was the addition of the weekly IRSW. We hypothesize that the improvement in wait times comes from being able to inform patients of wait times to immediate breast reconstruction at the time of surgical oncology appointment, the ability to direct patients to a surgeon team that will be able to provide immediate reconstruction within reasonable time frames, and the decreased surgeon downtime with the staggering of cases from the utilization of both operating rooms simultaneously.

The creation of the IRSW days was incremental, starting with the oncologic and reconstructive surgeon switching rooms after the first case, then adding a second switch to allow two reconstructions to be done, and then adding a third switch to allow three cases to be completed. The final step was preplanned, weekly IRSW days. Discussions were held with Anesthesia, the Department of Surgery, the Divisions of General and Plastic Surgery, nursing, operating room administration, and surgeons when we began switching rooms and again when we implemented preplanned weekly scheduling. Quality assurance work had identified wait time to surgery for IBR as a concern, and the resource-neutral nature of the IRSW scheduling request facilitated approval. Thereafter, on Tuesdays, an operating room has been assigned to General Surgery and Plastic Surgery, and each division assigns that time to a breast surgeon.

TABLE 3 Reason for mastectomy, type of surgery, and complications

	2009/10 cohort (n = 75)	2015 cohort (n = 138)
Reason for mastectomy		
Tumor too large for size of breast (%)	23 (30%)	44 (30%)
Multicentric/multifocal lesions (%)	15 (20%)	34 (23%)
Margins positive (%)	2 (3%)	2 (1%)
Margins close (< 2 mm) (%)	5 (7%)	4 (3%)
Contraindication to radiotherapy (%)	3 (4%)	5 (3%)
Previous cancer (%)	12 (16%)	0
Patient preference (%)	6 (8%)	30 (21%)
Recurrence (%)	2 (3%)	3 (2%)
Young patient (40 years) (%)	3 (4%)	9 (6%)
BRCA/other family history with cancer (%)	0	8 (6%)
BRCA/other family history prophylactic (%)	3 (4%)	3(2%)
Previous contralateral cancer (%)	1 (1%)	1 (1%)
Imaging negative cancer (%)	0	1 (1%)
Mastectomy type		
Nipple-sparing mastectomy (%)	0 (0%)	32 (22%)
Skin-sparing mastectomy (%)	75 (100%)	113 (78%)
Contralateral prophylactic mastectomy (%)	25 (33%)	44 (30%)
Reconstruction type		
Tissue expander (%)	50 (67%)	41 (28%)
Bioprosthesis/implant (%)	3 (4%)	92 (63%)
TRAM* (%)	22 (29%)	11 (7%)
DIEP* (%)	0 (0%)	0 (0%)
Other flap* (%)	0 (0%)	3 (2%)
Reason for return to OR within 3 months		
Mastectomy flap necrosis (%)	3 (4%)	14 (10%)
Nipple necrosis (%)	N/A	2 (1%)
Infection (%)		2 (1%)
Bleeding (%)		1 (1%)
Nipple core positive for cancer (%)	N/A	1 (1%)
Other (%)		
Implant loss at 1 year	0	3

BRCA, *BRCA1* or *BRCA2* gene mutation; TRAM, transabdominal myocutaneous flap; DIEP, deep inferior epigastric perforator flap

*Many flap procedures not done on immediate reconstruction swing room days

Challenges have been identified for having the IRSW day run effectively. Attention to detail is important with regards to scheduling, as the planning of the order of cases needs to balance the time that both the breast surgical oncologist and reconstructive surgeon will need in order to have the transitions between rooms run smoothly. When such details have been overlooked, one operating room may be waiting during the day and the other run overtime. Increased communication about the planned procedure between the breast surgical oncologist, the reconstructive surgeon, anesthesia, and nursing is needed prior to surgery and on the day of surgery. Flexibility is necessary in administrative perioperative routines, such as the sequence in which care providers speak to patients. Complete operative briefings, timeouts, and debriefings are essential to ensure that all team members are prepared for surgery. When timing is not optimal, we will adjust the order of cases, move up a nonreconstructive case to the middle of the day, adjust the room staffing for additional help at change over, and switch cases between the rooms to decrease the chance of the OR running overtime. However, despite these efforts, there are days where the OR does run over with IRSW scheduling, but we would estimate that this is no more frequent than with traditional IR scheduling. This could not be measured in our study as traditional IR scheduling often had noncancer cases at the end of the

day. A concern that has been raised by smaller hospitals is that they would not have enough cases to run a full IRSW day. Although we have the potential to do three or four IBR cases, the number of cases that are done varies from zero to four from week to week, depending on the type of surgery required or the number of cases needing reconstruction. The remainder of the day not used for reconstruction is filled as per usual by the breast surgical oncologist or reconstructive surgeon assigned to the day. No operating time is lost. Hospitals with smaller reconstructive needs could employ a similar strategy of scheduling a breast surgical oncologist and reconstructive plastic surgeon on the same day even if IBR would not happen every week; it is the potential to schedule these cases with minimal disruption that allows for the decrease in wait times and improvement in IBR rate. Oncoplastic procedures requiring the presence of a breast surgical oncology and plastic surgery can also be booked on these days.

A limitation of this study is that it is retrospective in nature and we are not able to obtain information about booking delays or decisions that may be being made at the time relating to access to reconstruction or patient or hospital factors that may have led to delay. We also do not know how many patients altered the desired cancer surgery due to access issues.

Factors affecting decision making for IBR have been studied and include patient education, patient and surgeon perceptions about IBR, and clinical concerns with cancer treatment.[18] Morrow studied patient perceptions on IBR decision making and found that the desire to avoid further surgery and clinical concerns with cancer treatment were the most common reasons to decline IBR, although systems issues were also reported.[19] We think that our increased reconstructive rate may be related to improving systems issues and decreasing cancer concerns from wait times, but this study does not assess these factors, and this is a limitation of the study. Understanding these will help to further improve patient care pathways.

It is also possible that other factors could have contributed to the decreased wait times. Other studies that we have undertaken show little difference in wait times to breast cancer surgery between 2009 and 2012 versus 2012 and 2015 at our center.[20,21] Furthermore, more cases were done in 2009/10 than 2015, suggesting that OR access was not the reason for improved wait times in 2015.

This OR scheduling strategy for breast reconstruction has facilitated improvement in our wait times for IBR for breast cancer treatment and improved our rate of IBR for patients having mastectomy to nearly half of our patients. This improvement has not used additional OR resources, and the basis of this strategy is intentional scheduling of a reconstructive plastic surgeon and breast surgical oncologist in the operating room on the same day. In order to improve the breast reconstruction rate following mastectomy in our province, other areas may benefit from strategies such as IRSW scheduling to increase opportunities for IBR.

CONCLUSIONS

This innovative scheduling model has contributed to improved wait times to breast cancer surgery and our breast cancer reconstruction rate without requiring additional operating room resources. Expansion of such multidisciplinary scheduling strategies to other centers may help to improve breast cancer reconstruction access in a resource-limited system.

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