
ORIGINAL ARTICLE

UNEQUAL ACCESS TO BREAST-CONSERVING SURGERY IN WESTERN AUSTRALIA 1982–2000

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Background: The purpose of the present study was to examine the effects of demographic, locational and social disadvantage and the possession of private health insurance in Western Australia on the likelihood of women with breast cancer receiving breast-conserving surgery rather than mastectomy.

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 2000 inclusive. Comparisons between those receiving breast-conserving surgery and mastectomy were made after adjustment for covariates in logistic regression.

Results: Younger women, especially those aged less than 60 years, and those with less comorbidity were more likely to receive breast-conserving surgery (BCS). In lower socio-economic groups, women were less likely to receive BCS (OR 0.73; 95% CI 0.60–0.90). Women resident in rural areas tended to receive less BCS than those from metropolitan areas (OR 0.84; 95% CI 0.55–1.29). Women treated in a rural hospital had a reduced likelihood of BCS (OR 0.74; 95% CI 0.61–0.89). Treatment in a private hospital reduced the likelihood of BCS (OR 0.70; 95% CI 0.54–0.90), while women with private health insurance were much more likely to receive BCS (OR 1.39; 95% CI 1.08–1.79).

Conclusion: Several factors were found to affect the likelihood of women with breast cancer receiving breast-conserving surgery, in particular, women from disadvantaged backgrounds were significantly less likely to receive breast-conserving surgery than those from more privileged groups.

Key words: breast-conserving surgery, locational disadvantage, private health insurance, record linkage, social disadvantage.

Abbreviations: ABS, Australian Bureau of Statistics; ARAI, Accessibility/Remoteness Index of Australia; BCS, breast-conserving surgery; CD, collector district; ICD, International Classification of Diseases; IRSD, Index of Relative Socio-economic Disadvantage; NHMRC, National Health and Medical Research Council.

INTRODUCTION

Breast cancer is the most common malignancy in Australian women, with one in 11 women being diagnosed before age 75 years.¹ The majority of patients undergo surgery, with or without adjuvant therapy. Originally, the surgery was radical, consisting of removal of not just the breast tissue and surrounding lymph nodes, but also the underlying pectoral muscles. Over the years, the procedure was refined, allowing more breast tissue to be conserved, such that complete local excision of the tumour (with clear histological margins) and clearance of axillary lymph nodes is now the treatment of choice. These changes have been informed by the international literature over the last 20 years² and have been synthesized in the National Health and Medical Research Council's (NHMRC) *Clinical Practice Guidelines for the Management of Early Breast Cancer* released in 1995.³ These treatment changes have been assisted by the advent of improved adjuvant therapies, including radiotherapy. Conservation of breast structures has led to less mental and physical health problems postsurgery, with less depression, improved body image and

less concern with sexuality. These outcomes have been achieved with no reduction in cancer survival.^{3–7} Not all breast cancers are suitable for such limited surgery, and mastectomy is still appropriate in women with tumours that are extensive, have poorly defined histological margins, or in women who select mastectomy for personal reasons.³

Despite these improvements, the question remains as to whether all women are given equal opportunity to undergo breast-conserving surgery, or if some are effectively discriminated against for reasons of social or locational disadvantage or because they do not possess private health insurance. We used the WA Record Linkage Project to examine factors affecting the treatment of women with breast cancer in Western Australia from 1982 to 2000. Specifically, we investigated the role of locational and social disadvantage and the possession of private health insurance on the uptake of breast-conserving surgery.

PATIENTS AND METHODS

Linked data and case selection

The WA Record Linkage Project was used to extract all hospital morbidity, cancer registrations and death records of all women, resident in WA, with any mention of breast cancer in any record. The International Classification of Diseases (ICD) codes used for this initial extraction are presented in Appendix I. The linkages were those current at 1 October 2001. A case was defined as a female with a hospital separation record with a surgical procedure for primary breast cancer and a diagnosis of primary breast

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cancer in the cancer registry or, in cases with no cancer registration, a breast cancer diagnosis on their hospital separation record. The incident date was defined by either the date of diagnosis recorded by the Cancer Registry for primary breast cancer or the date of admission on the first hospital separation record for a primary breast cancer if there was no cancer registration. Only patients with an incident date between 1 January 1982 and 31 December 2000 were included in the study.

