

Inequalities in breast cancer reconstructive surgery according to social and locational status in Western Australia

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Aims: To study the effects of demographic, locational and social status and the possession of private health insurance in Western Australia on the likelihood of women receiving breast reconstructive surgery after surgery for breast cancer.

Methods: The WA Record Linkage Project was used to extract all hospital morbidity, cancer and death records of women with breast cancer in Western Australia from 1982 to 2001. Comparisons between those receiving and not receiving breast reconstructive surgery were made after adjustment for co-variables in Cox regression.

Results: Overall, 9.1% of women received breast reconstructive surgery after surgery for breast cancer. Women who were younger, with less co-morbidity and non-indigenous women were more likely to receive breast reconstructive surgery. Women in lower socio-economic groups were much significantly less likely to receive breast reconstructive surgery (RR 0.76; 95% CI 0.54–1.06). Women from rural areas were less likely to receive breast reconstructive surgery than those from metropolitan areas (RR 0.54; 95% CI 0.25–1.15) as were those treated in a rural hospital (RR 0.78; 95% CI 0.66–0.92). Treatment in a private hospital (RR 1.25; 95% CI 1.10–1.42) or with private health insurance (RR 1.25; 95% CI 1.08–1.39) independently increased the likelihood of breast reconstructive surgery.

Conclusion: The rate of breast reconstructive surgery was lower than expected with several factors found to affect the rate; women from disadvantaged backgrounds were less likely to receive breast reconstructive surgery than those from more privileged groups.

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Key words: breast-reconstructive surgery; locational disadvantage; social disadvantage; private health insurance; record linkage.

INTRODUCTION

For many women their breasts are a symbol of their femininity and sexuality. The loss of the breast, or part of the breast, after breast cancer surgery can have serious repercussions on their psychosocial health and relationships.^{1–3} Breast reconstructive techniques were first described in 1895, but it was not until the 1970s and 1980s that they became more commonly available.² Relatively few women decide to undergo reconstructive surgery, but whether this is for economic reasons or fears of interference with any future breast cancer treatments is uncertain. Figures from the United States (US) cite reconstructive rates between 9 and 30% during the 1990s.³ There is a greater uptake in younger, less

socio-economically disadvantaged women^{4–7} and those outside the Southern or Midwestern states.⁶

In Australia, trends and predictors of reconstructive surgery have received little attention. The question remains open as to whether all eligible women are given equal opportunity to undergo breast reconstructive surgery. We used the WA Record Linkage Project to examine factors affecting reconstructive surgery rates after surgery for breast cancer in Western Australia (WA) from 1982 to 2000. Specifically, we investigated the role of social and locational status and the possession of private health insurance on the uptake of breast reconstructive surgery.

PATIENTS AND METHODS

Linked data and case selection

The WA Record Linkage Project was used to extract all

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hospital morbidity, cancer registrations and death records of all women, residing in WA, with any mention of breast cancer in any record from 1st January 1982 to 31st December 2000. The ICD codes used for this extraction were ICD-9 170.0–170.9 and ICD-10 C50.0–C50.9^{8–11}. The linkages were those current at 1st October 2001.

A case was defined as a female with a diagnosis of breast cancer on either their hospital separation record or a cancer registration, indicating a primary diagnosis of breast cancer together with a surgical procedure code for mastectomy or breast-conserving surgery.

There were 11 206 cases that met the above definition and, had undergone mastectomy or breast-conserving surgery as their first surgical procedure. Most cases had a linked breast cancer registration ($n = 10\,687$, 95%). A death was recorded for 3059 (27%) of the cases and in 1944 (63%) of these breast cancer was the given cause of death. There were 134 074 linked hospital morbidity records for the 11 206 cases and for 1025 (9.1%) a surgical procedure code for breast reconstructive surgery appeared on the record of the index or subsequent episode.

The Charlson Morbidity Index was used to account for the effects of co-morbidity.^{12–14} This index consisted of 17 groups of ICD codes weighted according to mortality risk. The total weight was used in the regression analysis to adjust for co-morbidity. Only co-morbidity present at the time of the admission for the primary breast cancer procedure or identified in the hospital morbidity records in the previous 365 days contributed to the index.

