

# SURGEON AND HOSPITAL CASELOAD INCREASE THE RISK OF REOPERATION AFTER BREAST-CONSERVING SURGERY: A POPULATION-BASED STUDY

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## Introduction

Surgery is the cornerstone of treatment for breast cancer. With the development of more conservative surgical techniques, many women diagnosed with breast cancer are suitable for breast-conserving surgery (BCS). One of the few disadvantages of BCS is the possibility of re-operation if the excision of the tumour is incomplete, margins are not clear of tumour cells or margins are clear but considered too close. It is therefore expected that a proportion of women who initially undergo BCS will require further surgery, often another BCS but sometimes TM.

Re-resection of breast cancer has many individual consequences such as poorer cosmetic outcome, emotional distress, delay in beginning adjuvant treatment, extended recovery period and probably a higher risk of local and distant recurrence. For the healthcare system it represents additional costs that could be avoided. Few studies have explored factors associated with risk of subsequent BCS and TM separately. Some of the determinants of re-operation risk are not modifiable. Others – such as those related to health service organisation or provision – are potentially modifiable, but have been little investigated. The aims of this study were: (i) to provide up-to-date population-based estimates of frequency of re-operation, (ii) to identify risk factors related to any type of re-operation, (iii) to identify risk factors related to subsequent TM in women who underwent re-operation.

## Methods

From the National Cancer Registry Ireland, we identified breast cancers diagnosed 2002-2008, for which the first surgical procedure was BCS. Cases that underwent one BCS were the baseline category and the main outcomes were two binary variables: re-resection by any method, and re-resection by mastectomy. For breast cancers that were re-resected more than once the most extensive resection procedure was considered. Poisson regression with robust error variance models were built and the clinical variables included were: T, N, M, subtype, grade, and screening detection. Age, area of residence, deprivation status, smoking and marital status were the socio-demographic variables included in the models. Significance of the variables was tested using Wald test to decide whether they were significant for the models.

## Results

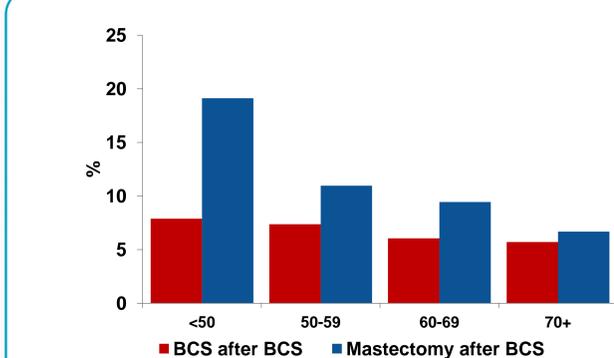
8318 women underwent initial BCS and 17% (n=1442) underwent at least one reoperation. Of those who underwent reoperation 38% (n=513) had BCS and 62% (n=894) mastectomy (table 1). Older women tended to undergo more BCS compared to the 50-59 age-group (figure 1). Risk of any reoperation and mastectomy was significantly increased in T2/3/4 cancers, with nodal involvement. HER2 over-expressing subtype was associated with any reoperation and luminal B with mastectomy (table 2). After adjusting for these clinical factors, risk of reoperation was also significantly raised in women having surgery in low-volume hospitals by low-volume surgeons compared to those operated in high-volume hospitals by high-volume surgeons; risk of mastectomy was increased if women were operated by a lower or intermediate volume surgeon (table 3). Whether cancers were screen-detected was unrelated to re-resection risk.

**Table 1. Number and type of re-operation in patients initially undergoing BCS.<sup>a</sup>**

Number and type of re-operations <sup>a</sup>	n	% (95% CI)
BCS	513	35.6 (33.1, 38.0)
TM	760	52.7 (50.1, 55.3)
BCS+TM	118	8.2 (6.8, 9.6)
2 BCS	30	2.1 (1.3, 2.8)
2 BCS+TM	15	1.0 (0.5, 1.6)
3 BCS	5	0.3 (0.0, 0.7)
3 BCS+TM	1	0.1 (0.0, 0.2)
Total	1442	100

<sup>a</sup> Within 4 months from the initial BCS.