There were 11206 cases that met the above definition and had undergone mastectomy or breast-conserving surgery as their first surgical procedure. There was a linked breast cancer registration for 10 687 (95%) of the surgical cases and there were 134 074 linked hospital morbidity records. For 3059 (27%) of the surgical cases there was a death recorded, 1944 (63%) of which recorded breast cancer as the underlying cause of death.

Comorbidity was analysed using the Charlson Morbidity Index.^{12–14} It consisted of 17 groups of ICD codes, which were weighted according to mortality risk (breast cancer neoplasms were removed). The total weight was used in the regression analysis to control for comorbidity. Only comorbidity 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 was included in the analysis.

Assignment of indices of disadvantage

A feature of the WA Record Linkage Project is that Australian Bureau of Statistics' (ABS) collector districts (CDs) are assigned to the records based on residential address. ABS social and locational disadvantage indices can then be linked to each CD.^{15,16} Each CD contains approximately 200 dwellings in an urban area and fewer in rural and remote areas. ABS does not publish data on CDs where populations are small and publication could lead to identification of households. In instances where a CD was unavailable, 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 degree of locational disadvantage was represented by the Accessibility/Remoteness Index of Australia (ARIA).¹⁶ An ARIA category was assigned to each CD; however, CD to ARIA mapping was only available from the 1996 census onwards. Thus, the 1991 CDs in the study file were first mapped to 1996 CDs to allow for ARIA index assignment.

The Index of Relative Socio-economic Disadvantage (IRSD) was based on ABS Western Australian census data for 1991 and 1996 at the CD and postcode levels.¹⁵ Based on household and individual attributes, the IRSD had five categories dividing the population into quartiles of disadvantage with the lowest quartile subdivided into the lowest 10% and next 15% most disadvantaged.¹⁵ Analysis using IRSD or ARIA codes was restricted to admissions occurring after 1 January 1991, when CDs first became available by means of address mapping.

Analysis of the patterns of surgical care

Univariate analysis followed by crude and adjusted logistic regression analyses using the likelihood of receiving breast-conserving surgery as the binary dependent variable were carried out. Breast-conserving surgery was defined as lumpectomy with or without auxiliary clearance and all more radical surgery, as mastectomy (Appendix I). For the age variable, the Box-Tidwell term ($\text{age} \times \ln[\text{age}]$) was used to produce the best fit model for

adjustment purposes. Although indigenous status had no statistically significant effect in any of the regression analyses, it was retained in the model because of its a priori credibility as a potential confounder. Analysis of the data was carried out using SPSS Version 10.0.7 (SPSS, Chicago, IL, USA).¹⁷ The Human Research Ethics Committee of the University of Western Australia granted approval for this study.

RESULTS

The characteristics of the breast cancer patients who underwent mastectomy ($n = 5882$, 52.5%) or breast-conserving surgery ($n = 5324$, 47.5%) are presented in Table 1. Markers of social and locational disadvantage and being treated in a rural hospital decreased the likelihood of receiving breast-conserving surgery. Strongly positive determinants of breast-conserving surgery were admission in a more recent calendar period, a low level of comorbidity and age under 60 years. Figure 1 shows the rising trend in use of breast-conserving surgery from 13.7% in 1982 to 70.6% in 2000 and the continuation of the trend after the release of the 1995 NHMRC clinical practice guidelines.³ (Fig. 1 and Table 1).