Assignment of indices of status

The WA Record Linkage Project assigns geocodes (latitudes and longitudes) to records based on residential address. These geocodes are mapped onto Australian Bureau of Statistics (ABS) Collection Districts (CDs), each of which contains approximately 200 dwellings in urban areas and fewer in rural and remote areas. This enables the assignment of social status and remoteness indices based on the CD.^{15,16} ABS does not publish data on CDs where populations are small and publication could lead to identification of households. Moreover, due to technical limitations, geocodes on the WA records have not been completely mapped. In instances where a CD was not available (16%) the social disadvantage and remoteness indices were based on postcode. After this procedure less than 1% of cases were missing social disadvantage or remoteness indices.

The accessibility/remoteness index of Australia (ARIA) was used to represent the degree of locational disadvantage. Each CD was assigned to an ARIA category, however, CD to ARIA mapping was only available from the 1996 census onwards and thus the 1991 CDs in the study file were first mapped to 1996 CDs to allow for

ARIA index assignment. Index records where the residential CD was missing were reassigned an ARIA index from another linked hospital separation record, being the closest in time to the missing record. This was on the proviso that the missing CD occurred within five years of the admission with the CD, and secondly, the postcode of both admissions was the same.

The index of relative socio-economic disadvantage (IRSD), based on Western Australian census data for 1991 and 1996 at the CD and postcode levels, is published by the ABS. Based on household and individual attributes, the IRSD has five categories dividing the population into quartiles of disadvantage with the lowest quartile subdivided into the 15 and 10% most disadvantaged.¹⁶ The IRSD was matched to the CD of each linked record in the file, or if a CD was unavailable, to the postcode. Analysis using IRSD or ARIA codes was restricted to admissions occurring after 1st January 1991, when CDs first became available via address mapping.

Analysis of the patterns of surgical care

Initial descriptive analysis followed by univariate analysis of study factors using Chi squared (χ^2) testing was performed. Crude and adjusted Cox regression analyses of the likelihood of receiving breast reconstructive surgery were carried out with follow-up commencing from the date of admission for the primary surgical treatment and ending with either the date of admission for breast reconstruction, a censoring date of 31st December, 2000 or the date of death of cases that had died earlier on. Breast reconstructive surgery was defined under four categories, breast reconstruction, nipple reconstruction, breast augmentation mammoplasty and breast reduction mammoplasty presumed to have been sought primarily to reduce the size of the contra lateral breast. The Box–Tidwell transformation ($\text{age} \times \ln[\text{age}]$) was placed in the regression models with a continuous age co-variate to achieve the best-fit for adjustment purposes. The data analysis was carried out using SPSS Version 10.¹⁷ The Human Research Ethics Committee of The University of Western Australia granted ethics approval for the study.

RESULTS

The characteristics of the 1021 women who underwent breast reconstructive surgery after either a mastectomy or breast-conserving surgery for breast cancer between 1982 and 2000 are shown in Table 1. Women who underwent reconstructive surgery were generally younger, non-indigenous and had less co-morbidity. They were less likely to be socially disadvantaged and more likely to live in or have been treated in the metropolitan area. They were also more likely to have

Table 1 Characteristics of breast cancer patients who underwent reconstructive breast surgery after either mastectomy or breast-conserving surgery in Western Australia 1982–2000

Independent variable	Total number per category <i>n</i> (%)	Reconstructive surgery		
		%	<i>p</i> -Value	
Calendar period (by year of admission) (<i>n</i> = 11 205)				
1982–1986	2021 (18.0)	8.3	0.185	
1987–1991	2366 (21.1)	9.2		
1992–1996	3433 (30.6)	8.8		
1997–2000	3385 (30.2)	9.9		
Age at admission (<i>n</i> = 11 205)				
Age group less than 50 years	3457 (30.9)	19.9	<0.001	
Age group 50 years or more	7748 (69.1)	4.3		
Age group less than 60 years	6133 (54.7)	15.1	<0.001	
Age group 60 years or more	5072 (45.3)	1.9		
Charlson weighted co-morbidity index (<i>n</i> = 11 205)				
Co-morbidity weight 0–2	8450 (75.4)	9.7	<0.001	
Co-morbidity weight 3–4	505 (4.5)	2.4		
Co-morbidity weight 5–11	2250 (20.1)	8.5		
Marital status (<i>n</i> = 11 205)				
Never married	668 (6)	11.1	<0.001	
Widowed	1991 (17.8)	2.1		
Divorced/separated	874 (7.8)	13.4		
Married or defacto	7499 (66.9)	10.4		
Unknown	173 (1.5)	6.4		
Indigenous status (<i>n</i> = 11 175)				
Non-indigenous/undetermined status	11 024 (98.6)	9.2	1.0	
Indigenous	151 (1.4)	5.3		
IRSD 1991–2000 inclusive (<i>n</i> = 7295)				
Least disadvantaged	1	2106 (28.9)	12.4	<0.001
	2	1698 (23.3)	9.6	
	3	1934 (26.5)	7.7	
	4	993 (13.6)	6.5	
	5	564 (7.7)	7.3	
Most disadvantaged				
Location of hospital (<i>n</i> = 11 205)				
Metropolitan	9049 (80.8)	9.3	0.081	
Rural	2156 (19.2)	8.1		
Area remoteness indices for Australia 1991–2000 inclusive (<i>n</i> = 7303)				
Highly accessible	6253 (85.6)	9.6	0.018	
Accessible	457 (6.3)	6.6		
Moderately accessible	361 (4.9)	7.5		
Remote	124 (1.7)	15.3		
Very remote	108 (1.5)	7.4		
Insurance status (<i>n</i> = 11 205)				
Public for main package of care	5636 (50.3)	7.2	<0.001	
Private for main package of care	5569 (49.7)	11.1		
Hospital status (<i>n</i> = 11 205)				
Public	6387 (57.0)	7.3	<0.001	
Private	4818 (43.0)	11.5		