**Figure 1. Reoperation rates by age-group (%).**



**Table 2. Incidence rate ratios (95%CI) for clinical factors included in the multivariate models.**

Clinical variables	Any re-operation IRR (95% CI)	Mastectomy IRR (95% CI)
<b>Residual disease</b>		
Negative	1.00	–
Positive	1.31 (1.15, 1.49)	–
Unknown	0.90 (0.76, 1.07)	–
<b>Subtype</b>		
Luminal A	1.00	1.00
Luminal B	1.03 (0.87, 1.22)	1.13 (1.00, 1.27)
HER2 over-expressing	1.60 (1.32, 1.94)	1.12 (0.97, 1.30)
TNBC	0.74 (0.60, 0.92)	0.86 (0.70, 1.05)
Unknown	0.99 (0.89, 1.11)	0.97 (0.87, 1.07)
<b>Grade</b>		
Low/intermediate	1.00	–
High	0.95 (0.85, 1.07)	–
Unknown	1.25 (1.06, 1.47)	–
<b>Tumour size</b>		
T1	1.00	1.00
T2	1.28 (1.15, 1.42)	1.16 (1.06, 1.27)
T3/T4	1.86 (1.55, 2.22)	1.52 (1.37, 1.69)
Unknown	0.92 (0.60, 1.43)	1.37 (1.00, 1.88)
<b>Nodal status</b>		
N0	1.00	1.00
N1	1.15 (1.04, 1.27)	1.10 (1.02, 1.20)
Unknown	0.82 (0.65, 1.05)	0.87 (0.68, 1.12)
<b>Metastasis</b>		
M0	1.00	1.00
M1	0.37 (0.23, 0.61)	0.94 (0.68, 1.30)
Unknown	0.87 (0.78, 0.96)	0.85 (0.78, 0.94)

**Table 3. Incidence rate ratios (95%CI) for socio-demographic and healthcare factors included in the multivariate models.**

Socio-demographic and healthcare variables	Any re-operation IRR (95% CI)	Mastectomy IRR (95% CI)
<b>Age</b>		
<50	1.26 (1.12, 1.42)	1.14 (1.04, 1.25)
50-59	1.00	1.00
60-69	0.82 (0.72, 0.94)	1.01 (0.90, 1.14)
70+	0.59 (0.49, 0.71)	0.93 (0.80, 1.08)
<b>Current smoker</b>		
No	1.00	1.00
Yes	0.83 (0.73, 0.94)	0.86 (0.77, 0.97)
<b>Screen-detected</b>		
No	1.00	–
Yes	0.82 (0.69, 0.96)	–
<b>Surgeon/hospital caseload<sup>a</sup></b>		
HV surgeon/HV hospital	1.00	–
HV surgeon/IV hospital	1.07 (0.90, 1.29)	–
HV surgeon/LV hospital	1.23 (0.87, 1.73)	–
IV surgeon/HV hospital	1.03 (0.86, 1.23)	–
IV surgeon/IV hospital	0.74 (0.60, 0.92)	–
IV surgeon/LV hospital	1.45 (1.19, 1.77)	–
LV surgeon/HV hospital	1.28 (1.04, 1.58)	–
LV surgeon/IV hospital	1.48 (1.23, 1.79)	–
LV surgeon/LV hospital	1.56 (1.33, 1.83)	–
<b>Surgeon caseload<sup>a</sup></b>		
HV surgeon	–	1.00
IV surgeon	–	1.20 (1.08, 1.33)
LV surgeon	–	1.17 (1.06, 1.30)

Hospital caseload: HV higher-volume ( $\geq 150$ –250 BC surgeries/year), IV intermediate-volume (70–150 BC surgeries/year), LV lower-volume ( $< 70$  BC surgeries/year); Surgeon caseload: HV higher-volume ( $\geq 70$  BC surgeries/year), IV intermediate-volume (35–69 BC surgeries/year), LV lower-volume (third tertile:  $< 35$  BC surgeries/year).

## Conclusions

Our study shows that surgeon and hospital volume influence risk of reoperation of any type and that surgeon volume influences the risk of subsequent TM, suggesting that some of those re-operations could be avoided by the centralisation of breast cancer management and the development of clearer guidelines on both the selection of women for BCS and the criteria for re-operation. Women diagnosed with breast cancer should be made aware of the possibility of re-operation when undergoing BCS: population-based data like this may inform the development of information resources to help enable them make informed treatment decisions.