Two sets of logistic regression models were carried out. The first model adjusted for demographic factors only and included all the years from 1982 to 2000. The second model is for the years 1991–2000 when the socio-economic and locational indices were available and thus the model was adjusted for these factors as well as the demographic factors. Logistic regression for the years 1982–2000, confirmed that women were more likely to receive breast-conserving surgery, after adjustment for other factors, if they were treated more recently, were younger, had less comorbidity or described themselves as divorced or separated (Table 2). The IRSD was an important determinant of who received breast-conserving surgery. Women in the second-least disadvantaged category were less likely than women in the first

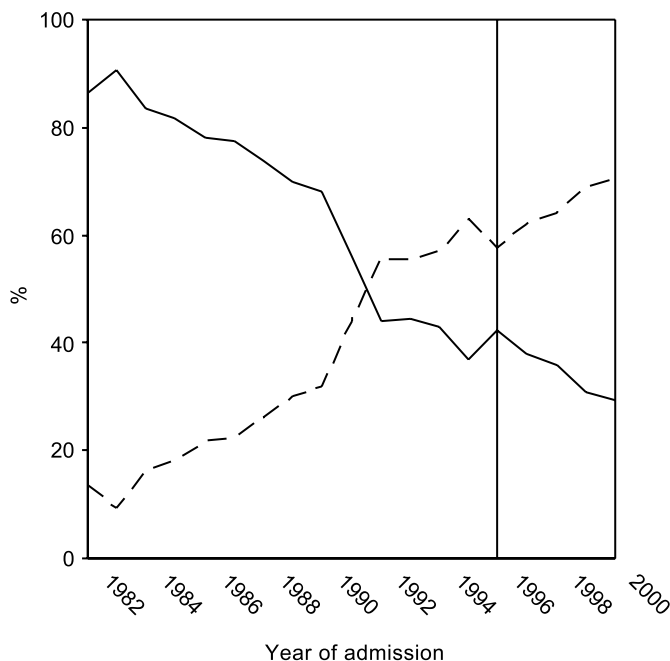


Fig. 1. Proportion of women who underwent mastectomy or breast-conserving surgery annually in Western Australia 1982–2000. —, Mastectomy; - - -, breast-conserving surgery.

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

Independent variable	Total number per category <i>n</i> (%)	Breast conserving surgery (%)	<i>P</i> -value	
Calendar period (by year of admission) (<i>n</i> = 11206)				
1982–1986	2021 (18.1)	16.1		
1987–1991	2366 (21.1)	31.4		
1992–1996	3434 (30.6)	58.1	<0.001	
1997–2000	3385 (30.2)	66.8		
Age at admission (<i>n</i> = 11206)				
Age group less than 60 years	3458 (30.9)	50.6		<0.001
Age group 60 years or more	7748 (69.1)	43.8		
Charlson weighted comorbidity index (<i>n</i> = 11206)				
Comorbidity weight 0	8228 (73.4)	48.9	<0.001	
Comorbidity weight 1–2	670 (6.0)	51.9		
Comorbidity weight 3–14	2308 (20.6)	41.3		
Marital status (<i>n</i> = 11206)				
Never married	668 (6)	47.5	<0.001	
Widowed	1991 (17.8)	40.8		
Divorced/separated	874 (7.8)	54.3		
Married or de facto	7500 (66.9)	48.4		
Unknown	173 (1.5)	52.0		
Indigenous status (<i>n</i> = 11176)				
Non-indigenous/undetermined status	11025 (98.6)	47.6	0.90	
Indigenous	151 (1.4)	47.0		
Index of Relative Socio-economic Disadvantage 1991–2000 inclusive (<i>n</i> = 7296)				
Least disadvantaged	1	2106 (28.9)	<0.001	
	2	1698 (23.3)		
	3	1934 (26.5)		
	4	994 (13.6)		
Most disadvantaged	5	564 (7.7)		
Location of hospital (<i>n</i> = 11206)				
Metropolitan	9049 (80.8)	48.6	<0.001	
Rural	2157 (19.2)	42.8		
Area Remoteness Indices for Australia 1991–2000 inclusive (<i>n</i> = 7304)				
Highly accessible	6253 (85.6)	61.8	0.02	
Accessible	458 (6.3)	57.9		
Moderately accessible	361 (4.9)	54.3		
Remote	124 (1.7)	62.1		
Very remote	108 (1.5)	55.6		
Payment classification (<i>n</i> = 11178)				
Public for main package of care	5550 (49.7)	48.2	0.17	
Private for main package of care	5628 (50.3)	46.9		
Hospital status (<i>n</i> = 11206)				
Public	6388 (57.0)	47.2	0.40	
Private	4818 (43.0)	48.0		