been treated in a private hospital or to possess private health insurance.

The breast reconstructive surgery rates increased by 1.6% points (from 8.3 to 9.9%) over the 18 years of the study. The number of women undergoing reconstruction doubled from 167 in 1982–1986 to 335 in 1997–2000.

In this study women of indigenous descent had half the rate of reconstructive surgery compared with non-indigenous Australians.

Overall, breast reconstructive surgery was uncommon. Only 9.1% of patients underwent one or more reconstructive procedures (Table 2). Reconstructive surgery was more common after mastectomy (11.2%) than after breast-conserving surgery (6.9%). Most of the women who underwent reconstructive surgery had only one procedure (59%), 28% had two procedures and 13% had three or more procedures. Breast reconstruction alone or in combination with augmentation mammoplasty or nipple reconstruction, was the most common procedure, accounting for 87% of those who received reconstructive surgery (Table 2). The cumulative incidence curves for the first reconstructive procedure in each of several year of admission categories are shown in Figure 1. They show that there was a marked increase in the uptake of early reconstructive surgery in the most recent calendar period, 1997–2000.

Cox regression, after adjustment for demographic factors, confirmed that women were more likely to undergo reconstructive surgery if they were younger, separated or divorced, non-indigenous and had less comorbidity (Table 3). Women who had undergone their primary surgery for breast cancer in a rural hospital or who lived in a rural area were less likely to have had reconstructive surgery. Similarly, women from lower socio-economic groups (IRSD 2–5) were less likely to undergo reconstructive surgery. If the primary surgery for the breast cancer was performed in a private hospital, or if the woman possessed private health insurance, they were considerably more likely to undergo reconstructive surgery (Table 3).

A second Cox regression analysis on the later years (1991–2000) was adjusted simultaneously for the social, locational and health insurance factors; these were

unavailable for the earlier years. It showed similar results, but with some weakening of associations observed in the models adjusted only for demographic factors.

DISCUSSION

Access to breast reconstructive surgery has not been equitably distributed across socio-demographic groups with women, who were younger, not of indigenous descent or in less socially disadvantaged groups much more likely to receive breast reconstructive surgery, as were women in metropolitan areas. Women with private health insurance or treated in a private hospital at the time of their primary breast cancer surgery were also more likely to receive breast reconstructive surgery even after adjustment for other co-variates.

The use of linked administrative data, and in particular the WA Record Linkage Project, is a valuable tool in health services research, and this study provides a further demonstration of this.^{18–20} The study found a considerable delay in time to reconstructive surgery in some cases and the possibility exists that women who underwent their primary surgery for breast cancer in later years may still decide to undergo reconstruction in the future. However, this would not account for the strong socio-demographic differences found in this study, especially with the marked trend towards earlier reconstructive surgery. This study utilised state-based data, therefore any women who went interstate or overseas for their reconstructive surgery would have been missed. However, population movements in this age group in WA are low and going interstate for surgery is thought to be uncommon. Women who had reconstructive surgery performed in a physician's private rooms would also have been overlooked using hospital administrative data. However, this seems rare in WA, with the exception of tattooing of the areola.