category to receive breast-conserving surgery, with further declines in the most disadvantaged patients. Women treated in rural hospitals were much more likely to receive a mastectomy as their primary surgical treatment than those treated in metropolitan hospitals. Those resident outside of the metropolitan areas were also more likely to receive a mastectomy. Women who possessed private health insurance were more likely to receive breast-conserving surgery. Thus, socially and locationally disadvantaged women and those without private health insurance were significantly less likely to receive breast-conserving surgery.

A similar picture was seen in the second logistic regression model for 1991–2000; however, it is less clear. This may be because of the smaller number of women available for the analysis, especially in the rural and remote areas.

DISCUSSION

The results of this study showed that breast-conserving surgery increased 5-fold in Western Australia between 1982 and 2000, but the increase was not evenly distributed across all socio-demographic groups. Women in more socially disadvantaged groups were much less likely to receive breast-conserving surgery, as were those without private health insurance. Residence in a rural or remote area also decreased the likelihood of breast-conserving surgery, especially if the surgery was in a rural hospital. In contrast, younger women, women who were divorced or separated and women who had less comorbidity at time of diagnosis were more likely to undergo breast-conserving surgery.

Table 2. Logistic regression analysis of the likelihood of breast-conserving surgery for breast cancer according to demographic, social and locational disadvantage and the possession of private health insurance

Factor	1982–2000† Adjusted Odds Ratio (95% CI)	1991–2000‡ Adjusted Odds Ratio (95% CI)
Calendar period (by year of admission)		
1982–1986	1.00	N/A
1987–1991	2.53 (2.18–2.93)	1.00
1992–1996	8.30 (7.21–9.54)	1.86 (1.54–2.25)
1997–2000	12.38 (10.73–14.28)	2.78 (2.29–3.36)
Age (per year)	0.99 (0.98–0.99)	0.99 (0.98–0.99)
Charlson weighted comorbidity index		
Comorbidity weight 0–2	1.00	1.00
Comorbidity weight 3–4	1.01 (0.85–1.21)	0.90 (0.74–1.10)
Comorbidity weight 5–11	0.49 (0.44–0.55)	0.43 (0.38–0.48)
Marital status		
Never married	1.00	1.00
Widowed	1.04 (0.85–1.28)	1.07 (0.83–1.37)
Divorced/separated	1.32 (1.05–1.65)	1.37 (1.05–1.80)
Married/defacto	1.12 (0.93–1.33)	1.10 (0.90–1.37)
Unknown	0.86 (0.60–1.22)	0.89 (0.61–1.32)
Indigenous status (no/yes)	0.86 (0.60–1.21)	1.09 (0.72–1.65)
IRSD (index)		
Least disadvantaged 1	1.00	1.00
2	0.84 (0.73–0.96)	0.85 (0.74–0.98)
3	0.77 (0.67–0.89)	0.81 (0.70–0.93)
4	0.79 (0.67–0.92)	0.80 (0.68–0.95)
Most disadvantaged 5	0.72 (0.59–0.88)	0.73 (0.60–0.90)
Location of hospital (rural/metropolitan)	0.74 (0.64–0.84)	0.74 (0.61–0.89)
ARIA (index)		
Very accessible	1.00	1.00
Accessible	0.83 (0.68–1.00)	1.02 (0.81–1.27)
Moderately accessible	0.70 (0.56–0.88)	0.82 (0.65–1.04)
Remote	0.94 (0.64–1.38)	1.07 (0.73–1.56)
Very remote	0.72 (0.47–1.10)	0.84 (0.55–1.29)
Payment classification private	0.97 (0.89–1.05)	1.39 (1.08–1.79)
Hospital status private	0.93 (0.86–1.01)	0.70 (0.54–0.90)

ARIA, Accessibility/Remoteness Index of Australia; IRSD, Index of Relative Socio-economic Disadvantage.