This study found that younger women were more likely to undergo reconstructive surgery. This concurs with the findings of Polednak,^{4,5,21} Morrow⁶ and Desch⁷ in the US and Charavel³ in France. Marital status has not previously been shown to affect the demand for

Table 2 Reconstructive breast surgery after mastectomy or breast-conserving primary surgery in women with breast cancer in Western Australia 1982–2000

Type of surgery	Postmastectomy <i>n</i> = 5882, % (<i>n</i>)	Postbreast-conserving surgery <i>n</i> = 5323, % (<i>n</i>)	Total % (<i>n</i>)
Any reconstructive surgery*	11.1 (654)	6.9 (367)	9.1 (1021)
Augmentation	2.2 (129)	0.8 (40)	1.5 (169)
Mammoplasty	2.8 (164)	2.1 (111)	2.5 (275)
Reconstruction	9.9 (584)	5.7 (304)	7.9 (888)
Nipple reconstruction	3.0 (176)	1.5 (82)	2.3 (258)

*The sum of the individual procedures exceeds that of the 'any reconstructive surgery' as some women had more than one reconstructive procedure.

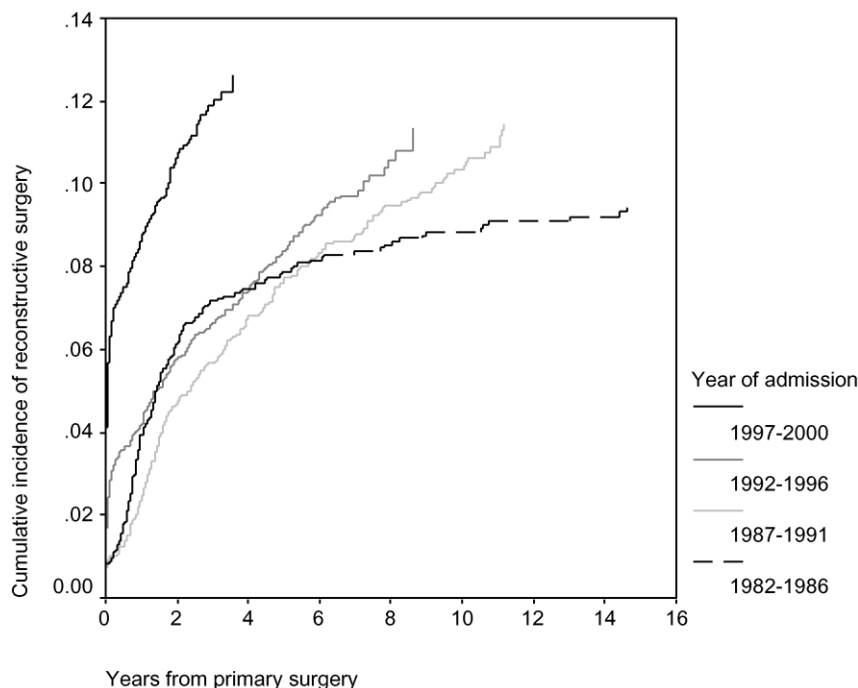


Figure 1 Days to reconstructive surgery after primary surgery for breast cancer for women in Western Australia 1982–2000.

reconstructive surgery.^{3,4} Women who were divorced or separated, however, were shown in this study to undergo reconstructive surgery more often, although the reasons behind this were not explored.

The impact of co-morbidity on the uptake of breast reconstructive surgery has not been reported before in the literature. Apparently, it has a limiting effect on uptake that is independent of age.

The effects of social status on the uptake of breast reconstructive surgery were profound, with a 40% reduction between the least disadvantaged group and most disadvantaged groups.³ In the US poverty but not race has been shown to be associated with a lower rate of breast reconstructive surgery.^{4–6,21}

The use of reconstructive surgery in Western Australian patients with breast cancer is low. For all women, even in recent years (1997–2000) the rate of reconstructive surgery was around half that in the US. This compares with rates of 16–30% in more affluent and urban areas of the US, although in poorer and more rural areas the rates are on a par.^{4, 5,21,22} In Australia, there is a publicly funded universal system of health care alongside ‘community-pooled risk’ private health insurance schemes available to anyone who can afford the government-subsidised premiums. Reconstructive surgery is available in both the public and the private sectors, although it is more likely to be undertaken in the private sector. Whether this is by patient choice, education, socio-economic status or due to the recommendation of the surgeon is unknown. The lower rates in both the public and private sector in Australia relative to the

US are difficult to explain other than by differences in social and *medical* culture.

Polednak⁵ found that more rural states in the US had significantly reduced rate of reconstruction, as did we. Factors which may limit women’s treatment choices in rural areas include travel, time and barriers to communication.²³

This study has shown that even in a country which provides universal health care, groups with disadvantage do badly in terms of breast reconstructive surgery following malignant disease.

This is the first study to demonstrate that social and locational status and the possession of private health insurance all exhibit measurable and independent effects on the receipt of breast reconstructive surgery in Australia. A number of policy options are available to assist with improving the rate of reconstructive surgery both for women in general and, in particular, for those from disadvantaged groups. These may include, education for all surgeons on the psychosocial sequelae experienced by many women and the expectations of reconstructive surgery, and in rural areas updating surgeons on breast-reconstructive surgery techniques. In areas where the provision of reconstructive surgery is not feasible, resources to assist women to travel to the metropolitan area should be readily available to those in need. In parallel, consumer education about reconstructive surgery options is required, in forms suitable for all social groups. The development of guidelines for breast reconstructive surgery are also required.

Table 3 Cox regression analysis of the likelihood of reconstructive breast surgery after surgery for breast cancer according to demographic, social and locational disadvantage and the possession of private health insurance

Factor	1982–2000 Adjusted relative risk* (95% CI)	1991–2000 Adjusted relative risk† (95% CI)
Calendar period (by year of admission)	1.00	N/A
1982–1986	1.00	
1987–1991	1.28 (1.04–1.57)	1.00
1992–1996	2.01 (1.64–2.46)	1.62 (1.17–2.25)
1997–2000	4.21 (3.41–5.20)	3.46 (2.47–4.82)
Age	1.58 (1.29–1.94)	1.79 (1.36–2.36)
Per year	0.23 (0.21–0.27)	1.12 (0.87–1.46)
Age greater than 50 years	0.14 (0.11–0.17)	0.53 (0.38–0.76)
Age greater than 60 years	1.00	1.00
Charlson weighted co-morbidity index	0.61 (0.34–1.08)	0.52 (0.26–1.05)
0–2	0.75 (0.64–0.88)	0.72 (0.60–0.86)
3–4	1.00	1.00
5–11	0.97 (0.65–1.45)	0.91 (0.54–1.55)
Marital status	1.49 (1.11–2.00)	1.36 (0.94–1.96)
Never married	1.07 (0.84–1.37)	1.02 (0.75–1.37)
Widowed	0.66 (0.35–1.25)	0.72 (0.36–1.44)
Divorced/separated	0.52 (0.26–1.04)	0.70 (0.31–1.59)
Married/de facto	1.00	1.00
Unknown	0.81 (0.67–0.98)	0.84 (0.69–1.03)
Indigenous status (no/yes)	0.70 (0.57–0.85)	0.73 (0.59–0.91)
IRSD (index)	0.63 (0.48–0.83)	0.66 (0.50–0.86)
Least disadvantaged	0.76 (0.54–1.06)	0.82 (0.58–1.16)
1	0.78 (0.66–0.92)	1.11 (0.79–1.56)
2	1.00	1.00
3	0.68 (0.47–0.99)	0.69 (0.42–1.12)
4	0.71 (0.48–1.04)	0.72 (0.44–1.10)
5	1.34 (0.85–2.13)	1.35 (0.77–2.34)
Most disadvantaged	0.54 (0.25–1.15)	0.55 (0.24–1.25)
Location of hospital (rural/metropolitan)	1.25 (1.08–1.39)	1.10 (0.94–1.29)
ARIA (index)	1.25 (1.10–1.42)	1.10 (0.94–1.29)
Very accessible		
Accessible		
Moderate accessible		
Remote		
Very remote		
Insurance status (private/public)		
Hospital status (private/public)		

*For the adjusted OR 1982–2000, each factor was adjusted for age, Box–Tidwell transformation of age, calendar period, Charlson index, indigenous status and marital status, except where it was the factor of interest.

†For the adjusted OR 1991–2000, each factor was adjusted for age, Box–Tidwell transformation of age, calendar period, Charlson index, indigenous status, marital status, ARIA, IRSD, location of hospital, and insurance status except where it was the factor of interest.

We conclude that the provision of breast reconstructive surgery for breast cancer, especially in disadvantaged women, is deficient in Australia.

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