†For the adjusted OR 1982–2000, each factor was adjusted for 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, calendar period, Charlson index, indigenous status, marital status, ARIA, IRSD, location of hospital, insurance and hospital status except where it was the factor of interest.

A declining trend in the odds of breast-conserving surgery from the least to most socio-economically disadvantaged women was observed in this study, with those most disadvantaged being significantly less likely to undergo breast-conserving surgery. Kricke *et al.* in New South Wales² also found that women in more disadvantaged groups were less likely to receive breast-conserving surgery, but in their study, this did not reach significance. There are several potential explanations for these differences. It is possible that women in lower socio-economic groups are presenting with larger tumours that are less amenable to breast conserving surgery. This has been observed in several US studies^{18–22} and is supported by a study that found that Western Australian women in lower socio-

economic groups were less likely to attend for screening mammography.²³ However, other studies have found no significant relationship between socio-economic deprivation and tumour size and/or pathology.^{24–27} Studies from the USA,^{18,28} Scotland²⁷ and Denmark²⁹ similarly examined the effect of socio-economic status on breast-conserving surgery, they found that women in poorer groups were more likely to receive mastectomy independent of tumour size or stage. While some of the variation in the odds of breast-conserving surgery amongst socio-economic groups may be attributable to stage of disease at presentation, it is likely that contributing factors may also include fear of cancer recurrence, fear of radiation, surgeon preference and other psychosocial reasons.^{3,30–33}

Rural and remote women were less likely to receive breast-conserving surgery than women living in metropolitan areas, and in particular, women treated in rural hospitals were considerably less likely to receive breast-conserving surgery. This is consistent with results reported by Kricger *et al.*² and Craft *et al.*³⁴ in Australia and Paszat *et al.*⁶ in Canada. A survey of Western Australian women found that women living in rural areas were more likely to choose mastectomy.³³ This is in contrast to a Victorian study³⁵ that reported that 68% of rural women in a 3-year retrospective study had breast-conserving surgery compared with 45% seen in metropolitan centres² or the 34% reported in other rural populations.³⁴ As Furnival⁴ highlights, many factors serve to limit women's treatment choices in rural areas, including travel, time and communication. This applies especially where a treatment modality is unavailable locally, such as is the case with adjuvant chemotherapy or radiotherapy or specialist surgeons in Western Australia. Travelling distances to receive radiotherapy as little as 65 km have been shown to affect whether a woman chooses mastectomy or breast conserving surgery³⁶ and in a state as large as WA, distance is a major disadvantage.

It is also possible that women from rural and remote areas are presenting more often with tumours that require mastectomy; however, this is not supported by reports from BreastScreen, the state public breast screening programme, which show that women from rural areas present for mammography screening more frequently than women living in metropolitan Perth.³⁷ There is also the possibility that women might be unaware of the treatment choices available and settle for their local hospital. Many rural hospitals treat only a few cases each year, and the experience of the surgeon may be more limited than in a metropolitan centre.⁴

Women with private health insurance, whether treated in the public or private sectors during the later years, were more likely to receive breast-conserving surgery. Kotwall in the USA reported a similar observation.³⁸ This is the first Australian study to demonstrate that the possession of private health insurance, social disadvantage and locational disadvantage all exhibit measurable and independent effects on the type of procedure that patients receive for breast cancer.

Younger women, those who described themselves as divorced or separated and those with less comorbidity were more likely to receive breast-conserving surgery. Other Australian^{2,34} and Danish²⁹ studies also found that age was a strong factor in the treatment received, while Yancik *et al.*³⁹ in the USA found that age and comorbidity limited treatment options. It is plausible that younger, divorced or separated Australian women would prefer breast-conserving surgery and that their surgeons may be more motivated to preserve cosmetic appearance, as has been observed elsewhere.⁴⁰ The effect of marital status on treatment choice has received little previous attention in the literature.

Whilst the NHMRC's *Clinical Practice Guidelines for the Management of Early Breast Cancer* have been well received by surgeons,^{41,42} the results of the present study suggest that there may be disparities in their implementation. A major limitation of this study, however, was that the Western Australian Cancer Registry did not routinely record information on the size of the tumour or cancer stage. This limited our ability to determine whether these differences were due to surgeon or patient choice, reduced access to facilities, lack of knowledge or because of tumour prognostic information. Further fieldwork is required to clarify this.

Kricger *et al.*² cite a 1995 study that found 25% of Australian women make a conscious choice to select mastectomy. Informed patient choice is fundamental and women may choose mastectomy for a number of reasons, including concerns about radiotherapy (especially the travel involved for rural women) and the risk of recurrence. Patient choice is unlikely, however, to account for all of the unequal treatment patterns observed in disadvantaged groups in a system of universal medical care cover by the Medicare Benefits Scheme and free treatment in the public hospital system. The question arises as to whether universal cover is sufficient to guarantee equal and efficient treatment of patients or if other policy interventions are needed.

A range of policy options to optimize care in rural areas are available and include: provision of multidisciplinary teams and adjuvant therapy options in rural areas; updating rural surgeons on breast-conserving techniques; surgical audit to ensure adherence to clinical practice guidelines;⁴³ consumer education about treatment options; and dissemination of results of population-based audits of treatment patterns, preferably with staging of cancers and tumour size available from the cancer registries. The NHMRC's guidelines³ state that women in rural and remote areas risk receiving inappropriate treatment. As Tulloh and Goldsworthy³⁵ found, good liaison between rural and metropolitan surgeons and oncologists can alleviate these problems. Women in more remote areas will almost certainly continue to travel long distances, as their numbers are too small to make visiting specialist services an economically viable proposition.

Women in socio-economically disadvantaged groups, whether in metropolitan, rural or remote areas, require particular attention. Further research is required to determine whether higher mastectomy rates are their choice, related to tumour size or the result of medical attitudes. Woven into this issue is the possession of private health insurance. While the present Australian government has a pro private health insurance policy, women in the lower socio-economic groups are unlikely to be able to purchase private health insurance.⁴⁴ Not all of the difference between women who receive breast-conserving surgery and those that do not could be explained by differences in private health care cover as socio-economic disadvantage and locational disadvantage had independent effects. If surgeons do promote mastectomy for women in lower socio-economic groups, this requires an assessment of why it is happening (such as ease of compliance for the woman; lack of ability to cope with adjuvant therapy; cost to the health system; or patient out of pocket expenses) and the development of policy to alleviate barriers. If on the other hand it is due to a lack of knowledge by the woman, then as specified in the NHMRC guidelines³⁵ women should be well informed to understand their treatment options and consequences of that choice.

In a country that prides itself on universal health care, this study highlights the differences in treatment patterns for breast cancer experienced by women from disadvantaged groups.

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APPENDIX I

ICD codes used for the extraction of the breast cancer cohort from the WA-linked Database^{8–11}

	ICD 9 1980–1987	ICD 9 CM 1988–June 1999	ICD 10 AM July 1999 onwards
Hospital morbidity codes for diseases	174.0 to 174.9	174.0 to 174.9	C50.0-9
Hospital morbidity codes for procedures			
Breast-conserving surgery	5-860 5-872	85.20 to 85.23	30342-00 to 01 30346-00 to 01 30350-00 to 01
Mastectomy	5-861 to 5-869	85.33 to 85.48	30338-00 to 30338-03 30353-00 to 30353-03 30356-00 to 30356-03 30359-00 to 30359-07
Cancer registration	174.0 to 174.9	174.0 to 174.9	174.0 to 174.9
Death registration	174.0 to 174.9	174.0 to 174.9	174.0 to 174.9

ICD, International Classification of Diseases. Note: all codes are inclusive.